BUSINESS ANALYTICS

SUB CODE: CCW331

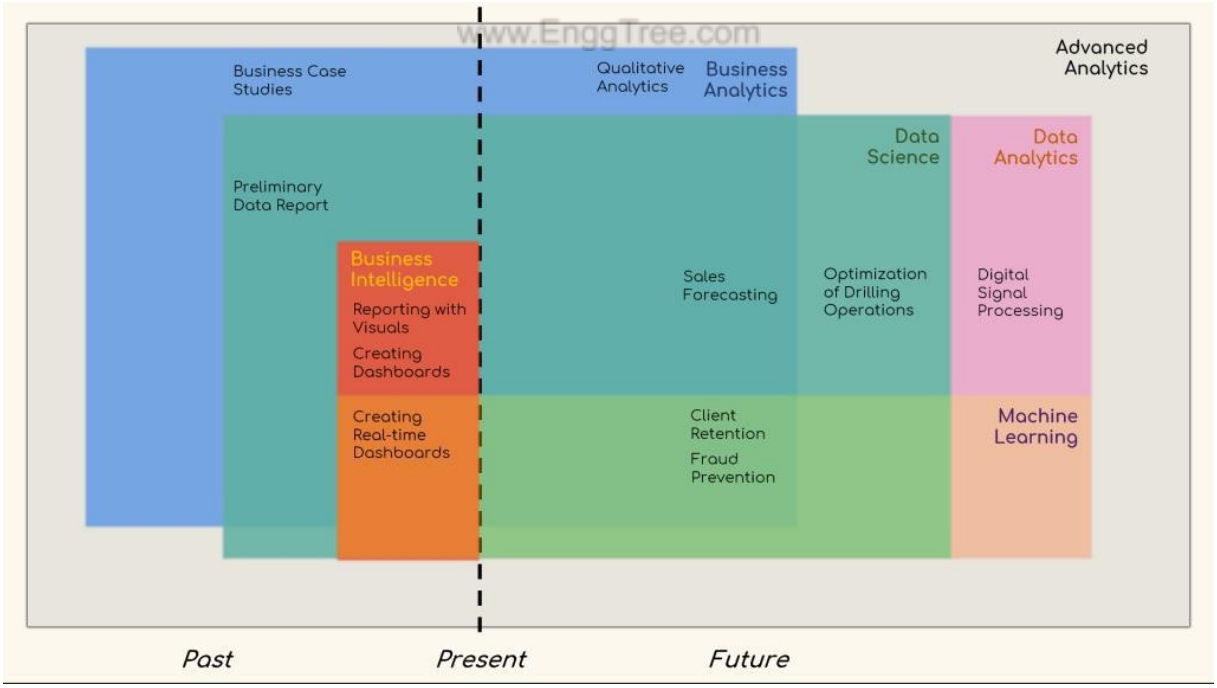
UNIT I INTRODUCTION TO BUSINESS ANALYTICS 9

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

DATA ANALYTICS VS BUSINESS ANALYTICS VS DATA SCIENCE

Data science. It's a discipline that has been constantly evolving. Just when you're sure you've worked out what a data scientist is, someone goes and pulls the rug out from under you! With a barrage of new terms and buzzwords flying around, even HR managers in the field get confused, so how are you supposed to keep up with the fields of business and data analytics, data science, business intelligence, machine learning, and AI?

The diagram shows how these *similar-yet-unique* areas. Here it is!



May seem a bit complicated in the beginning, but I assure you that everything will be clear after we walk through it. Let's start at the very beginning.

Business Analytics

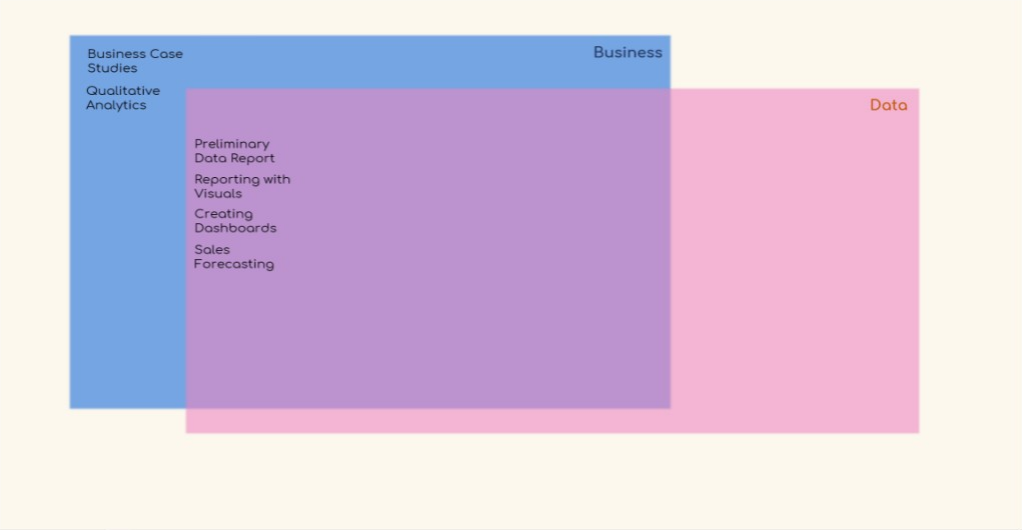
Before talking about data science, it is a good idea to start from a much older concept - **business.** Here's a list of branches from the business field:

- Business case studies.
- qualitative analytics.
- preliminary data report.
- reporting with visuals.
- creating dashboards.
- sales forecasting.

For a second, have a think which ones are related to business, to data, or both.

Business Analytics vs Data Analytics

Look at the picture below to check if your ideas matched ours. Note that the **blue rectangle** contains activities related to **business** and the **pink** one to **data**. If something sits in an area that overlaps, then it is related to both fields.



As you can see, all terms are business activities but only some are **data-driven**, the rest of them are experience-driven.

You'll need data to create:

- A preliminary report
- A visual representation of your company's performance for last year
- A business dashboard
- A forecast for the future sales of your company.

So, these four labels sit comfortably in the overlapping

area. What about the other two terms?

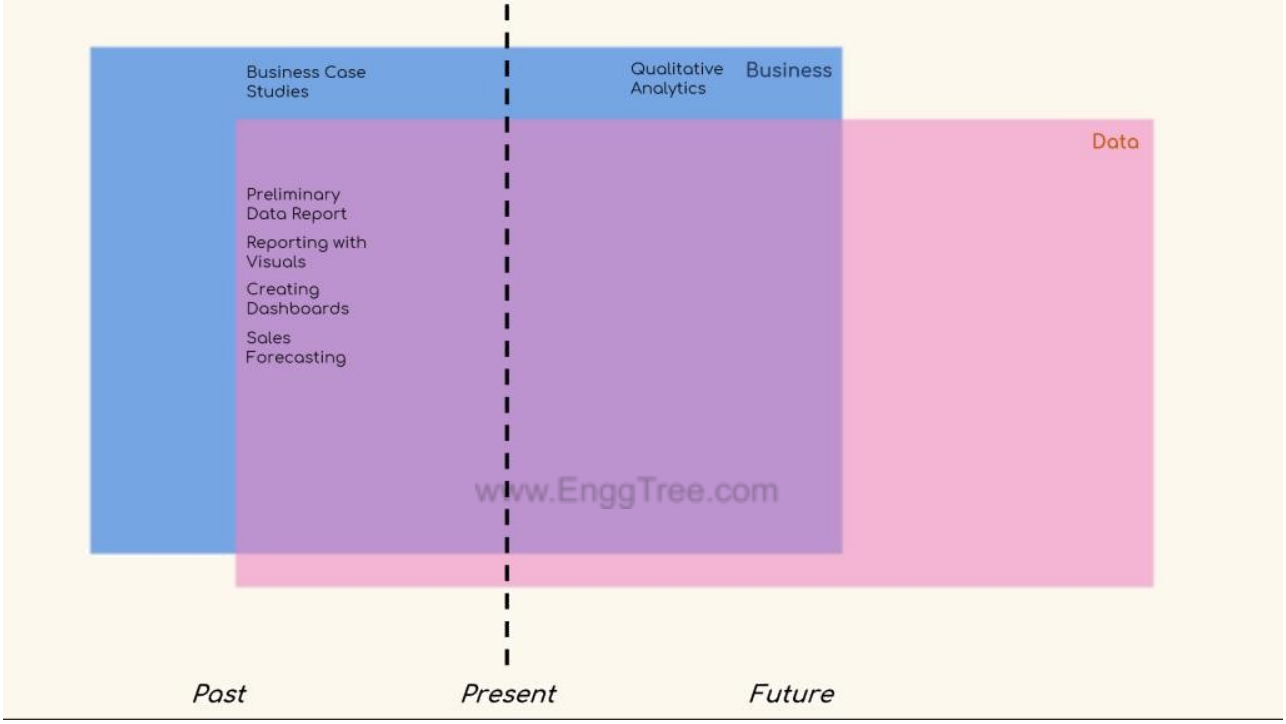
- Business case studies
- Qualitative analytics

Business case studies are real-world experiences of how business people and companies succeed or fail. **Qualitative analytics** is about using your intuition and knowledge to assist in future planning. You don't need a dataset to learn from either. Thus, both remain in the blue rectangle.

Do those fields depend on time?

Now would be the perfect ***time*** to introduce a timeline. Some of the terms you see refer to activities that explain ***past*** behavior, while others refer to activities used for predicting ***future*** behavior. We're going to put a line through the middle to represent the ***present***. Therefore, all terms that are on the right of this line will regard future planning and forecasting, those that are on the left of the line will be related to the analysis of past events or data.

Again, take a moment to decide which aspects refer to which point in time.



Let explain why we segregated it as we did.

Business case studies examine events that have **already happened**. For instance, one could learn from them and attempt to prevent making a similar mistake in the future, so this activity refers to the past.

Contrast it to the other business term, *'qualitative analytics'* which includes working with tools that help **predict future** behavior and you'll realize this must be placed on the right.

Preparing a report or a dashboard is always a reflection of **past data**, these terms will remain on the left. Forecasting, though, is a **future-oriented** activity, we've put it to the right of the black

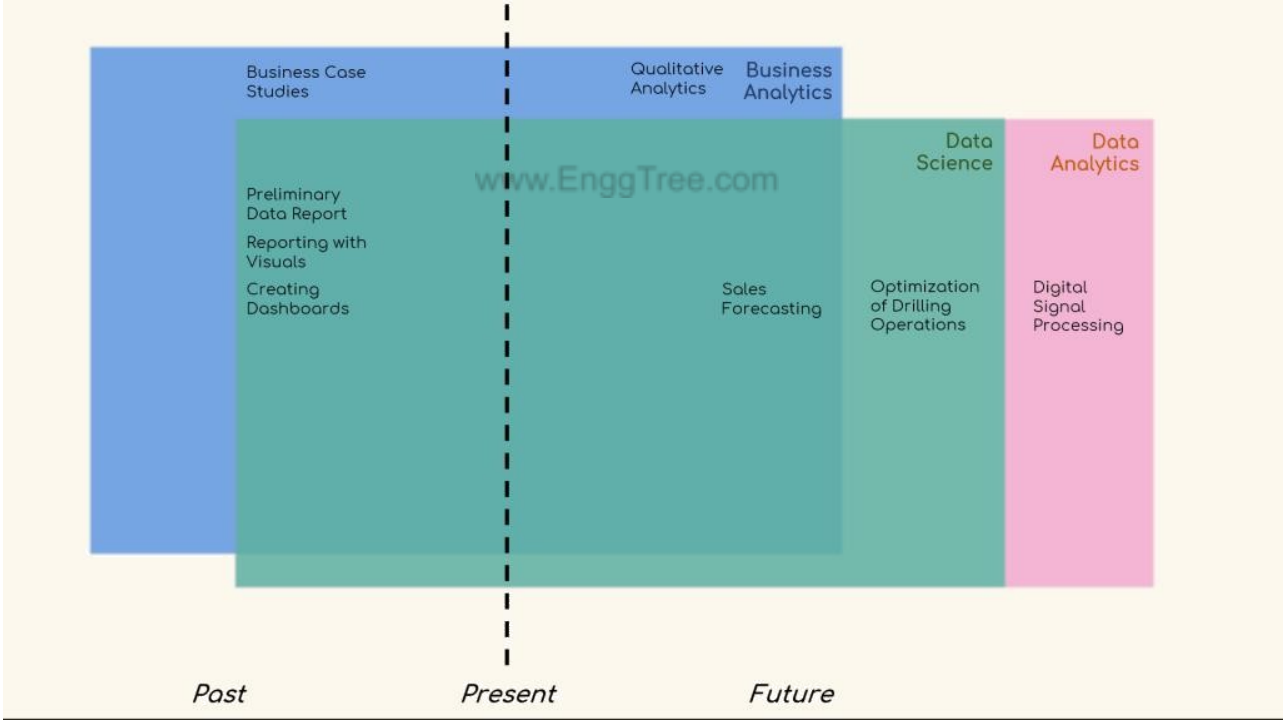
line, but not too much – it must still belong to the sphere of business, so it must be in the area where business analytics and data intersect.

Business Analytics vs Data Analytics vs Data Science

Data science is a discipline reliant on data availability, at the same time, business analytics does not completely rely on data; be that as it may, data science incorporates part of data analytics. Mostly the part that uses complex mathematical, statistical, and programming tools to perform data-operations.With the help of Data Science, we analyze Big Data. We extract information and meaningful insights from this data. First, the Data scientist gathers datasets from multi-disciplines and compiles it together.

After that, he/she applies **machine learning**, predictive and sentimental analysis. The data is then sharpened to a point where some meaning can be derived out of it. At last, useful information is derived from the data.

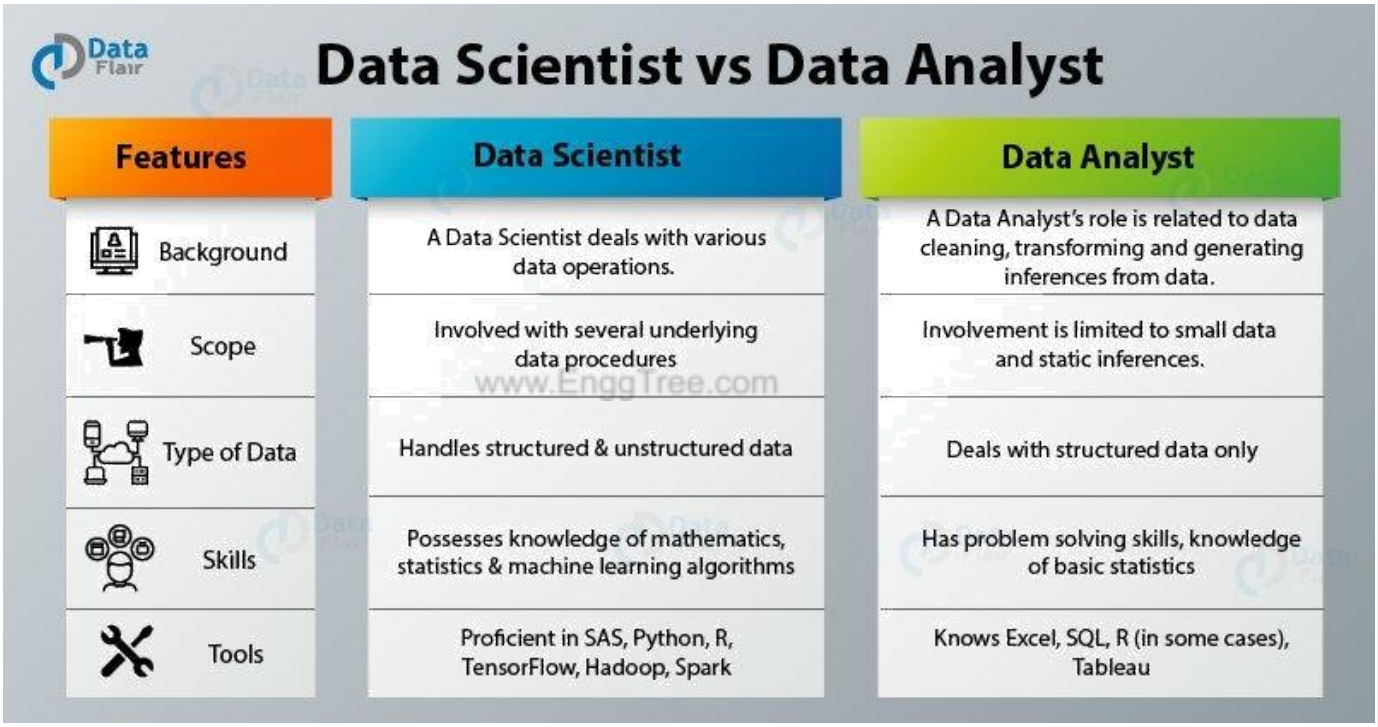
Consequently, this green rectangle, representing **'data science'** on our diagram, does not overlap with 'data analytics' completely. But it does reach a point beyond the area of business analytics.Let us show you another picture to make things clearer.



Does this mean that the preliminary data report, reporting with visuals, creating dashboards, and sales forecasting are of interest to a data scientist? *Yes, absolutely.*You notice we added a couple of aspects that weren't there before, good eye! *'Optimization of drilling operations'* and *'digital signal processing'* are a couple of examples that fit into sub-areas outside of business.

Consider the oil and gas industry, and the optimization of drilling operations. This is a perfect example of an aspect which requires **data science** and **data analytics** but **NOT business**. We use data science to improve predictions based on data extracted from activities typical for drilling efficiency. And that certainly isn't business analytics. We use digital signal to represent data in the form of discrete values. Therefore, we can apply data analytics to digital signal to produce a higher quality signal, without going into data science.

The difference between Data Science and Data Analytics.



ANALYTICS LIFE CYCLE

BUSINESS ANALYTICS LIFE CYCLE

Business Analytics is a very prevalent term in the 21st century across various sectors. It corresponds to a set of methodologies and tools that change the way of how organizations approach decision-making. Since the impact of Business Analytics is very heavy, organizations have defined a business analytics lifecycle to make sure not to commit mistakes or miss out on any crucial information. This process is termed the Business Analytics process. The steps of the process may vary from organization to organization as a lot of factors, viz. the industry, the type of product, the size of the company, etc., play major roles in determining them. However, broadly, you can classify the entire Business Analytics process into six steps.

we will discuss the Business Analytics process and its six steps in the following sections:

- Introduction to Business Analytics
- The Business Analytics Process
- 6 Steps Involved in the Business Analytics Process

Business Analytics is a term that took industries by storm in the 21st century. All businesses around the world were looking to make more and more profits, and the only way they could do that was by finding out gaps and filling them. The Business Analytics process initially came as a problem-solving approach to many organizations where data was being captured and accessed. This data was then used for multiple purposes, ranging from improving customer services to predicting fraud. Due to its vast success, people realized quickly that Business Analytics can not only solve pre-existing visible problems but also can notify them about the illusive problems that do not seem to be existing.

Once the world started noticing the impact of Business Analytics, organizations soon realized that its potential is not related to just problem-solving, but they can also use it to predict, plan, improvise, and overcome various obstacles that they may find.Business Analytics is a discipline where you use the pre-existing data to find out key insights that can help you solve a business problem. To find the said insights, you have to apply a lot of statistical models, as well as manipulate the data to fit such models. In today's world, Business Analytics is so important that almost every organization has a Business Analytics team and well defined business analytics

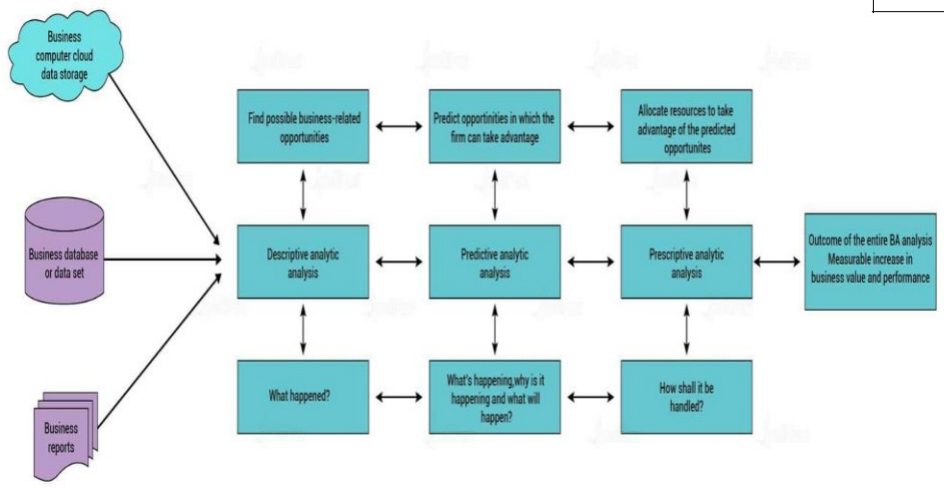
process steps. Since there are problems and gaps in all forms of businesses, Business Analytics is a viable approach across all industries. From the food industry to the IT sector, everyone is employing Business Analytics to find out the optimum ways to do business.

Moreover, almost every organization of the day follows a well-defined Business Analytics process steps. These process steps differ from organization to organization. However, some key steps remain the same for almost everyone. Let's discuss them in this blog.

THE BUSINESS ANALYTICS PROCESS

The Business Analytics process involves asking questions, looking at data, and manipulating it to find the required answers. Now, every organization has different ways to execute this process as all of these organizations work in different sectors and value different metrics more than the others based on their specific business model.

Since the approach to business is different for different organizations, their solutions and their ways to reach the solutions are also different. Nonetheless, all of the actions that they do can be classified and generalized to understand their approach. The image given below demonstrates the steps in Business Analytics process of a firm:



The above image just covers the overview of the Business Analytics process. Now, let's convert it into the actual steps that are involved in solving problems.

6 Steps in the Business Analytics Process

Step 1: Identifying the Problem

The first step of the process is identifying the business problem. The problem could be an actual crisis; it could be something related to recognizing business needs or optimizing current processes. This is a crucial stage in Business Analytics as it is important to clearly understand what the expected outcome should be. When the desired outcome is determined, it is further broken down into smaller goals. Then, business stakeholders decide the relevant data required to solve the problem. Some important questions must be answered in this stage, such as: What kind of data is available? Is there sufficient data? And so on.

Step 2: Exploring Data

Once the problem statement is defined, the next step is to gather data (if required) and, more importantly, cleanse the data—most organizations would have plenty of data, but not all data points would be accurate or useful. Organizations collect huge amounts of data through different methods, but at times, junk data or empty data points would be present in the dataset. These faulty pieces of data can hamper the analysis. Hence, it is very important to clean the data that has to be analyzed.

To do this, you must do computations for the missing data, remove outliers, and find new variables as a combination of other variables. You may also need to plot time series graphs as they generally indicate patterns and outliers. It is very important to remove outliers as they can have a heavy impact on the accuracy of the model that you create. Moreover, cleaning the data helps you get a better sense of the dataset.

Step 3: Analysis

Once the data is ready, the next thing to do is analyze it. Now to execute the same, there are various kinds of statistical methods (such as hypothesis testing, correlation, etc.) involved to find out the insights that you are looking for. You can use all of the methods for which you have the data.

The prime way of analyzing is pivoting around the target variable, so you need to take into account whatever factors that affect the target variable. In addition to that, a lot of assumptions are also considered to find out what the outcomes can be. Generally, at this step, the data is sliced, and the comparisons are made. Through these methods, you are looking to get actionable insights.

Step 4: Prediction and Optimization

Gone are the days when analytics was used to react. In today's era, Business Analytics is all about being proactive. In this step, you will use prediction techniques, such as neural networks or decision trees, to model the data. These prediction techniques will help you find out hidden insights and relationships between variables, which will further help you uncover patterns on the most important metrics. By principle, a lot of models are used simultaneously, and the models with the most accuracy are chosen. In this stage, a lot of conditions are also checked as parameters, and answers to a lot of 'what if…?' questions are provided.

Step 5: Making a Decision and Evaluating the Outcome

From the insights that you receive from your model built on target variables, a viable plan of action will be established in this step to meet the organization's goals and expectations. The said plan of action is then put to work, and the waiting period begins. You will have to wait to see the actual outcomes of your predictions and find out how successful you were in your endeavors. Once you get the outcomes, you will have to measure and evaluate them.

Step 6: **Optimizing and Updating**

Post the implementation of the solution, the outcomes are measured as mentioned above. If you find some methods through which the plan of action can be optimized, then those can be implemented. If that is not the case, then you can move on with registering the outcomes of the

entire process. This step is crucial for any analytics in the future because you will have an ever-improving database. Through this database, you can get closer and closer to maximum optimization. In this step, it is also important to evaluate the ROI (return on investment). Take a look at the diagram below of the life cycle of business analytics.

DATA ANALYTICS LIFE CYCLE

Data science is the study of raw data that encompasses data analytics, data mining, and machine learning under one roof. Data science study helps us in finding meaningful patterns and insights from raw and unstructured data and is used to tackle big data that includes data cleansing, preparation, and analysis. As a data scientist, you have to gather raw data from various sources and then apply several techniques such as machine learning, predictive analytics, or sentiment analysis to collect meaningful information.With data science, you can bring structure to big data, search for compelling patterns, and advise the decision-makers to bring in the changes effectively that suits your business needs.

Why Do We Need Data Science and Analytics?

In earlier days, the size of the data was minimal, and it was effortless to analyze the data by using some business intelligence tools. But with the advancement of digital technology and more data getting generated from several different sources such as financial logs, text files, multimedia forms, sensors, instruments, etc., companies face big-time challenges in cleansing and analyzing this unstructured data with traditional business intelligence tools. The chart below clearly indicates that the percentage of this unstructured data will rise to 80% by the end of 2020.

Hence, we need tools built on the latest technology and use advanced algorithms that are capable of cleansing, preparing, and processing this massive chunk of unstructured data to produce meaningful insights.

The LIFECYCLE OF A DATA SCIENCE

There are multiple phases in the lifecycle of data science. Let's understand it better with a real-life example. Imagine that you run a retail shop and your primary goal is to improve the sales of the shop. To identify the factors that drive your sales numbers, you must answer a few questions, such as which products are the most profitable? Are you gaining any benefit from the in-store promotions? These questions are better explained by following the steps involved in the lifecycle of data science.

A data science life cycle includes the following steps:

Data Discovery

The data discovery phase consists of the multiple sources from which you discover the raw and unstructured data such as videos, images, text files, etc. So, as per the above example, you need a clear understanding of the factors that affect your sales to procure the data that will be relevant for your further analysis. You can consider the following factors: store location, staff, working hours, promotions, product pricing, and so on.

Data Preparation

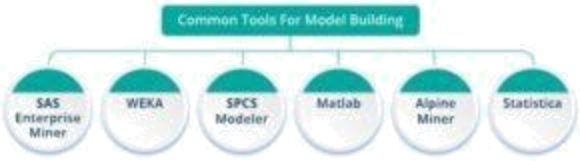
The next stage of the data science lifecycle is preparing the raw and unstructured data for further analysis. For this, you need to convert the data into a standard format so that you can work on it seamlessly. This phase includes steps for exploring, pre-processing, and conditioning of data. After your data is cleaned and pre-processed, it is much easier to perform exploratory analytics on it.

Model Planning

The model planning phase includes the methods and techniques that you will use to determine the relationships between variables. This relationship can act as a base for the algorithms that are used at the time of model building. You can use several different tools for model planning, such as SQL analysis services, R programming, or SAS/access. Out of all these tools, R programming is the most commonly used tool in model planning.

Model Building

In the model-building phase, you will create different datasets for training and testing purposes. For this purpose, you can divide your dataset into the 70 and 30 per cent ratio. 70% of data will be used to train the model, and the remaining 30% of data will be used to test the trained model. You can use techniques such as classification, association, or clustering to build your model.



Operationalize

In the operationalize phase, you will deliver the final reports, briefings, code, and any other technical documents.

Communicate Results

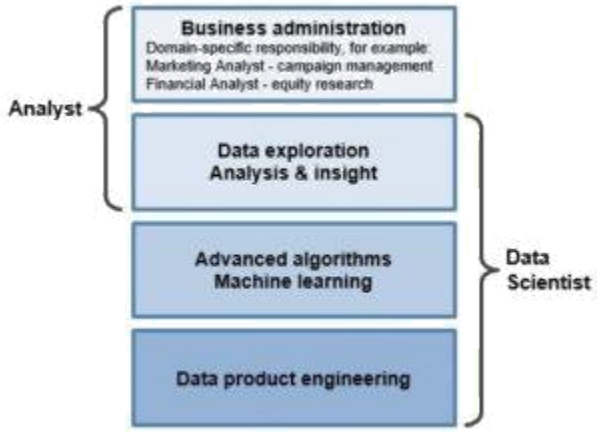
In the last phase, you will evaluate if you can achieve the goal that you set in the first phase. In this phase, you will communicate all your critical findings to the respective stakeholders and determine whether your project results in a success or failure based on the criteria defined in phase 1.

Difference Between a Data Science and Analytics Role

As stated above, data science is an umbrella term that includes data analytics, machine learning, and data mining; hence, data analytics can be considered as a subset of data science. Data science is the blend of various tools, algorithms, and machine learning principles that are studied to discover the meaningful pattern and information from the raw and unstructured data. On the other hand, data analysis explains what is going on by processing the history of the data, and includes techniques such as descriptive analytics, advanced analytics, diagnostic analytics, and prescriptive analytics. Each of the methods stated has its applications in the field of business. For example, descriptive analytics helps answer questions about what happened and summarize large datasets to describe outcomes to stakeholders. Diagnostic analytics helps answer why things happened and supplement more basic descriptive analytics. Predictive analytics helps answer questions such as what will happen in the future, and identifies the trends and determines if they are likely to recur. Prescriptive analytics finds an answer to what should be done and

helps businesses make informed decisions in the face of uncertainty.

The following block diagram shows how the two job titles, data scientist and data analyst, map to the skills and scope of the responsibilities:



TYPES OF ANALYTICS

There are 4 different types of analytics: Descriptive, Diagnostic, Predictive, and Prescriptive analytics, through which you can eradicate flaws and promote informed decisions. By implementing these methods, decision-making becomes much more efficient. However, the right combination of analytics is essential.

Analytical methods, or analytics for short, change the game for the better. Each type has its reasoning and calculated consequences, so you are rarely caught off-guard. A sorted process backs it up, which deals with analyzing data at each of its stages.

So far, we have come up with four broad categories, viz. descriptive, diagnostic, predictive, and prescriptive analytical methods.

Each one is used in a particular scenario and helps you comprehend where the company is at. Accordingly, it leads you to an insightful solution. Before getting into the intricate details of every analytical method, defining them briefly would be ideal for better understanding.

DESCRIPTION

Firstly, we have **descriptive analytics**, under which you do the required bare minimum of sorting and categorizing. It includes summarizing your data through business intelligence tools. The purpose is to get clarity on a particular event.

Next up, we have **diagnostic analytics**. As the words suggest, it focuses on diagnosing the event. You consider the past performances to understand and track why the current event has taken place. By the end of this process, you will have yourself an analytical dashboard.

Meanwhile, **predictive analytics** focuses on making predictions of what the possible outcomes could be. However, these are not baseless predictions and depend on machine learning techniques. You might have come across statistical models, which will also come in handy.

Lastly, **prescriptive analytics** emphasizes recommending or prescribing multiple courses of action. That, of course, happens based on how the data has been analyzed. The concepts might sound very vague, confusing, or overlapping at the moment. However, by the time you are through to the end, clarity will present itself.

4 TYPES OF DATA ANALYSIS

The four types of data analysis are:

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

Below, we will introduce each type and give examples of how they are utilized in business.

Descriptive Analysis

The first type of data analysis is descriptive analysis. It is at the foundation of all data insight. It is the simplest and most common use of data in business today. Descriptive analysis answers the "what happened" by summarizing past data usually in the form of dashboards. More information about designing dashboards can be found here.

The biggest use of descriptive analysis in business is to track Key Performance Indicators (KPI's). KPI's describe how a business is performing based on chosen benchmarks.

Business applications of descriptive analysis include:

- KPI dashboards
- Monthly revenue reports
- Sales leads overview

Diagnostic Analysis

After asking the main question of "what happened" you may then want to dive deeper and ask why did it happen? This is where diagnostic analysis comes in.

Diagnostic analysis takes the insight found from descriptive analytics and drills down to find the cause of that outcome. Organizations make use of this type of analytics as it creates more connections between data and identifies patterns of behavior.

A critical aspect of diagnostic analysis is creating detailed information. When new problems arise, it is possible you have already collected certain data pertaining to the issue. By already having the data at your disposal, it ends having to repeat work and makes all problems interconnected.

Business applications of diagnostic analysis include:

- A freight company investigating the cause of slow shipments in a certain region
- A SaaS company drilling down to determine which marketing activities increased trials

Predictive Analysis

Predictive analysis attempts to answer the question "what is likely to happen". This type of analytics utilizes previous data to make predictions about future outcomes.

This type of analysis is another step up from the descriptive and diagnostic analyses. Predictive analysis uses the data we have summarized to make logical predictions of the outcomes of events. This analysis relies on statistical modeling, which requires added technology and manpower to forecast. It is also important to understand that forecasting is only an estimate; the accuracy of predictions relies on quality and detailed data.

While descriptive and diagnostic analysis are common practices in business, predictive analysis is where many organizations begin show signs of difficulty. Some companies do not have the manpower to implement predictive analysis in every place they desire. Others are not yet willing to invest in analysis teams across every department or not prepared to educate current teams.

Business applications of predictive analysis include:

- Risk Assessment
- Sales Forecasting
- Using customer segmentation to determine which leads have the best chance of converting
- Predictive analytics in customer success teams

Prescriptive Analysis

The final type of data analysis is the most sought after, but few organizations are truly equipped to perform it. Prescriptive analysis is the frontier of data analysis, combining the insight from all previous analyses to determine the course of action to take in a current problem or decision.

Prescriptive analysis utilizes state of the art technology and data practices. It is a huge organizational commitment and companies must be sure that they are ready and willing to put forth the effort and resources.

Final Thoughts

- Data analytics is quite an important process of breaking down the functioning of your organization. The primary reason behind that being the help it offers to businesses. Meaning, optimizing your performances accordingly becomes swift and efficient.
- By implementing the required data analytics into your business model would reduce incurred costs or failure. Moreover, it helps you identify multiple efficient ways of going about with your daily business!

BUSINESS PROBLEM DEFINITION

As a business analyst you will have to understand your clients' needs and constructively provide valuable solution options. You will have to find the real roots of the needs and approach problems in a way that will enable change.

Your task is not just to collect requirements. It's to elicit requirements in order to ensure long – lasting change. It is common for clients to come up with the solution in mind. For example, a client may request an addition of a step to the process. Diving more and trying to figure out the actual need behind this request may reveal that there is another way of treating the actual need.

The following stages are commonly used by Business Analysts when problem solving is required.

1) Problem Definition

The first step in the approach is the problem definition. Gathering information, ascertaining its validity against other sources of information, and analyzing the available information are key at this stage. The way a problem is identified first and then defined can have a significant impact on the alternatives that may be emerge. Identifying the problem will also delineate the goals and objectives that the alternative solutions should cover. The more complete a problem statement is, the easier it will be to identify alternatives, selection & evaluation.

Common pitfalls in this stage include:

- Too wide or too narrow definitions of the problem can impact the quality of the solution. Analysts are asked to find the balance between small and large range so that there are several alternatives.
- Focusing on the symptoms rather than the causes is a common mistake in defining a problem. Of course the subjectivity involved in characterizing the symptom often makes this mistake inevitable. Many techniques such as the "5 Whys" can help in avoiding this pitfall.
- Choosing the right problem means that while there may be parallel problems we must choose with a systemic approach the problem that is most possible to some extent another problem. Systemic thinking is of paramount importance as there is usually an interdependence between seemingly unrelated problems.

2) Alternative Solutions

Once the problem is identified, the analyst, should, together with the technical team to search for possible solutions.

Solution options has to be aligned with the project scope, the overall business needs and the technical feasibility. Solutions options must be realistic from business and technical side and of course valid in the eyes of the stakeholders.

A common mistake in this step is to abandon an alternative too quickly. This often happens under the pressure of time and other circumstances. However, because an alternative seems convenient, this does not make it ideal. It may have harmful side effects, or it may be less effective than other alternatives that would result if given enough time at this stage.

One way to limit the error of the incomplete "pool of alternatives" is to involve key stakeholders in discussions of identifying different solutions. It's a good way for different perspectives to be presented and contribute to different solution alternatives.

3) Identify the best solution

For every solution option an assessment shall be done against the other solution options. The business analysts in collaboration with the key stakeholders identify the criteria that will be used for this comparison.

A cost-benefit analysis is commonly used for each solution option in order to figure out the benefits against the costs. However sometimes the full benefits or costs cannot be monetized, and indirect benefits or costs may be derived by the implementation of a solution. So, it is not a good idea to compare different options based strictly on a cost – benefit analysis as it is not easy to think about all costs and benefits and give them a value.

An analyst understands the cognitive limitations of human information processing capabilities and the difficulty of making optimization decisions. It is worth noting that the best alternative is choosing an environment of delimited rationality. An environment of delimited rationality is created as the limits of the decision-making process are set by the available information and the context.

Problem solving is vital in all aspects of business from people problems to technical problems and from short-term to long-term problems. And problem-solving involves two completely different, possibly conflicting thought processes: creativity and decision making. A business analyst shall continuously try to improve problem solving skills by implementing in practice useful techniques and approaches and continuously following up the outcomes.

DATA COLLECTION

WHAT IS DATA COLLECTION?

Data collection is the methodological process of gathering information about a specific subject. It's crucial to ensure your data is complete during the collection phase and that it's collected legally and ethically. If not, your analysis won't be accurate and could have far-reaching consequences.

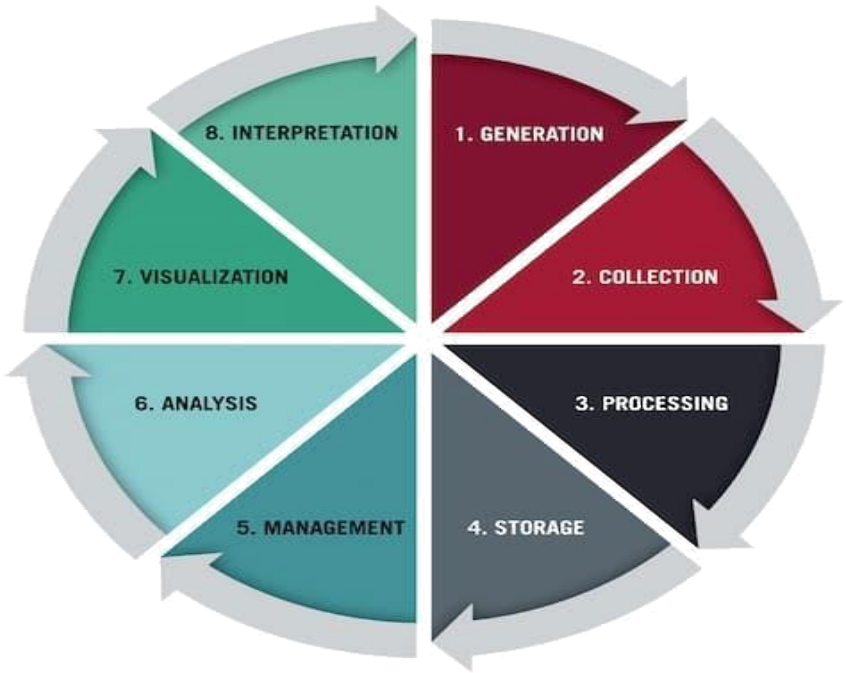
In general, there are three types of consumer data:

- First-party data, which is collected directly from users by your organization
- Second-party data, which is data shared by another organization about its customers (or its first-party data)
- Third-party data, which is data that's been aggregated and rented or sold by organizations that don't have a connection to your company or users

Although there are use cases for second- and third-party data, first-party data (data you've collected yourself) is more valuable because you receive information about how your audience behaves, thinks, and feels—all from a trusted source.

Data can be qualitative (meaning contextual in nature) or quantitative (meaning numeric in nature). Many data collection methods apply to either type, but some are better suited to one over the other.

In the data life cycle, data collection is the second step. After data is generated, it must be collected to be of use to your team. After that, it can be processed, stored, managed, analyzed, and visualized to aid in your organization's decision-making.



Before collecting data, there are several factors you need to define:

- The question you aim to answer
- The data subject(s) you need to collect data from
- The collection timeframe
- The data collection method(s) best suited to your needs

The data collection method you select should be based on the question you want to answer, the type of data you need, your timeframe, and your company's budget. Explore the options in the next section to see which data collection method is the best fit.

7 DATA COLLECTION METHODS USED IN BUSINESS ANALYTICS

1. Surveys

Surveys are physical or digital questionnaires that gather both qualitative and quantitative data from subjects. One situation in which you might conduct a survey is gathering attendee feedback after an event. This can provide a sense of what attendees enjoyed, what they wish was different, and areas you can improve or save money on during your next event for a similar audience.

Because they can be sent out physically or digitally, surveys present the opportunity for distribution at scale. They can also be inexpensive; running a survey can cost nothing if you use a free tool. If you wish to target a specific group of people, partnering with a market research firm to get the survey in the hands of that demographic may be worth the money.

Something to watch out for when crafting and running surveys is the effect of bias, including:

- Collection bias: It can be easy to accidentally write survey questions with a biased lean. Watch out for this when creating questions to ensure your subjects answer honestly and aren't swayed by your wording.
- Subject bias: Because your subjects know their responses will be read by you, their answers may be biased toward what seems socially acceptable. For this reason, consider pairing survey data with behavioral data from other collection methods to get the full picture.

2. Transactional Tracking

Each time your customers make a purchase, tracking that data can allow you to make decisions about targeted marketing efforts and understand your customer base better.

Often, e-commerce and point-of-sale platforms allow you to store data as soon as it's generated, making this a seamless data collection method that can pay off in the form of customer insights.

3. Interviews and Focus Groups

Interviews and focus groups consist of talking to subjects face-to-face about a specific topic or issue. Interviews tend to be one-on-one, and focus groups are typically made up of several people. You can use both to gather qualitative and quantitative data.

Through interviews and focus groups, you can gather feedback from people in your target audience about new product features. Seeing them interact with your product in real-time and recording their reactions and responses to questions can provide valuable data about which product features to pursue.

As is the case with surveys, these collection methods allow you to ask subjects anything you want about their opinions, motivations, and feelings regarding your product or brand. It also introduces the potential for bias. Aim to craft questions that don't lead them in one particular direction.

One downside of interviewing and conducting focus groups is they can be time-consuming and expensive. If you plan to conduct them yourself, it can be a lengthy process. To avoid this, you can hire a market research facilitator to organize and conduct interviews on your behalf.

4. Observation

Observing people interacting with your website or product can be useful for data collection because of the candor it offers. If your user experience is confusing or difficult, you can witness it in real-time.

Yet, setting up observation sessions can be difficult. You can use a third-party tool to record users' journeys through your site or observe a user's interaction with a beta version of your site or product.

While less accessible than other data collection methods, observations enable you to see firsthand how users interact with your product or site. You can leverage the qualitative and quantitative data gleaned from this to make improvements and double down on points of success.

5. Online Tracking

To gather behavioral data, you can implement pixels and cookies. These are both tools that track users' online behavior across websites and provide insight into what content they're interested in and typically engage with.

You can also track users' behavior on your company's website, including which parts are of the highest interest, whether users are confused when using it, and how long they spend on product pages. This can enable you to improve the website's design and help users navigate to their destination.

Inserting a pixel is often free and relatively easy to set up. Implementing cookies may come with a fee but could be worth it for the quality of data you'll receive. Once pixels and cookies are set, they gather data on their own and don't need much maintenance, if any.

It's important to note: Tracking online behavior can have legal and ethical privacy implications. Before tracking users' online behavior, ensure you're in compliance with local and industry data privacy standards.

6. Forms

Online forms are beneficial for gathering qualitative data about users, specifically demographic data or contact information. They're relatively inexpensive and simple to set up, and you can use them to gate content or registrations, such as webinars and email newsletters.

You can then use this data to contact people who may be interested in your product, build out demographic profiles of existing customers, and in remarketing efforts, such as email workflows and content recommendations.

7. Social Media Monitoring

Monitoring your company's social media channels for follower engagement is an accessible way to track data about your audience's interests and motivations. Many social media platforms have analytics built in, but there are also third-party social platforms that give more detailed, organized insights pulled from multiple channels.

You can use data collected from social media to determine which issues are most important to your followers. For instance, you may notice that the number of engagements dramatically increases when your company posts about its sustainability efforts.

DATA PREPARATION

Data preparation is a pre-processing step that involves cleansing, transforming, and consolidating data. In other words, it is a process that involves connecting to one or many different data sources, cleaning dirty data, reformatting or restructuring data, and finally merging this data to be consumed for analysis.

The data preparation pipeline consists of the following steps

1. Access the data.
2. Ingest (or fetch) the data.
3. Cleanse the data.
4. Format the data.
5. Combine the data.
6. And finally, analyze the data.

1.Access

There are many sources of business data within any organization. Examples include endpoint data, customer data, marketing data, and all their associated repositories. This first essential data preparation step involves identifying the necessary data and its repositories. This is not simply identifying all possible data sources and repositories, but identifying all that are applicable to the desired analysis. This means that there must first be a plan that includes the specific questions to be answered by the data analysis.

2.Ingest

Once the data is identified, it needs to be brought into the analysis tools. The data will likely be some combination of structured and semi-structured data in different types of repositories. Importing it all into a common repository is necessary for the subsequent steps in the pipeline. Access and ingest tend to be manual processes with significant variations in exactly what needs to be done. Both data preparation steps require a combination of business and IT expertise and are therefore best done by a small team. This step is also the first opportunity for data validation.

3.Cleanse

Cleansing the data ensures that the data set can provide valid answers when the data is analyzed. This step could be done manually for small data sets but requires automation for most realistically sized data sets. There are software tools available for this processing. If custom processing is needed, many data engineers rely on applications coded in Python. There are many different problems possible with the ingested data. There could be missing values, out-of-range values, nulls, and whitespaces that obfuscate values, as well as outlier values that could skew analysis results. Outliers are particularly challenging when they are the result of combining two or more variables in the data set. Data engineers need to plan carefully for how they are going to cleanse their data.

4.Format

Once the data set has been cleansed; it needs to be formatted. This step includes resolving issues like multiple date formats in the data or inconsistent abbreviations. It is also possible that some data variables are not needed for the analysis and should therefore be deleted from the analysis data set. This is another data preparation step that will benefit from automation. Cleansing and formatting steps should be saved into a repeatable recipe data scientists or engineers can apply to similar data sets in the future. For example, a monthly analysis of sales and support data would likely have the same sources that need the same cleansing and formatting steps each month.

5.Combine

When the data set has been cleansed and formatted, it may be transformed by merging, splitting, or joining the input sets. Once the combining step is complete, the data is ready to be moved to the data warehouse staging area. Once data is loaded into the staging area, there is a second opportunity for validation.

6.Analyze

Once the analysis has begun, changes to the data set should only be made with careful consideration. During analysis, algorithms are often adjusted and compared to other results. Changes to the data can skew analysis results and make it impossible to determine whether the different results are caused by changes to the data or the algorithms.

Data Preparation Principles and Best Practices

Many of the principles of functional programming can be applied to data preparation. It is not necessary to use a functional programming language to automate data preparation, but such languages are often used to do so.

1. Understand the data consumer – who is going to use the data and what questions do they need answered.
2. Understand the data – where it is coming from and how it was generated.
3. Save the raw data. If the data engineer has the raw data, then all the data transformations can be recreated. Additionally, don't move or delete the raw data once it is saved.
4. If possible, store all the data, raw and processed. Of course, privacy regulations like the European Union (EU)'s General Data Protection Regulation (GDPR) will influence what data can be saved and for how long.

5. Ensure that transforms are reproducible, deterministic and idempotent. Each transform must produce the same results each time it is executed given the same input data set, without harmful effects.
6. Future proof your data pipeline. Version not only the data and the code that performs the analysis, but also the transforms that have been applied to the data.
7. Ensure that there is adequate separation between the online system and the offline analysis so that the ingest step does not impact user-facing services.
8. Monitor the data pipeline for consistency across data sets.
9. Employ Data Governance early, and be proactive. IT's need for security and compliance means incorporating governance capabilities like data masking, retention, lineage, and role-based permissions are all important aspects of the pipeline.

Know your data, know your customers' needs, and set up a reproducible process for constructing your data preparation pipeline.

HYPOTHESIS GENERATION

Introduction

The first step towards problem-solving in data science projects isn't about building machine learning models. Yes, you read that right!That distinction belongs to hypothesis generation – the step where combine our problem solving skills with our business intuition. It's a truly crucial step in ensuring a successful data science project.

Let's be honest – all of us think of a hypothesis almost every day. Let us consider the example of a famous sport in India – cricket. It is that time of the year when IPL fever is high and we are all absorbed in predicting the winner.

If you have been guessing which team would win based on various factors like the size of the stadium and batsmen present in the team with six hitting capabilities or batsmen with high T20 averages, then kudos to you all. You have all been making an educated guess and generating hypotheses based on your domain knowledge of the sport.

Similarly, the first step towards solving any business problem using machine learning is hypothesis generation. Understanding the problem statement with good domain knowledge is important and formulating a hypothesis will further expose you to newer ideas of problem-solving.

So in this article, let's dive into what hypothesis generation is and figure out why it is important for every data scientist. Let's see the following topics in detail.

- What is Hypothesis Generation?
- Hypothesis Generation vs Hypothesis Testing
- How Does Hypothesis Generation Help?
- When Should you Perform Hypothesis Generation?
- Case Study: Hypothesis Generation with NYC Taxi Trip Duration Prediction

What is Hypothesis Generation?

Hypothesis generation is an educated "guess" of various factors that are impacting the business problem that needs to be solved using machine learning. In framing a hypothesis, the data scientist must not know the outcome of the hypothesis that has been generated based on any evidence.

"A hypothesis may be simply defined as a guess. A scientific hypothesis is an intelligent guess."

– Isaac Asimov

Hypothesis generation is a crucial step in any data science project. If you skip this or skim through this, the likelihood of the project failing increases exponentially.

Hypothesis Generation vs. Hypothesis Testing

This is a very common mistake data science beginners make.

Hypothesis generation is a process beginning with an educated guess whereas hypothesis testing is a process to conclude that the educated guess is true/false or the relationship between the variables is statistically significant or not.

This latter part could be used for further research using statistical proof. A hypothesis is accepted or rejected based on the significance level and test score of the test used for testing the hypothesis

How Does Hypothesis Generation Help?

Here are 5 key reasons why hypothesis generation is so important in data science:

- Hypothesis generation helps in comprehending the business problem as we dive deep in inferring the various factors affecting our target variable
- You will get a much better idea of what are the major factors that are responsible to solve the problem
- Data that needs to be collected from various sources that are key in converting your business problem into a data science-based problem
- Improves your domain knowledge if you are new to the domain as you spend time understanding the problem
- Helps to approach the problem in a structured manner

When Should we Perform Hypothesis Generation?

The million-dollar question – when in the world should you perform hypothesis generation?

The hypothesis generation should be made before looking at the dataset or collection of the data. You will notice that if you have done your hypothesis generation adequately, you would have included all the variables present in the dataset in your hypothesis generation. You might also have included variables that are not present in the dataset

Case Study: Hypothesis Generation on "New York City Taxi Trip Duration Prediction"

Let us now look at the "NEW YORK CITY TAXI TRIP DURATION PREDICTION" problem statement and generate a few hypotheses that would affect our taxi trip duration to understand hypothesis generation.

Here's the problem statement: To predict the duration of a trip so that the company can assign the cabs that are free for the next trip. This will help in reducing the wait time for customers and will also help in earning customer trust. Let's begin!

Hypothesis Generation Based On Various Factors

1. Distance/Speed based Features

Let us try to come up with a formula that would have a relation with trip duration and would help us in generating various hypotheses for the problem: TIME=DISTANCE/SPEED

Distance and speed play an important role in predicting the trip duration.We can notice that the trip duration is directly proportional to the distance traveled and inversely proportional to the speed of the taxi. Using this we can come up with a hypothesis based on distance and speed.

- **Distance**: More the distance traveled by the taxi, the more will be the trip duration.
- **Interior drop point**: Drop points to congested or interior lanes could result in an increase in trip duration
- **Speed:** Higher the speed, the lower the trip duration

2. Features based on Car

Cars are of various types, sizes, brands, and these features of the car could be vital for commute not only on the basis of the safety of the passengers but also for the trip duration. Let us now generate a few hypotheses based on the features of the car.

- **Condition of the car**: Good conditioned cars are unlikely to have breakdown issues and could have a lower trip duration
- **Car Size**: Small-sized cars (Hatchback) may have a lower trip duration and larger-sized cars (XUV) may have higher trip duration based on the size of the car and congestion in the city

3. Type of the Trip

Trip types can be different based on trip vendors – it could be an outstation trip, single or pool rides. Let us now define a hypothesis based on the type of trip used.

- **Pool Car**: Trips with pooling can lead to higher trip duration as the car reaches multiple places before reaching your assigned destination

4. Features based on Driver Details

A driver is an important person when it comes to commute time. Various factors about the driver can help in understanding the reason behind trip duration and here are a few hypotheses this.

- **Age of driver**: Older drivers could be more careful and could contribute to higher trip duration
- **Gender**: Female drivers are likely to drive slowly and could contribute to higher trip duration
- **Driver experience**: Drivers with very less driving experience can cause higher trip duration
- **Medical condition**: Drivers with a medical condition can contribute to higher trip duration

5. Passenger details

Passengers can influence the trip duration knowingly or unknowingly. We usually come across passengers requesting drivers to increase the speed as they are getting late and there could be other factors to hypothesize which we can look at.

- **Age of passengers:** Senior citizens as passengers may contribute to higher trip duration as drivers tend to go slow in trips involving senior citizens
- **Medical conditions or pregnancy:** Passengers with medical conditions contribute to a longer trip duration
- **Emergency:** Passengers with an emergency could contribute to a shorter trip duration
- **Passenger count:** Higher passenger count leads to shorter duration trips due to congestion in seating

6. Date-Time Features

The day and time of the week are important as New York is a busy city and could be highly congested during office hours or weekdays. Let us now generate a few hypotheses on the date and time-based features.

Pickup Day:

- Weekends could contribute to more outstation trips and could have a higher trip duration
- Weekdays tend to have higher trip duration due to high traffic
- If the pickup day falls on a holiday then the trip duration may be shorter
- If the pickup day falls on a festive week then the trip duration could be lower due to lesser traffic

Time:

- Early morning trips have a lesser trip duration due to lesser traffic
- Evening trips have a higher trip duration due to peak hours

7. Road-based Features

Roads are of different types and the condition of the road or obstructions in the road are factors that can't be ignored. Let's form some hypotheses based on these factors.

- **Condition of the road**: The duration of the trip is more if the condition of the road is bad
- **Road type**: **Trips** in concrete roads tend to have a lower trip duration
- **Strike on the road:** Strikes carried out on roads in the direction of the trip causes the trip duration to increase

8. Weather Based Features

Weather can change at any time and could possibly impact the commute if the weather turns bad. Hence, this is an important feature to consider in our hypothesis.

- **Weather at the start of the trip**: Rainy weather condition contributes to a higher trip duration

After writing down our hypothesis and looking at the dataset you will notice that you would have covered the writing of hypothesis on most of the features present in the data set. There could also be a possibility that you might have to work with fewer features and the features on which you have generated hypotheses are not currently being captured/stored by the business and are not available. Always go ahead and capture data from external sources if you think that the data is relevant for your prediction. Ex: Getting weather information. It is also important to note that since hypothesis generation is an estimated guess, the hypothesis generated could come out to be true or false once exploratory data analysis and hypothesis testing is performed on the data.

MODELING

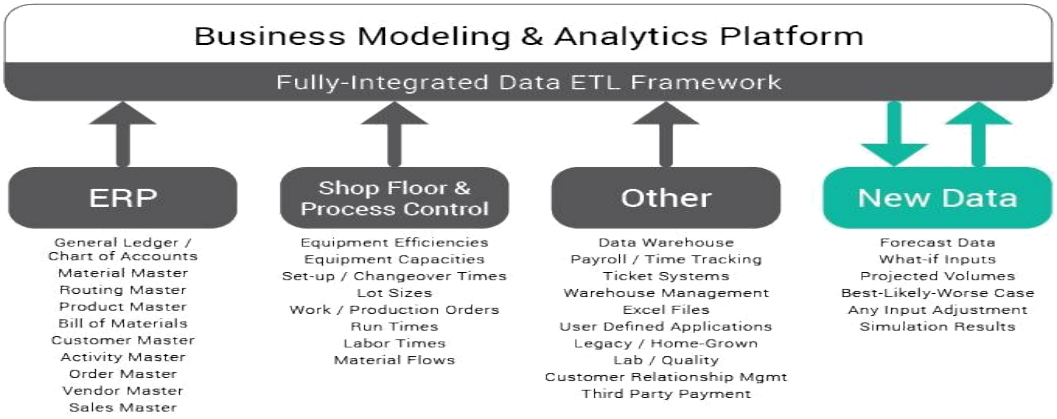
The purpose of the institution of business is to create and deliver value in an efficient enough way that it will generate profit after cost." If only it were as simple as it sounds! It's bigger than checking boxes to produce reports, closing the books each period and remaining in compliance. To create real value, forward-looking finance organizations have moved beyond traditional finance activities and are establishing robust business modeling & analytics programs that provides detailed visibility into historical performance and expected results.

Establishing a Robust Business Modeling & Analytics Program

Companies are increasingly dependent on automation and analytics to deliver clear, actionable and forward-looking insights. With the explosion of available data from quickbooks desktop canada and the need to quickly evaluate it, finance teams are centered on two areas – the data and the models.

- **Integrating data and accessing results:**

As the size of the organization grows, so do the number of systems that support it. Companies can have hundreds of machines that generate endless data points along with groups of data warehouses, BI systems and other data sources holding information. Without a way to link data across the enterprise, it's impossible to deliver meaningful insights or accurate results.



One shortcoming of most business analytics programs is the inability to integrate forecasted or simulated data as part of the modeling data set. Along with the expected data from ERP, shop floor and other systems, advanced analytics program recognize the need to retain and use forecasted or

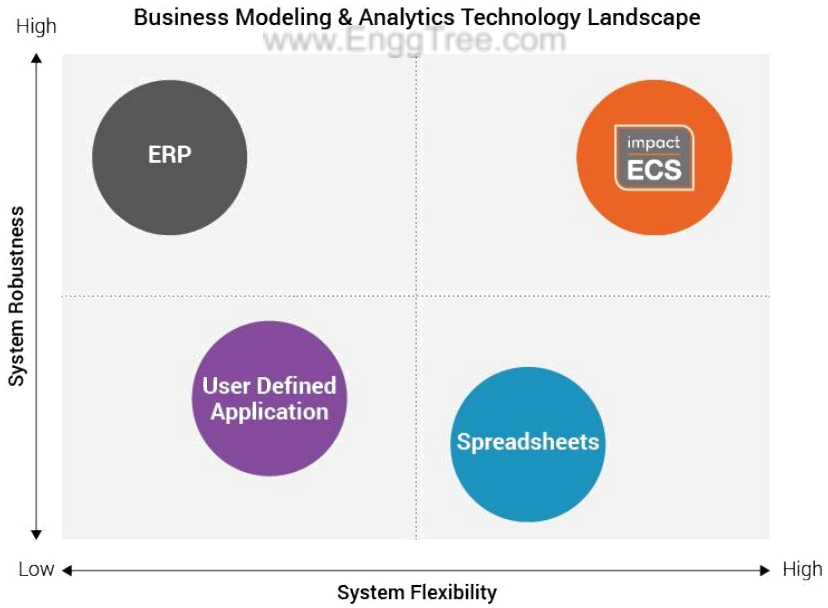
simulated data alongside historical data to predict performance and test assumptions for any data combination.

❷ **Building models and running simulations:**

The best models and simulations reflect real-world scenarios, not a pre-defined process or methodology, and delivers results in a timely manner. They must include measurable and meaningful KPIs that expose improvement opportunities and encourage behaviors that positively effect performance.

What is an integrated modeling platform, and why do you need one?

Most organizations have a few "system types" that provide, calculate, or share data as part of the planning and analytics process. The Business Modeling & Analytics Technology Landscape compares the different technologies and their attributes. The vertical axis measures the robustness of the system – or its ability to handle very large data sets and the ability to execute large sets of calculations quickly. Also, robust systems are scalable and can handle multiple users and permission sets. On the horizontal axis, the flexibility of the system represents the ability for the system to be configured to meet the company's unique needs, both now and in the future.



Business Modeling and Analytics "System Types"

ERP: The ERP system is the system of record for organizations and serves as the transactional system. They are often limited by the design choices in the initial implementation, creating a rigid environment with no inherent simulation capabilities.

User Defined Applications: Many companies try to meet their analytical needs with applications developed internally. From legacy systems dating back to the 70s to AS400 and Access databases, User defined applications offer customized solutions, but their capabilities are often a reduced or partial set of controls. Additionally, simulation capabilities are limited to the programmed options, and changes to the system require IT involvement in maintaining and upgrading systems.

Spreadsheets: Desktop modeling tools solve a variety of challenges when it comes to creating a flexible modeling environment. It isn't however, a system. That means limited controls and auditability will assure integrity issues. Further, spreadsheets are unable to scale with the requirements to build a robust modeling and analytics environment, and has difficulty handling larger sets of data.

Integrated Business Modeling & Analytics Platform: ImpactECS is an integrated modeling & analytics platform that leverages data from existing systems and delivers complete flexibility to design, calculate, manage, and report results that drive results by creating value. With a centralized approach, finance and planning organizations can link important data from across the company and build models to calculate, predict, or simulate performance at any level of detail or business dimension.

Each of these system types are critical and offer valuable benefits that keep the business running. However, organizations on a mission to create real value through analytics need to augment their IT footprint with technology that delivers the best of both worlds – a solid, enterprise-level system that connects relevant systems and data, and a flexible modeling platform to build, run, and maintain models that meet the company's unique business requirements. Companies build models with ImpactECS for everything from detailed manufacturing product costs, cost-to-serve and distribution costs, and profitability analytics for any business dimension.

VALIDATION AND EVALUATION

MODEL VALIDATION

Model validation is defined within regulatory guidance as "the set of processes and activities intended to verify that models are performing as expected, in line with their design objectives, and business uses." It also identifies "potential limitations and assumptions, and assesses their possible impact."Generally, validation activities are performed by individuals independent of model development or use. Models, therefore, should not be validated by their owners as they can be highly technical, and some institutions may find it difficult to assemble a model risk team that has sufficient functional and technical expertise to carry out independent validation. When faced with this obstacle, institutions often outsource the validation task to third parties. In statistics, **model validation** is the task of confirming that the outputs of a statistical model are acceptable with respect to the real data-generating process. In other words, model validation is the task of confirming that the outputs of a statistical model have enough fidelity to the outputs of the data-generating process that the objectives of the investigation can be achieved.

The Four Elements

Model validation consists of four crucial elements which should be considered:

1. Conceptual Design

The foundation of any model validation is its conceptual design, which needs documented coverage assessment that supports the model's ability to meet business and regulatory needs and the unique risks facing a bank.

The design and capabilities of a model can have a profound effect on the overall effectiveness of a bank's ability to identify and respond to risks. For example, a poorly designed risk assessment model may result in a bank establishing relationships with clients that present a risk that is greater than its risk appetite, thus exposing the bank to regulatory scrutiny and reputation damage.

A validation should independently challenge the underlying conceptual design and ensure that documentation is appropriate to support the model's logic and the model's ability to achieve desired regulatory and business outcomes for which it is designed.

2. System Validation

All technology and automated systems implemented to support models have limitations. An effective validation includes: firstly, evaluating the processes used to integrate the model's conceptual design and functionality into the organisation's business setting; and, secondly, examining the processes implemented to execute the model's overall design. Where gaps or limitations are observed, controls should be evaluated to enable the model to function effectively.

3. Data Validation and Quality Assessment

Data errors or irregularities impair results and might lead to an organisation's failure to identify and respond to risks. Best practise indicates that institutions should apply a risk-based data validation, which enables the reviewer to consider risks unique to the organisation and the model.

To establish a robust framework for data validation, guidance indicates that the accuracy of source data be assessed. This is a vital step because data can be derived from a variety of sources, some of which might lack controls on data integrity, so the data might be incomplete or inaccurate.

4. Process Validation

To verify that a model is operating effectively, it is important to prove that the established processes for the model's ongoing administration, including governance policies and procedures, support the model's sustainability. A review of the processes also determines whether the models are producing output that is accurate, managed effectively, and subject to the appropriate controls.

If done effectively, model validation will enable your bank to have every confidence in its various models' accuracy, as well as aligning them with the bank's business and regulatory expectations. By failing to validate models, banks increase the risk of regulatory criticism, fines, and penalties.

The complex and resource-intensive nature of validation makes it necessary to dedicate sufficient resources to it. An independent validation team well versed in data management, technology, and relevant financial products or services — for example, credit, capital management, insurance, or financial crime compliance — is vital for success. Where shortfalls in the validation process are identified, timely remedial actions should be taken to close the gaps.

MODEL EVALUATION

Model Evaluation is an integral part of the model development process. It helps to find the best model that represents our data and how well the chosen model will work in the future. Evaluating model performance with the data used for training is not acceptable in data science because it can easily generate overoptimistic and overfitted models. There are two methods of evaluating models in data science, Hold-Out and Cross-Validation. To avoid overfitting, both methods use a test set (not seen by the model) to evaluate model performance.

- **Hold-Out:** In this method, the mostly large dataset is *randomly* divided to three subsets:

1. **Training set** is a subset of the dataset used to build predictive models.
2. **Validation set** is a subset of the dataset used to assess the performance of model built in the training phase. It provides a test platform for fine tuning model's parameters and selecting the best-performing model. Not all modelling algorithms need a validation set.
3. **Test set** or unseen examples is a subset of the dataset to assess the likely future performance of a model. If a model fit to the training set much better than it fits the test set, overfitting is probably the cause.

- **Cross-Validation:** When only a limited amount of data is available, to achieve an unbiased estimate of the model performance we use *k*-fold cross-validation. In *k*-fold cross-validation, we divide the data into *k* subsets of equal size. We build models *k*times, each time leaving out one of the subsets from training and use it as the test set. If *k* equals the sample size, this is called "leave-one-out".

Model evaluation can be divided to **two sections:**

- **Classification Evaluation**
- **Regression Evaluation**

INTERPRETATION

Data analysis and interpretation have now taken center stage with the advent of the digital age… and the sheer amount of data can be frightening. In fact, a Digital Universe study found that the total data supply in 2012 was 2.8 trillion gigabytes! Based on that amount of data alone, it is clear the calling card of any successful enterprise in today's global world will be the ability to analyze complex data, produce actionable insights and adapt to new market needs… all at the speed of thought.

Business dashboards are the digital age tools for big data. Capable of displaying key performance indicators (KPIs) for both quantitative and qualitative data analyses, they are ideal for making the fast-paced and data-driven market decisions that push today's industry leaders to sustainable success. Through the art of streamlined visual communication, data dashboards permit businesses to engage in real-time and informed decision-making and are key instruments in data interpretation. First of all, let's find a definition to understand what lies behind data interpretation meaning.

1.) What Is Data Interpretation?

Data interpretation refers to the process of using diverse analytical methods to review data and arrive at relevant conclusions. The interpretation of data helps researchers to categorize, manipulate, and summarize the information in order to answer critical questions.

The importance of data interpretation is evident and this is why it needs to be done properly. Data is very likely to arrive from multiple sources and has a tendency to enter the analysis process with haphazard ordering. Data analysis tends to be extremely subjective. That is to say, the nature and goal of interpretation will vary from business to business, likely correlating to the type of data being analyzed. While there are several different types of processes that are implemented based on individual data nature, the two broadest and most common categories are "quantitative analysis" and "qualitative analysis".

Yet, before any serious data interpretation inquiry can begin, it should be understood that visual presentations of data findings are irrelevant unless a sound decision is made regarding scales of measurement. Before any serious data analysis can begin, the scale of measurement must be decided for the data as this will have a long-term impact on data interpretation ROI. The varying scales include:

- **Nominal Scale:** non-numeric categories that cannot be ranked or compared quantitatively. Variables are exclusive and exhaustive.
- **Ordinal Scale:** exclusive categories that are exclusive and exhaustive but with a logical order. Quality ratings and agreement ratings are examples of ordinal scales (i.e., good, very good, fair, etc., OR agree, strongly agree, disagree, etc.).
- **Interval:** a measurement scale where data is grouped into categories with orderly and equal distances between the categories. There is always an arbitrary zero point.
- **Ratio:** contains features of all three.

2.) How To Interpret Data?

When interpreting data, an analyst must try to discern the differences between correlation, causation, and coincidences, as well as much other bias – but he also has to consider all the factors involved that may have led to a result. There are various data interpretation methods one can use.

The interpretation of data is designed to help people make sense of numerical data that has been collected, analyzed, and presented. Having a baseline method (or methods) for interpreting data will provide your analyst teams with a structure and consistent foundation. Indeed, if several departments have different approaches to interpret the same data while sharing the same goals, some mismatched objectives can result. Disparate methods will lead to duplicated efforts, inconsistent solutions, wasted energy, and inevitably – time and money. In this part, we will look at the two main methods of interpretation of data: a qualitative and quantitative analysis.

Qualitative Data Interpretation

Qualitative data analysis can be summed up in one word – categorical. With qualitative analysis, data is not described through numerical values or patterns, but through the use of descriptive context (i.e., text). Typically, narrative data is gathered by employing a wide variety of person-to-person techniques. These techniques include:

- **Observations:** detailing behavioral patterns that occur within an observation group. These patterns could be the amount of time spent in an activity, the type of activity, and the method of communication employed.
- **Focus groups:** Group people and ask them relevant questions to generate a collaborative discussion about a research topic.
- **Secondary Research:** much like how patterns of behavior can be observed, different types of documentation resources can be coded and divided based on the type of material they contain.
- **Interviews:** one of the best collection methods for narrative data. Inquiry responses can be grouped by theme, topic, or category. The interview approach allows for highly-focused data segmentation.

A key difference between qualitative and quantitative analysis is clearly noticeable in the interpretation stage. Qualitative data, as it is widely open to interpretation, must be "coded" so as to facilitate the grouping and labeling of data into identifiable themes. As person-to-person data collection techniques can often result in disputes pertaining to proper analysis, qualitative data

analysis is often summarized through three basic principles: notice things, collect things, think about things.

Quantitative Data Interpretation

If quantitative data interpretation could be summed up in one word (and it really can't) that word would be "numerical." There are few certainties when it comes to data analysis, but you can be sure that if the research you are engaging in has no numbers involved, it is not quantitative research. Quantitative analysis refers to a set of processes by which numerical data is analyzed. More often than not, it involves the use of statistical modeling such as standard deviation, mean and median. Let's quickly review the most common statistical terms:

- **Mean:** a mean represents a numerical average for a set of responses. When dealing with a data set (or multiple data sets), a mean will represent a central value of a specific set of numbers. It is the sum of the values divided by the number of values within the data set. Other terms that can be used to describe the concept are arithmetic mean, average and mathematical expectation.
- **Standard deviation:** this is another statistical term commonly appearing in quantitative analysis. Standard deviation reveals the distribution of the responses around the mean. It describes the degree of consistency within the responses; together with the mean, it provides insight into data sets.
- **Frequency distribution:** this is a measurement gauging the rate of a response appearance within a data set. When using a survey, for example, frequency distribution has the capability of determining the number of times a specific ordinal scale response appears (i.e., agree, strongly agree, disagree, etc.). Frequency distribution is extremely keen in determining the degree of consensus among data points.

Typically, quantitative data is measured by visually presenting correlation tests between two or more variables of significance. Different processes can be used together or separately, and comparisons can be made to ultimately arrive at a conclusion. Other signature interpretation processes of quantitative data include:

- **Regression analysis:** Essentially, regression analysis uses historical data to understand the relationship between a dependent variable and one or more independent variables. Knowing which variables are related and how they developed in the past allows you to anticipate possible outcomes and make better decisions going forward. For example, if you want to predict your sales for next month you can use regression analysis to understand what factors will affect them such as products on sale, the launch of a new campaign, among many others.

- **Cohort analysis:** This method identifies groups of users who share common characteristics during a particular time period. In a business scenario, cohort analysis is commonly used to understand different customer behaviors. For example, a cohort could be all users who have signed up for a free trial on a given day. An analysis would be carried out to see how these users behave, what actions they carry out, and how their behavior differs from other user groups.

- **Predictive analysis:** As its name suggests, the predictive analysis method aims to predict future developments by analyzing historical and current data. Powered by technologies such as artificial

intelligence and machine learning, predictive analytics practices enable businesses to spot trends or potential issues and plan informed strategies in advance.

- **Prescriptive analysis:** Also powered by predictions, the prescriptive analysis method uses techniques such as graph analysis, complex event processing, neural networks, among others, to try to unravel the effect that future decisions will have in order to adjust them before they are actually made. This helps businesses to develop responsive, practical business strategies.

- **Conjoint analysis:** Typically applied to survey analysis, the conjoint approach is used to analyze how individuals value different attributes of a product or service. This helps researchers and businesses to define pricing, product features, packaging, and many other attributes. A common use is menu-based conjoint analysis in which individuals are given a "menu" of options from which they can build their ideal concept or product. Like this analysts can understand which attributes they would pick above others and drive conclusions.

- **Cluster analysis:** Last but not least, cluster analysis is a method used to group objects into categories. Since there is no target variable when using cluster analysis, it is a useful method to find hidden trends and patterns in the data. In a business context clustering is used for audience segmentation to create targeted experiences, and in market research, it is often used to identify age groups, geographical information, earnings, among others.

Now that we have seen how to interpret data, let's move on and ask ourselves some questions: what are some data interpretation benefits? Why do all industries engage in data research and analysis? These are basic questions, but they often don't receive adequate attention.

3.) Why Data Interpretation Is Important

The purpose of collection and interpretation is to acquire useful and usable information and to make the most informed decisions possible. From businesses to newlyweds researching their first home, data collection and interpretation provides limitless benefits for a wide range of institutions and individuals.

Data analysis and interpretation, regardless of the method and qualitative/quantitative status, may include the following characteristics:

- Data identification and explanation
- Comparing and contrasting of data
- Identification of data outliers
- Future predictions
- Informed decision-making
- Anticipating needs with trends identification
- Cost efficiency
- Clear foresight

4.) Common Data Analysis And Interpretation Problems

The oft-repeated mantra of those who fear data advancements in the digital age is "big data equals big trouble." While that statement is not accurate, it is safe to say that certain data interpretation problems or "pitfalls" exist and can occur when analyzing data, especially at the speed of thought. Let's identify some of the most common data misinterpretation risks and shed some light on how they can be avoided:

a) Correlation mistaken for causation: our first misinterpretation of data refers to the tendency of data analysts to mix the cause of a phenomenon with correlation. It is the assumption that because two actions occurred together, one caused the other. This is not accurate as actions can occur together absent a cause and effect relationship.

Digital age example: assuming that increased revenue is the result of increased social media followers… there might be a definitive correlation between the two, especially with today's multi-channel purchasing experiences. But, that does not mean an increase in followers is the direct cause of increased revenue. There could be both a common cause or an indirect causality.

Remedy: attempt to eliminate the variable you believe to be causing the phenomenon.

b) Confirmation bias: our second data interpretation problem occurs when you have a theory or hypothesis in mind but are intent on only discovering data patterns that provide support to it while rejecting those that do not.

Digital age example: your boss asks you to analyze the success of a recent multi-platform social media marketing campaign. While analyzing the potential data variables from the campaign (one that you ran and believe performed well), you see that the share rate for Facebook posts was great, while the share rate for Twitter Tweets was not. Using only the Facebook posts to prove your hypothesis that the campaign was successful would be a perfect manifestation of confirmation bias.

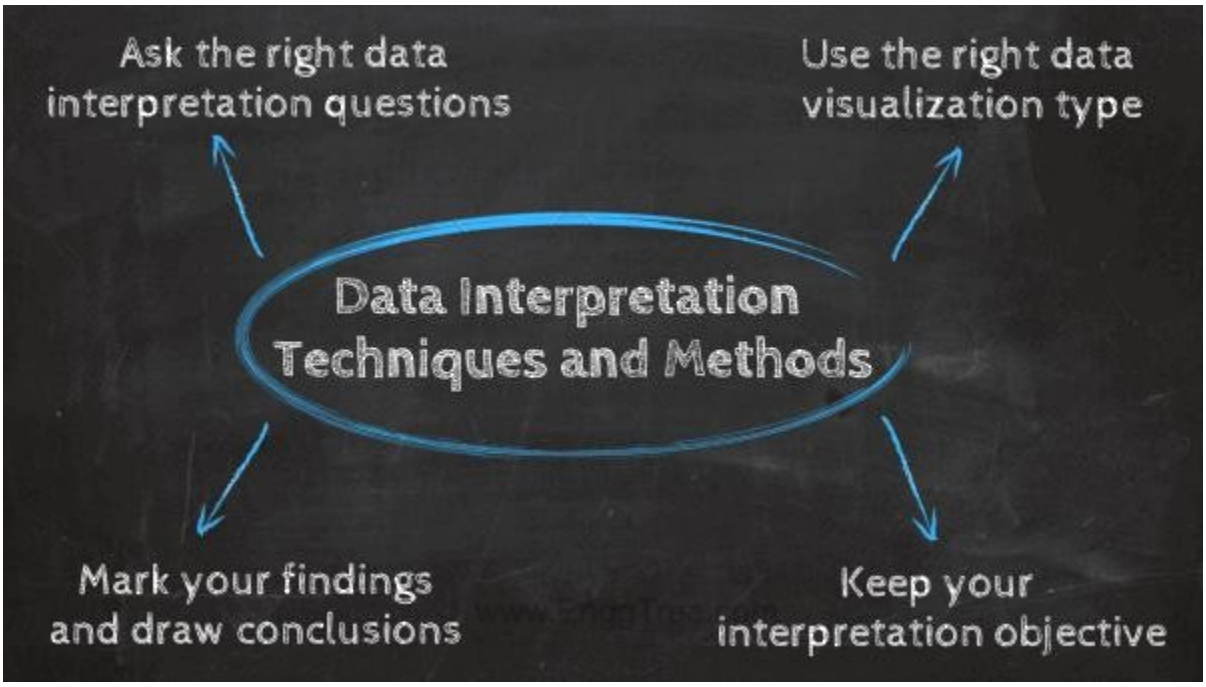
Remedy: as this pitfall is often based on subjective desires, one remedy would be to analyze data with a team of objective individuals. If this is not possible, another solution is to resist the urge to make a conclusion before data exploration has been completed. Remember to always try to disprove a hypothesis, not prove it.

c) Irrelevant data: the third data misinterpretation pitfall is especially important in the digital age. As large data is no longer centrally stored, and as it continues to be analyzed at the speed of thought, it is inevitable that analysts will focus on data that is irrelevant to the problem they are trying to correct.

Digital age example: in attempting to gauge the success of an email lead generation campaign, you notice that the number of homepage views directly resulting from the campaign increased, but the number of monthly newsletter subscribers did not. Based on the number of homepage views, you decide the campaign was a success when really it generated zero leads.

Remedy: proactively and clearly frame any data analysis variables and KPIs prior to engaging in a data review. If the metric you are using to measure the success of a lead generation campaign is newsletter subscribers, there is no need to review the number of homepage visits. Be sure to focus on the data variable that answers your question or solves your problem and not on irrelevant data.

5.)Data Interpretation Techniques and Methods



Data analysis and interpretation are critical to developing sound conclusions and making better-informed decisions. As we have seen with this article, there is an art and science to the interpretation of data. To help you with this purpose here we will list a few relevant data interpretation techniques, methods, and tricks you can implement for a successful data management process.

As mentioned at the beginning of this post, the first step to interpret data in a successful way is to identify the type of analysis you will perform and apply the methods respectively. Clearly differentiate between qualitative analysis (observe, document, and interview notice, collect and think about things) and quantitative analysis (you lead research with a lot of numerical data to be analyzed through various statistical methods).

a) Ask the right data interpretation questions

The first data interpretation technique is to define a clear baseline for your work. This can be done by answering some critical questions that will serve as a useful guideline to start. Some of them include: what are the goals and objectives from my analysis? What type of data interpretation method will I use? Who will use this data in the future? And most importantly, what general question am I trying to answer?

Once all this information has been defined, you will be ready to collect your data. As mentioned at the beginning of the post, your methods for data collection will vary depending on what type of analysis you use (qualitative or quantitative). With all the needed information in hand, you are ready to start the interpretation process, but first, you need to visualize your data.

b) Use the right data visualization type

Data visualizations such as business graphs, charts, and tables are fundamental to successfully interpreting data. This is because the visualization of data via interactive charts and graphs makes the information more understandable and accessible. As you might be aware, there are different types of visualizations you can use but not all of them are suitable for any analysis purpose. Using the wrong graph can lead to misinterpretation of your data so it's very important to carefully pick the right visual for it. Let's look at some use cases of common data visualizations.

- **Bar chart:** One of the most used chart types, the bar chart uses rectangular bars to show the relationship between 2 or more variables. There are different types of bar charts for different interpretations this includes the horizontal bar chart, column bar chart, and stacked bar chart.
- **Line chart:** Most commonly used to show trends, acceleration or decelerations, and volatility, the line chart aims to show how data changes over a period of time for example sales over a year. A few tips to keep this chart ready for interpretation is to not use many variables that can overcrowd the graph and keep your axis scale close to the highest data point to avoid making the information hard to read.
- **Pie chart:** Although it doesn't do a lot in terms of analysis due to its uncomplex nature, pie charts are widely used to show the proportional composition of a variable. Visually speaking, showing a percentage in a bar chart is way more complicated than showing it in a pie chart. However, this also depends on the number of variables you are comparing. If your pie chart would need to be divided into 10 portions then it is better to use a bar chart instead.
- **Tables:** While they are not a specific type of chart, tables are wildly used when interpreting data. Tables are especially useful when you want to portray data in its raw format. They give you the freedom to easily look up or compare individual values while also displaying grand totals.

With the use of data visualizations becoming more and more critical for businesses' analytical success, many tools have emerged to help users visualize their data in a cohesive and interactive way. One of the most popular ones is the use of BI dashboards. These visual tools provide a centralized view of various graphs and charts that paint a bigger picture about a topic. We will discuss more the power of dashboards for an efficient data interpretation practice in the next portion of this post. If you want to learn more about different types of data visualizations take a look at our complete guide on the topic.

c) Keep your interpretation objective

As mentioned above, keeping your interpretation objective is a fundamental part of the process. Being the person closest to the investigation, it is easy to become subjective when looking for answers in the data. Some good ways to stay objective is to show the information to other people related to the study, for example, research partners or even the people that will use your findings

once they are done. This can help avoid confirmation bias and any reliability issues with your interpretation.

d) Mark your findings and draw conclusions

Findings are the observations you extracted out of your data. They are the facts that will help you drive deeper conclusions about your research. For example, findings can be trends and patterns that you found during your interpretation process. To put your findings into perspective you can compare them with other resources that used similar methods and use them as benchmarks.

Reflect on your own thinking and reasoning and be aware of the many pitfalls data analysis and interpretation carries. Correlation versus causation, subjective bias, false information, and inaccurate data, etc. Once you are comfortable with your interpretation of the data you will be ready to develop conclusions, see if your initial question were answered, and suggest recommendations based on them.

6.)Interpretation of Data: The Use of Dashboards Bridging The Gap

As we have seen, quantitative and qualitative methods are distinct types of data analyses. Both offer a varying degree of return on investment (ROI) regarding data investigation, testing, and decision-making. Because of their differences, it is important to understand how dashboards can be implemented to bridge the quantitative and qualitative information gap. How are digital data dashboard solutions playing a key role in merging the data disconnect? Here are a few of the ways:

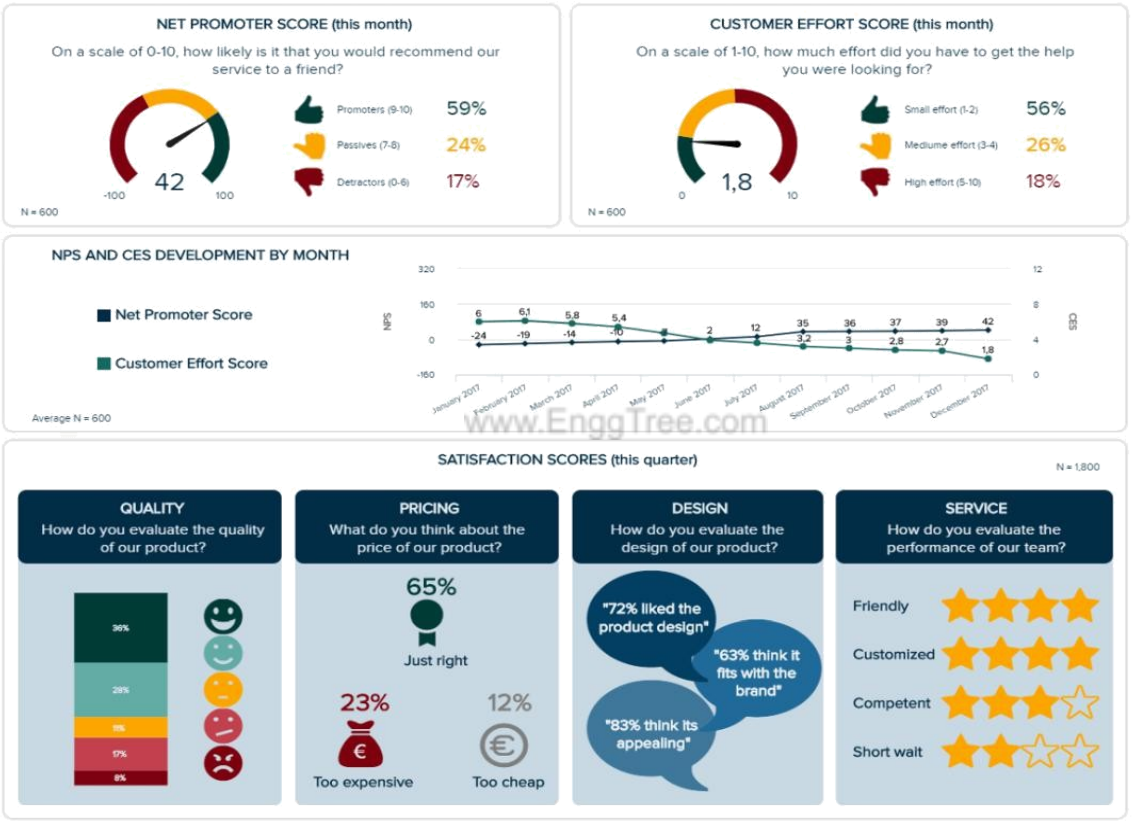
a) Connecting and blending data. With today's pace of innovation, it is no longer feasible (nor desirable) to have bulk data centrally located. As businesses continue to globalize and borders continue to dissolve, it will become increasingly important for businesses to possess the capability to run diverse data analyses absent the limitations of location. Data dashboards decentralize data without compromising on the necessary speed of thought while blending both quantitative and qualitative data. Whether you want to measure customer trends or organizational performance, you now have the capability to do both without the need for a singular selection.

b) Mobile Data. Related to the notion of "connected and blended data" is that of mobile data. In today's digital world, employees are spending less time at their desks and simultaneously increasing production. This is made possible by the fact that mobile solutions for analytical tools are no longer standalone. Today, mobile analysis applications seamlessly integrate with everyday business tools. In turn, both quantitative and qualitative data are now available on-demand where they're needed, when they're needed, and how they're needed via interactive online dashboards.

c) Visualization. Data dashboards **are** merging the data gap between qualitative and quantitative methods of interpretation of data, through the science of visualization. Dashboard solutions come "out of the box" well-equipped to create easy-to-understand data demonstrations. Modern online data visualization tools provide a variety of color and filter patterns, encourage user interaction, and are engineered to help enhance future trend predictability. All of these visual characteristics

make for an easy transition among data methods – you only need to find the right types of data visualization to tell your data story the best way possible.

To give you an idea of how a market research dashboard fulfills the need of bridging quantitative and qualitative analysis and helps in understanding how to interpret data in research thanks to visualization, have a look at the following one. It brings together both qualitative and quantitative data knowledgeably analyzed and visualizes it in a meaningful way that everyone can understand, thus empowering any viewer to interpret it:



Conclusion

Overall, data interpretation is an essential factor in data-driven decision-making. It should be performed on a regular basis as part of an iterative interpretation process. Investors, developers, and sales and acquisition professionals can benefit from routine data interpretation. It is what you do with those insights that determine the success of your business.

DEPLOYMENT AND ITERATION

The deployment phase is the final phase of any IT or SW development project, including those that are exploring Advanced Analytics capabilities.

The main objective is to ensure that the final solution is ready to be used within the operational environment and that end users have all the required tools to act upon the analytical insights discovered during the development phases of the project.

However, organisations, especially those that are deploying analytical initiatives for the first time, or that are still analytically "immature", typically focus too much on building an IT infrastructure, instead of planning how to deliver actionable insights to their end users and integrate this intelligence into internal organisational processes.

The lack of vision regarding usability and access to analytical information to drive decision making, is a common mistake in Advanced Analytics projects.

At Presidion, we've seen organisations perform best when they take the before, during and after of the deployment of analytics initiatives into consideration. This will help to maximize return on investment and achieve a high impact on business and operations.

Things to consider BEFORE deployment

There is a strong need for a **pre-deployment, planning phase** to ensure that the final solution is ready to operate in production mode.The key activities that should be performed before deploying the final solution are **Testing** and **Validation** activities and preparation of a well-defined **Transition period**. Depending on the size and the scope of the analytical application, this can include a formal **User Acceptance Testing** (UAT) and/or a **Cutover** plan for the application, which will replace a legacy solution or existing manual processes and **Go-live**.

Before proceeding to deployment, Data scientists and Development teams should exhaustively evaluate analytical outputs to assess quality and accuracy, but most importantly to validate that business objectives are properly addressed and success criteria, that were set during project initiation, are fully met.

The goal of the transition period is to make sure that end users have accepted the functionalities and the outputs of the solution, and that they are now ready to integrate the system outputs in a way that will improve future outcomes and decision making.

During the pre-deployment phase, end users should be placed at the centre of attention. **Training** and formal **Knowledge Transfer** sessions can significantly help them learn how to operate the new solution, validate the usability of the new system and ensure a smooth transition period.

Instead of deploying the technology, pre-deployment activities in Advanced Analytics projects should focus on the business problems that the new solution addresses. Data Scientists and Developers should be aware that they are deploying business, analytical insights and not technical, statistical outputs or model results. The terminology used in front end applications should be appropriate for non-technical users to enable them to adopt and quickly use the solution.

Things to consider DURING deployment

At this stage, technical teams can focus on deploying the technology and integrating the solution into an operational environment to automate decision making process.

The **Technical Infrastructure** and the **Production environment**, which will host the solution, and any required **Integration Interfaces** should by now be already developed, tested and ready in order to initiate deployment and successfully incorporate analytical results into an organisation's daily operations.

Typically, deployment of Advanced Analytics insights includes all operations to generate reports and recommendations for end users, visualisation of key findings, self-service and data discovery functionalities for business users, and finally, depending on the size and scope of the analytical application, implementation of a scoring process or workflows that integrate analytical outputs (in real time or not) with custom, operational and core systems.

During deployment, many iterations, enhancements and fine-tuning activities might be necessary to finalise the deployment of the system. Other activities necessary during deployment include Administration**,** Security and Authorisation**,** aswellas finalising Documentation and Transferring Ownership to business and operations**.**

Things to consider AFTER deployment

Market conditions, trends, policies and regulations, all change over time. **Monitoring** Advanced Analytics insights is essential to ensure that performance and accuracy is maintained over longer periods.

The goal of a **post-deployment** monitoring phase is to create the strategy and the foundations to continually monitor the solution's performance, **review** outputs, collect **feedback** from business users and address issues detected on an ongoing basis in a timely manner, without creating operational disruptions.

Model management is a very important concept towards that objective, as it is possible to systematically compare and assess analytical outputs, detect decrease in performance, and promote the best possible analytical results.

Finally, do not forget to **learn** from your previous mistakes and incorporate your end users feedback into this monitoring process to address issues either in future enhancements of the application or during regular updates to overall improve the accuracy of analytical outputs.

UNIT II BUSINESS INTELLIGENCE

Data Warehouses and Data Mart - Knowledge Management – Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence – OLAP – Analytic functions

DATA WAREHOUSES AND DATA MART

INTRODUCTION

Business intelligence, as we know it today, would not be possible without the data warehouse. At its core, business intelligence is the ability to answer complex questions about your data and use those answers to make informed business decisions. In order to do this well, you need a data warehouse, which not only provides a safe way to centralize and store all your data but also a method to quickly find the answers you need, when you need them. And that's a pretty important role. By 2025, it's estimated humanity will have produced a total of 175 zettabytes of data. For context, that's 175,000,000,000 terabytes.

Where does all of this information go? Well, most of it goes in the data warehouses.

Companies use data warehouses to manage transactions, understand their data, and keep it all organized. In short, data warehouses make large amounts of information more usable for organizations of all sizes and types. This has made them a linchpin of data pipelines and business intelligence systems the world over. And understanding how data warehouses work can help you fulfill the full potential of business intelligence (it's not as complex as it may seem).

WHAT IS A DATABASE?

A database is a storage location of related data used to capture a specific situation. One example of a database is a point-of-sale (POS) database. The POS database will capture and store all the relevant data surrounding a retail store's transactions.

Databases have a variety of flavors: structured, relational, relational database management systems (RDBMS), or unstructured data structures (known as _NoSQL'). New data coming into the database is processed, organized, managed, updated and then stored in tables. Databases are single-purpose repositories of raw transactional data. Because a database is closely tied with transactions, a database performs online transactional processing (OLTP).

Main Characteristics of Databases

- Structured according to company operations and applications
- Rigid rules set around data storage/organization (RDBMS-specific)
- Flexible data storage (NoSQL-specific)
- Single-purpose in its nature: handles one process (e.g., POS)
- Utilized for online transaction processing (OLTP)
- Data recording capabilities, capturing transactions as they occur and housing those transactions

WHAT IS A DATA WAREHOUSE?

A data warehouse is a data management system that stores large amounts of data for later use in processing and analysis. You can think of it as a large warehouse where trucks (i.e., source data) unload their data. That data is then sorted into rows and rows of well-organized shelves that make it easy to find exactly what you're looking for later. The biggest innovation data warehouses introduced at their inception, according to DW 2.0: The Architecture for the Next Generation of Data Warehousing, was the ability to store ―integrated granular historical data.‖

Breaking that down into human terms, this means data warehouses excel at storing data that's:

- Integrated: They combine data from many databases and data sources.
- Granular: The data they house is highly detailed and can be used in many different ways.
- Historical: They can host a continuous record of data over years and years.

You can store this data in three different ways: on-premise data warehouses, cloud data warehouses, and hybrid data warehouses.

On-premise data warehouses run on physical servers that your company owns and manages. Cloud data warehouses are fully online, and you pay for space on servers that another company manages, like Amazon Redshift. Hybrid data warehouses are a mix of both on-premise and cloud, and companies making the transition to the cloud over a period of time use this option.

With all the data stored in one place, data warehouses use a specific approach to process data called online analytical processing (OLAP), which is specifically designed for complex queries. One way to think about it is that when you go to your data warehouse to ask a question about the relationship between one set of data and another, OLAP is a way of organizing and moving among the rows and rows of shelves to quickly find that information.

This is great for business intelligence because the questions you ask about your data in order to make decisions are rarely simple. Because data warehouses use OLAP, they make finding answers to these complex questions very efficient. As a result, they've become a foundation for many successful business intelligence systems.

What Is the Role of Data Warehousing in Business Intelligence?

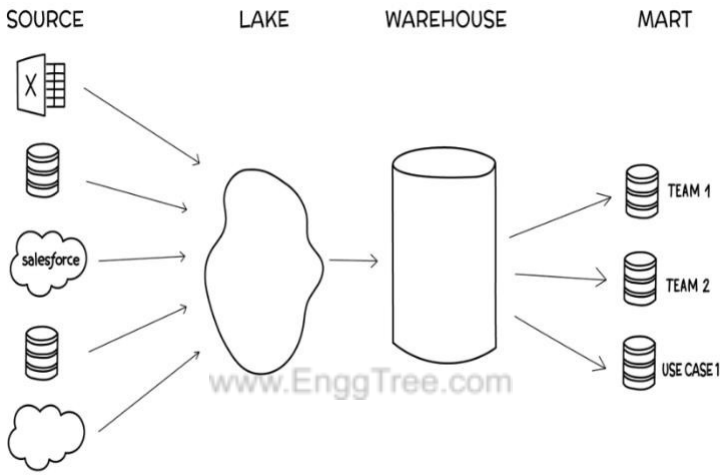
In business intelligence, data warehouses serve as the backbone of data storage. Business intelligence relies on complex queries and comparing multiple sets of data to inform everything from everyday decisions to organization-wide shifts in focus.

To facilitate this, business intelligence is comprised of three overarching activities: data wrangling, data storage, and data analysis. Data wrangling is usually facilitated by extract, transform, load (ETL) technologies, which we'll explain in detail below, and data analysis is done using business intelligence tools, like Chartio.

The glue holding this process together is data warehouses, which serve as the facilitator of data storage using OLAP. They integrate, summarize, and transform data, making it easier to analyze. Even though data warehouses serve as the backbone of data storage, they're not the only technology involved in data storage. Many companies go through a data storage hierarchy before reaching the point where they absolutely need a data warehouse.

When Should I Use a Data Warehouse for Business Intelligence?

There are generally four stages of data sophistication: source data, data lakes, data warehouses, and data marts. Knowing when to invest in a data warehouse requires you to know each stage, but at the end of the day, the data warehouse stage is what unlocks the true power of your data.



SOURCE DATA

Source data is any individual set of data like databases, Excel spreadsheets, individual application reports, etc. It's structured (i.e., organized) yet siloed data that works fine alone but does not provide a larger picture of your organization's data as a whole.

DATA LAKE

For teams who have graduated to a need to centralize their source data into one place, a data lake is increasingly becoming the next step. A data lake serves as a central repository for all raw, unstructured (i.e., not organized) data.

If a data warehouse is like backing up a truck and unloading the data in an orderly fashion into a well-organized shelving system, data lakes are like backing the truck up and dumping all the data into, well, a lake. James Dixon, who coined the term ―data lake,‖ describes it as the natural raw state of data that, for people with the diving skills, serves as a frontier to explore.

The drawback of a data lake is that the data is not ready for analysis. It‘s not well-organized, there may be duplicates, and in order to make sense of it, you‘ll need to tell your diver exactly what you‘re looking for. Even then, the diver might not find exactly what you need after all that effort.

DATA WAREHOUSE

Like a data lake, a data warehouse centralizes your data, but as we‘ve established, it‘s well-organized and set up for efficient analysis. It‘s a single source of truth for all data that‘s easier to understand and navigate.

Data warehouses can hook right up to source data, but nowadays, we‘re seeing more and more companies use their data warehouse as a layer on top of their data lake. Following Dixon‘s comparison, if a data lake is the water/data in its natural, unorganized state, a data warehouse is where you treat it and make it ready for consumption.

Building a Data Warehouse: The Basics

Business Intelligence has advanced quickly and dramatically in recent years, and many people are taking advantage of it. To be the most successful and efficient with this newfound Business Intelligence (BI) power, it‘s essential to be able to analyze and harness ALL of your data. Enter the data warehouse.

Simply put, a data warehouse is a large store of data that‘s collected from multiple different sources within a business. A data warehouse is used as storage for data analytic work (OLAP systems), leaving the transactional database (OLTP systems) free to focus on transactions. With a significant amount of data kept in one place, it‘s now easier for businesses to analyze and make better-informed decisions.

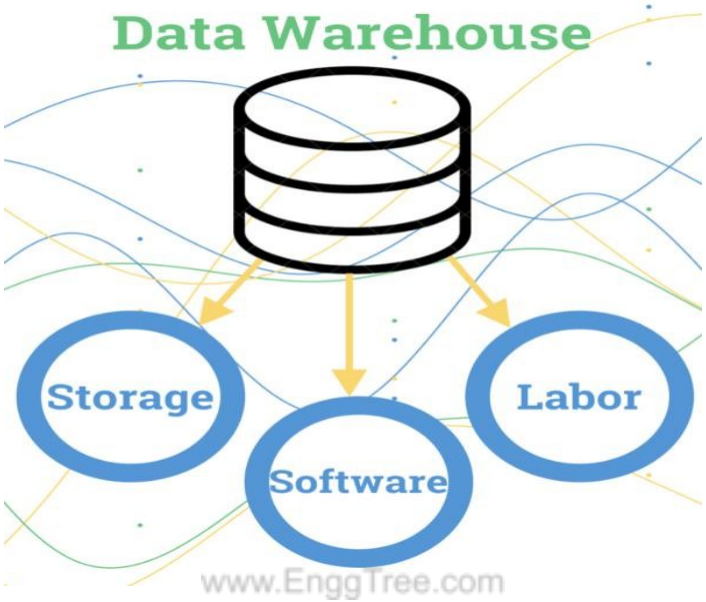
Why Should I Build a Data Warehouse?

While having all of your data gathered in one place is arguably the biggest benefit of having a data warehouse, it is certainly not the only one. Here, we‘ve listed some of the other benefits of having a data warehouse:

- **Save Time** – Business users can quickly access data from multiple sources within a data warehouse, meaning that time won‘t be wasted on retrieving data from multiple sources.
- **Boost Confidence** – Having data transferred automatically to your data warehouse by a structured system, as opposed to being transferred by human labor, gives you more confidence that your data is clean, current and complete.
- **Increase Insight** – Data warehouses structure your data so it‘s easily analyzable.
- **Improve Security** – Managing who has access to your data is much easier when there‘s a centralized connection point. Data warehouses make security completely customizable, so you‘re able to give access to whoever you‘d like and lock down all of your other systems.

When using a data warehouse to its full potential, analyzing data becomes convenient and answering important questions about your business becomes simple. Your data is organized and available so you can get your answers quickly and securely.

STRUCTURE OF A DATA WAREHOUSE



Regardless of the specific approach, you take to building a data warehouse, there are three components that should make up your basic structure: A storage mechanism, operational software, and human resources.

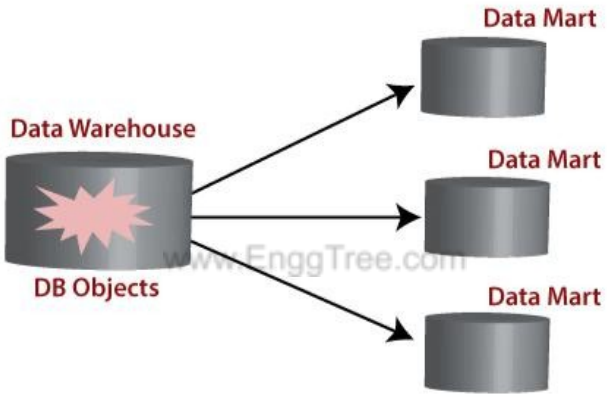
- **Storage** – This part of the structure is the main foundation — it‘s where your warehouse will live. There are two main options when it comes to storage, an in-house server (Oracle, Microsoft SQL Server) or on the cloud (Amazon S3, Microsoft Azure). An in-house server is internal hardware that‘s set up within your office, and the cloud is a digital storage solution based on external servers. Either is a feasible option when it comes to storage and all depends on your needs.
- **Software** – This is the operational part of the data warehouse structure. It‘s often broken down into two categories — centralization software and visualization software. Centralization software is needed to collect and maintain the data that comes from all of your separate databases. Visualization software is needed to take the data and present it in a visual form to aid in analyzation. Some centralization software includes visualization software as part of its package, but it is highly recommended that you have both types of software regardless.
- **Labor** – This is the management aspect of the data warehouse, something that‘s absolutely essential in having a working solution. To keep your warehouse functional, it might be necessary to hire new positions within your business. Hiring well-skilled professionals is crucial, as running a data warehouse requires a lot of knowledge. However, if you choose to have a cloud-based warehouse, it might not be necessary to

have as many human resources. The cloud is managed by third-party vendors, so it's their responsibility to do routine maintenance on hardware and servers

WHAT IS DATA MART?

A **Data Mart** is a subset of a directorial information store, generally oriented to a specific purpose or primary data subject which may be distributed to provide business needs. Data Marts are analytical record stores designed to focus on particular business functions for a specific community within an organization. Data marts are derived from subsets of data in a data warehouse, though in the bottom-up data warehouse design methodology, the data warehouse is created from the union of organizational data marts.

The fundamental use of a data mart is **Business Intelligence (BI)** applications. **BI** is used to gather, store, access, and analyze record. It can be used by smaller businesses to utilize the data they have accumulated since it is less expensive than implementing a data warehouse.



Reasons for creating a data mart

- Creates collective data by a group of users
- Easy access to frequently needed data
- Ease of creation
- Improves end-user response time
- Lower cost than implementing a complete data warehouses
- Potential clients are more clearly defined than in a comprehensive data warehouse
- It contains only essential business data and is less cluttered.

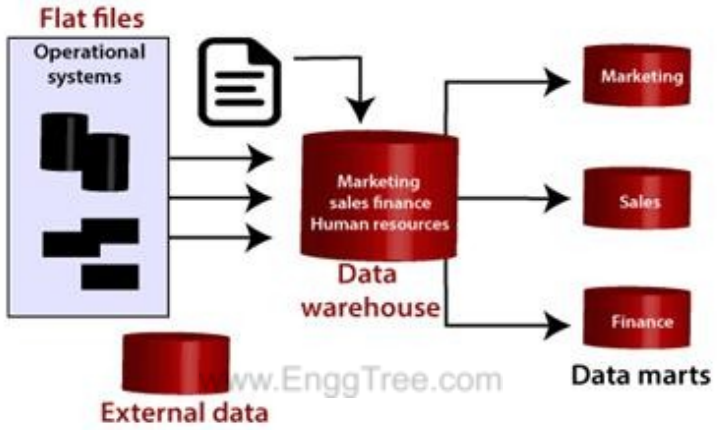
Types of Data Marts

There are mainly two approaches to designing data marts. These approaches are

- Dependent Data Marts
- Independent Data Marts

Dependent Data Marts

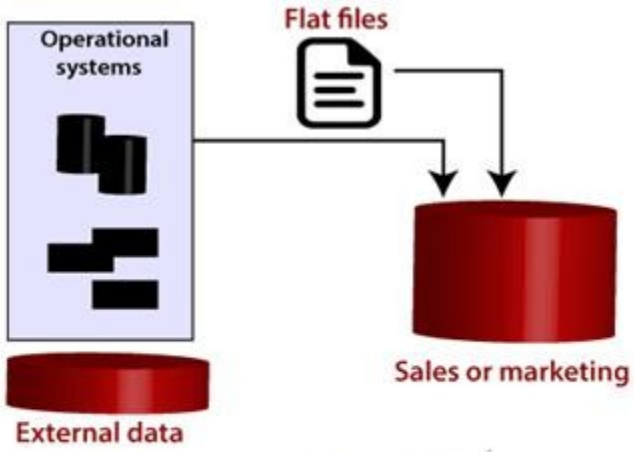
A dependent data marts is a logical subset of a physical subset of a higher data warehouse. According to this technique, the data marts are treated as the subsets of a data warehouse. In this technique, firstly a data warehouse is created from which further various data marts can be created. These data mart are dependent on the data warehouse and extract the essential record from it. In this technique, as the data warehouse creates the data mart; therefore, there is no need for data mart integration. It is also known as a **top-down approach**.



Dependent Data Mart

Independent Data Marts

The second approach is Independent data marts (IDM) Here, firstly independent data marts are created, and then a data warehouse is designed using these independent multiple data marts. In this approach, as all the data marts are designed independently; therefore, the integration of data marts is required. It is also termed as a **bottom-up approach** as the data marts are integrated to develop a data warehouse.



Independent Data Mart

Other than these two categories, one more type exists that is called "**Hybrid Data Marts**."

Hybrid Data Marts

It allows us to combine input from sources other than a data warehouse. This could be helpful for many situations; especially when Adhoc integrations are needed, such as after a new group or product is added to the organizations.

Steps in Implementing a Data Mart

The significant steps in implementing a data mart are to design the schema, construct the physical storage, populate the data mart with data from source systems, access it to make informed decisions and manage it over time. So, the steps are:

Designing

The design step is the first in the data mart process. This phase covers all of the functions from initiating the request for a data mart through gathering data about the requirements and developing the logical and physical design of the data mart.

It involves the following tasks:

1. Gathering the business and technical requirements
2. Identifying data sources
3. Selecting the appropriate subset of data
4. Designing the logical and physical architecture of the data mart.

Constructing

This step contains creating the physical database and logical structures associated with the data mart to provide fast and efficient access to the data.

It involves the following tasks:

1. Creating the physical database and logical structures such as table spaces associated with the data mart.
2. Creating the schema objects such as tables and indexes describe in the design step.
3. Determining how best to set up the tables and access structures.

Populating

This step includes all of the tasks related to the getting data from the source, cleaning it up, modifying it to the right format and level of detail, and moving it into the data mart.

It involves the following tasks:

1. Mapping data sources to target data sources
2. Extracting data

3. Cleansing and transforming the information.
4. Loading data into the data mart
5. Creating and storing metadata

Accessing

This step involves putting the data to use: querying the data, analyzing it, creating reports, charts and graphs and publishing them.

It involves the following tasks:

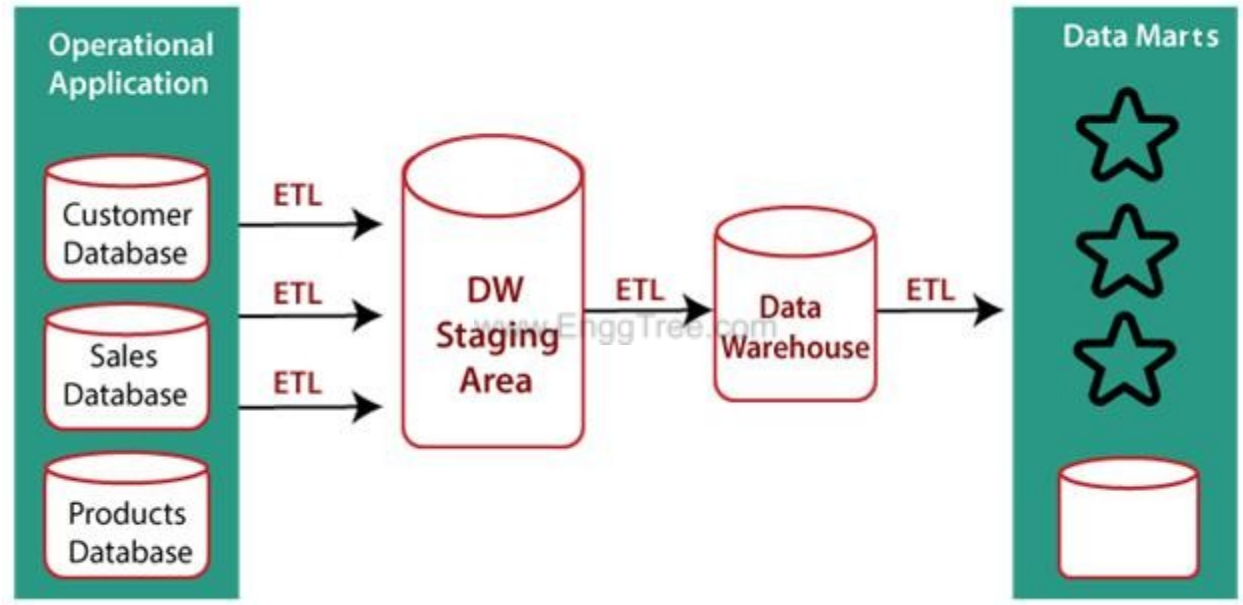
1. Set up and intermediate layer (Meta Layer) for the front-end tool to use. This layer translates database operations and objects names into business conditions so that the end-clients can interact with the data mart using words which relates to the business functions.
2. Set up and manage database architectures like summarized tables which help queries agree through the front-end tools execute rapidly and efficiently.

Managing

This step contains managing the data mart over its lifetime. In this step, management functions are performed as:

1. Providing secure access to the data.
2. Managing the growth of the data.
3. Optimizing the system for better performance.
4. Ensuring the availability of data event with system failures.

Difference between Data Warehouse and Data Mart



Data Warehouse	Data Mart
A Data Warehouse is a vast repository of information collected from various organizations or departments within a corporation.	A data mart is an only subtype of a Data Warehouses. It is architecture to meet the requirement of a specific user group.
It may hold multiple subject areas.	It holds only one subject area. For example, Finance or Sales.

It holds very detailed information.	It may hold more summarized data.
Works to integrate all data sources	It concentrates on integrating data from a given subject area or set of source systems.
In data warehousing, Fact constellation is used.	In Data Mart, Star Schema and Snowflake Schema are used.
It is a Centralized System. It is a Decentralized System.	
Data Warehousing is the data-oriented.	Data Marts is a project-oriented.

CONCLUSION

A data warehouse is a great solution to centralizing and easily analyzing your business's data. It increases data availability, boosts efficiency in analytical activity, improves the quality of information needed for reporting, and makes working with data secure. The structure of a data warehouse is basic, consisting of a storage system, two types of software, and a few employees to make it all work.

KNOWLEDGE MANAGEMENT

WHAT IS KNOWLEDGE MANAGEMENT?

Knowledge management (KM) is the process of identifying, organizing, storing and disseminating information within an organization. When knowledge is not easily accessible within an organization, it can be incredibly costly to a business as valuable time is spent seeking out relevant information versus completing outcome-focused tasks.

A knowledge management system (KMS) harnesses the collective knowledge of the organization, leading to better operational efficiencies. These systems are supported by the use of a knowledge base. They are usually critical to successful knowledge management, providing a centralized place to store information and access it readily.

Companies with a knowledge management strategy achieve business outcomes more quickly as increased organizational learning and collaboration among team members facilitates faster decision-making across the business. It also streamlines more organizational processes, such as training and on-boarding, leading to reports of higher employee satisfaction and retention.

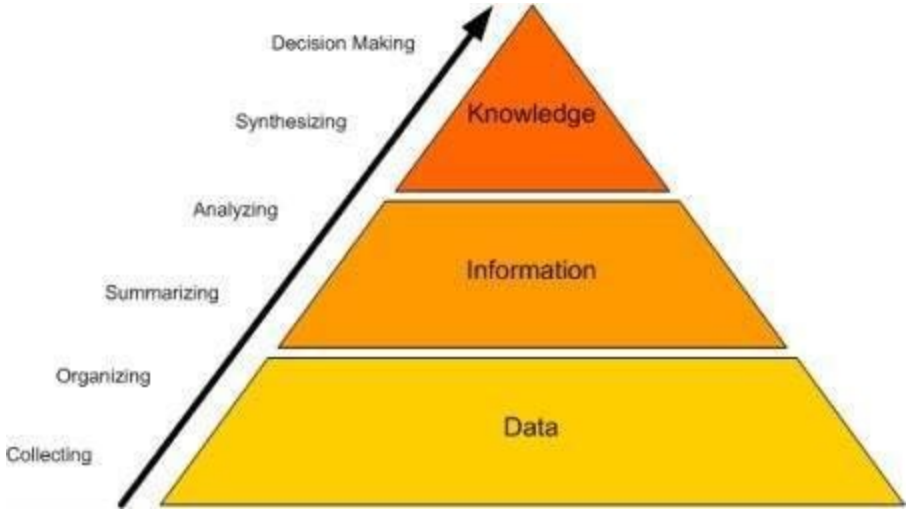
TYPES OF KNOWLEDGE

The definition of knowledge management also includes three types of knowledge—tacit, implicit, and explicit knowledge. These types of knowledge are largely distinguished by the codification of the information.

- **Tacit knowledge:** This type of knowledge is typically acquired through experience, and it is intuitively understood. As a result, it is challenging to articulate and codify, making it difficult to transfer this information to other individuals. Examples of tacit knowledge can include language, facial recognition, or leadership skills.
- **Implicit knowledge:** While some literature equivocates implicit knowledge to tacit knowledge, some academics break out this type separately, expressing that the definition of tactic knowledge is more nuanced. While tacit knowledge is difficult to codify, implicit knowledge does not necessarily have this problem. Instead, implicit information has yet to be documented. It tends to exist within processes, and it can be referred to as ―know-how‖ knowledge.
- **Explicit knowledge:** Explicit knowledge is captured within various document types such as manuals, reports, and guides, allowing organizations to easily share knowledge across teams. This type of knowledge is perhaps the most well-known and examples of it include knowledge assets such as databases, white papers, and case studies. This form of knowledge is important to retain intellectual capital within an organization as well as facilitate successful knowledge transfer to new employees.

THE KNOWLEDGE MANAGEMENT PROCESS

The process of knowledge management is universal for any enterprise. Sometimes, the resources used, such as tools and techniques, can be unique to the organizational environment.The Knowledge Management process has six basic steps assisted by different tools and techniques. When these steps are followed sequentially, the data transforms into knowledge.



Step 1: Collecting

This is the most important step of the knowledge management process. If you collect the incorrect or irrelevant data, the resulting knowledge may not be the most accurate. Therefore, the decisions made based on such knowledge could be inaccurate as well.

There are many methods and tools used for data collection. First of all, data collection should be a procedure in knowledge management process. These procedures should be properly documented and followed by people involved in data collection process.

The data collection procedure defines certain data collection points. Some points may be the summary of certain routine reports. As an example, monthly sales report and daily attendance reports may be two good resources for data collection.

With data collection points, the data extraction techniques and tools are also defined. As an example, the sales report may be a paper-based report where a data entry operator needs to feed the data manually to a database whereas, the daily attendance report may be an online report where it is directly stored in the database.

In addition to data collecting points and extraction mechanism, data storage is also defined in this step. Most of the organizations now use a software database application for this purpose.

Step 2: Organizing

The data collected need to be organized. This organization usually happens based on certain rules. These rules are defined by the organization.

As an example, all sales-related data can be filed together and all staff-related data could be stored in the same database table. This type of organization helps to maintain data accurately within a database.

If there is much data in the database, techniques such as 'normalization' can be used for organizing and reducing the duplication.

This way, data is logically arranged and related to one another for easy retrieval. When data passes step 2, it becomes information.

Step 3: Summarizing

In this step, the information is summarized in order to take the essence of it. The lengthy information is presented in tabular or graphical format and stored appropriately.

For summarizing, there are many tools that can be used such as software packages, charts (Pareto, cause-and-effect), and different techniques.

Step 4: Analyzing

At this stage, the information is analyzed in order to find the relationships, redundancies and patterns.

An expert or an expert team should be assigned for this purpose as the experience of the person/team plays a vital role. Usually, there are reports created after analysis of information.

Step 5: Synthesizing

At this point, information becomes knowledge. The results of analysis (usually the reports) are combined together to derive various concepts and artefacts.

A pattern or behavior of one entity can be applied to explain another, and collectively, the organization will have a set of knowledge elements that can be used across the organization.

This knowledge is then stored in the organizational *knowledge base* for further use.

Usually, the knowledge base is a software implementation that can be accessed from anywhere through the Internet.

You can also buy such knowledge base software or download an open-source implementation of the same for free.

Step 6: Decision Making

At this stage, the knowledge is used for decision making. As an example, when estimating a specific type of a project or a task, the knowledge related to previous estimates can be used.

This accelerates the estimation process and adds high accuracy. This is how the organizational knowledge management adds value and saves money in the long run.

Knowledge management tools

There are number of tools that organizations utilize to reap the benefits of knowledge management. Examples of knowledge management systems can include:

- **Document management systems** act as a centralized storage system for digital documents, such as PDFs, images, and word processing files. These systems enhance employee workflows by enabling easy retrieval of documents, such as lessons learned.

- **Content management systems** (CMS) are applications which manage web content where end users can edit and publish content. These are commonly confused with document management systems, but CMSs can support other media types, such as audio and video.
- **Intranets** are private networks that exist solely within an organization, which enable the sharing of enablement, tools, and processes within internal stakeholders. While they can be time-consuming and costly to maintain, they provide a number of groupware services, such as internal directories and search, which facilitate collaboration.
- **Wikis** can be a popular knowledge management tool given its ease of use. They make it easy to upload and edit information, but this ease can lead to concerns about misinformation as workers may update them with incorrect or outdated information.
- **Data warehouses** aggregate data from different sources into a single, central, consistent data store to support data analysis, data mining, artificial intelligence (AI), and machine learning. Data is extracted from these repositories so that companies can derive insights, empowering employees to make data-driven decisions.

STRATEGIES TO ACCELERATE KNOWLEDGE MANAGEMENT

While knowledge management solutions can be helpful in facilitating knowledge transfer across teams and individuals, they also depend on user adoption to generate positive outcomes. As a result, organizations should not minimize the value of human elements that enable success around knowledge management.

- **Organizational Culture:** Management practices will affect the type of organization that executives lead. Managers can build learning organizations by rewarding and encouraging knowledge sharing behaviors across their teams. This type of leadership sets the groundwork for teams to trust each other and communicate more openly to achieve business outcomes.
- **Communities of practice:** Centers of excellence in specific disciplines provide employees with a forum to ask questions, facilitating learning and knowledge transfer. In this way, organizations increase the number of subject matter experts in a given area of the company, reducing dependencies on specific individuals to execute certain tasks.

KNOWLEDGE MANAGEMENT USE CASES

Armed with the right tools and strategies, knowledge management practices have seen success in specific applications, such as:

- **Onboarding employees:** Knowledge management systems help to address the huge learning curve for new hires. Instead of overwhelming new hires with a _data dump‘ in their first weeks, continually support them with knowledge tools that will give them useful information at any time.
- **Day-to-day employee tasks:** Enable every employee to have access to accurate answers and critical information. Access to highly relevant answers at the right time, for the right person, allows workforces to spend less time looking for information and more time on activities that drive business.

- **Self-serve customer service:** Customers repeatedly say they'd prefer to find an answer themselves, rather than pick up the phone to call support. When done well, a knowledge management system helps businesses decrease customer support costs and increase customer satisfaction.

BENEFITS OF KNOWLEDGE MANAGEMENT

Companies experience a number of benefits when they embrace knowledge management strategies. Some key advantages include:

- **Identification of skill gaps:** When teams create relevant documentation around implicit or tacit knowledge or consolidate explicit knowledge, it can highlight gaps in core competencies across teams. This provides valuable information to management to form new organizational structures or hire additional resources.
- **Make better informed decisions:** Knowledge management systems arm individuals and departments with knowledge. By improving accessibility to current and historical enterprise knowledge, your teams can upskill and make more information -driven decisions that support business goals.
- **Maintains enterprise knowledge:** If your most knowledgeable employees left tomorrow, what would your business do? Practicing internal knowledge management enables businesses to create an organizational memory. Knowledge held by your long-term employees and other experts, then make it accessible to your wider team.
- **Operational efficiencies:** Knowledge management systems create a go-to place that enable knowledge workers to find relevant information more quickly. This, in turn, reduces the amount of time on research, leading to faster decision-making and cost-savings through operational efficiencies. Increase productivity not only saves time, but also reduces costs.
- **Increased collaboration and communication:** Knowledge management systems and organizational cultures work together to build trust among team members. These information systems provide more transparency among workers, creating more understanding and alignment around common goals. Engaged leadership and open communication create an environment for teams to embrace innovation and feedback .
- **Data Security:** Knowledge management systems enable organizations to customize permission control, viewership control and the level of document-security to ensure that information is shared only in the correct channels or with selected individuals. Give your employees the autonomy access knowledge safely and with confidence.

CONCLUSION

Knowledge management is an essential practice for enterprise organizations. Organizational knowledge adds long-term benefits to the organization in terms of finances, culture and people. Therefore, all mature organizations should take necessary steps for knowledge management in order to enhance the business operations and organization's overall capability.

TYPES OF DECISIONS IN BUSINESS

INTELLIGENCE INTRODUCTION

Modern cloud-native organizations have constantly growing streams of raw data flowing from every corner of the enterprise. Determining the impact this data has on business performance can be an overwhelming task requiring teams of analysts. That's where employing business intelligence (BI) can help.By presenting current and historical data within a business context, the data insights supplied by BI tools enable organizations to make smarter, more confident decisions that provide strategic direction for years to come.

Instead of relying on intuition and ―gut feel,‖ companies can use BI to find new ways to increase revenue, track performance, boost operational efficiency, identify market trends, expose problems, and much, much more. Before we dig deeper into the primary types of decisions in business intelligence, let's define what we mean by decision-making in a business context and understand how business intelligence factors into the process.

DECISION-MAKING DEFINED

Simply put, decision-making is the process of deciding something, especially with a group of people. From a business decision perspective, the aim is to achieve business objectives to satisfy stakeholder requirements, needs, and expectations.

For the decision to be effective, however, decision makers must forecast the outcome of each option and determine which is best for a particular situation. That makes decision support systems (DSS) like decision intelligence and business intelligence absolute essentials.

WHAT IS BUSINESS INTELLIGENCE?

Business intelligence refers to the technology tools and processes that enable businesses to organize, analyze, and contextualize business data from around the company. Business intelligence tools and decision-making transform raw data into meaningful and actionable information.

BI is the means through which organizations make smarter business decisions. While data fuels the engine, integrating BI-related infrastructure like a data warehouse, dashboards, reports, data discovery tools, and cloud data services make it possible to extract insights from your data.

THE ROLE OF BUSINESS INTELLIGENCE

Companies make big mistakes when they base business decisions on what they think will happen instead of relying on facts.

Using BI and advanced analytics, organizations can extract crucial facts from the mountain of data, transforming it into information companies can act on to make informed strategic decisions. The result: improved business processes, operational efficiency, and business productivity.

BUSINESS INTELLIGENCE DECISIONS

Business intelligence decisions typically fall into three categories: strategic, tactical, and operational.

An organization needs to gain a complete understanding of these types of decisions in business intelligence to make better-informed decisions that lead to increased customer retention, stakeholder satisfaction, operational efficiency, and revenue.

The Relationship between Business Intelligence and Business Analytics

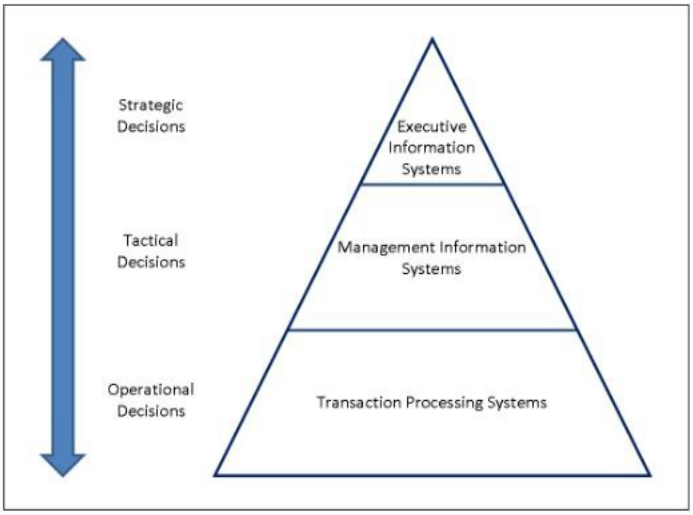
Business intelligence tells you what is currently happening and what happened in the past to bring you to that state.

On the other hand, business analytics is an umbrella term for predictive data analysis techniques (can tell you what's going to happen) and prescriptive (tells you what you should be doing to create better outcomes).

Using business intelligence and analytics efficiently is the difference between companies that succeed and those that fail in the modern environment.

THREE PRIMARY TYPES OF BUSINESS INTELLIGENCE DECISIONS

Business intelligence supports the three types of decision-making mentioned above: strategic, tactical, and operational. Its frequency and organizational impact characterize each.



STRATEGIC DECISIONS

Strategic decisions comprise the highest level of organizational business decisions and are usually less frequent and made by the organization's executives. Yet, their impact is enormous and far-reaching.

Some types of strategic decisions include selecting a particular market to penetrate, a company to acquire, or whether to hire additional staff.

Decisions made at this level usually involve significant expenditure. However, they are generally non-repetitive in nature and are taken only after careful analysis and evaluation of many alternatives.

TACTICAL DECISIONS

Tactical decisions (or semi structured decisions) occur with greater frequency (e.g., weekly or monthly) and fall into the mid-management level. Often, they relate to the implementation of strategic decisions.

Examples of tactical decisions include product price changes, work schedules, departmental reorganization, and similar activities.The impact of these types of decisions is medium regarding risk to the organization and impact on profitability.

OPERATIONAL DECISIONS

Operational decisions (or structured decisions) usually happen frequently (e.g., daily or hourly), relate to day-to-day operations of the enterprise, and have a lesser impact on the organization. Operational decisions determine the day-to-day profitability of the business, how effectively it retains customers, or how well it manages risk.

Answering a sales inquiry, approving a quotation, or calculating employee bonuses may be examples of this decision type.

You can summarize these types of decisions in business intelligence this way:

- Strategic: Long-term, complex, made by senior managers
- Tactical: Medium-term, less complex, made by mid-level managers
- Operational: Day-to-day, simple, routine, made by junior managers

HOW TO MAKE THE BEST DECISIONS FOR YOUR BUSINESS

How do you make the best business decisions? Some people trust intuition or gut feeling. Others reach out to constituents and experts for advice. Still, others cede decision-making to information systems and automation. However, the smartest business decisions are made by those who look at the numbers.

In a competitive business landscape, where agility, flexibility, and a real-time decision-making process are critical and timely, accurate data analysis is more important than ever. In that respect, relying on the types of decisions in business intelligence is non-negotiable. It is required for long-standing success and market dominance.

DECISION MAKING PROCESS

INTRODUCTION

Decision making is the process of making choices by identifying a decision, gathering information, and assessing alternative resolutions.

Using a step-by-step decision-making process can help you make more deliberate, thoughtful decisions by organizing relevant information and defining alternatives. This approach increases the chances that you will choose the most satisfying alternative possible.

Step 1: Identify the decision

You realize that you need to make a decision. Try to clearly define the nature of the decision you must make. This first step is very important.

Step 2: Gather relevant information

Collect some pertinent information before you make your decision: what information is needed, the best sources of information, and how to get it. This step involves both internal and external —work.‖ Some information is internal: you‘ll seek it through a process of self-assessment. Other information is external: you‘ll find it online, in books, from other people, and from other sources.

Step 3: Identify the alternatives

As you collect information, you will probably identify several possible paths of action, or alternatives. You can also use your imagination and additional information to construct new alternatives. In this step, you will list all possible and desirable alternatives.

Step 4: Weigh the evidence

Draw on your information and emotions to imagine what it would be like if you carried out each of the alternatives to the end. Evaluate whether the need identified in Step 1 would be met or resolved through the use of each alternative. As you go through this difficult internal process, you'll begin to favor certain alternatives: those that seem to have a higher potential for reaching your goal. Finally, place the alternatives in a priority order, based upon your own value system.

Step 5: Choose among alternatives

Once you have weighed all the evidence, you are ready to select the alternative that seems to be best one for you. You may even choose a combination of alternatives. Your choice in Step 5 may very likely be the same or similar to the alternative you placed at the top of your list at the end of Step 4.

Step 6: Take action

You're now ready to take some positive action by beginning to implement the alternative you chose in Step 5.

Step 7: Review your decision & its consequences

In this final step, consider the results of your decision and evaluate whether or not it has resolved the need you identified in Step 1. If the decision has *not* met the identified need, you may want to repeat certain steps of the process to make a new decision. For example, you might want to gather more detailed or somewhat different information or explore additional alternatives.

CONCLUSION

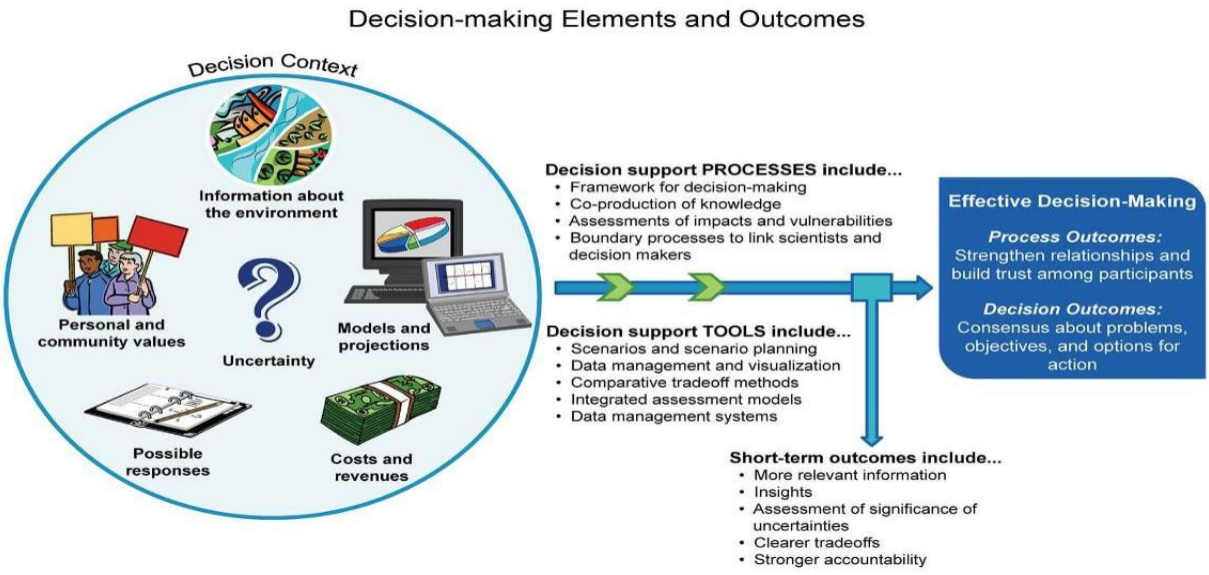
In any business situation there are multiple directions in which to take a strategy or an initiative. The variety of alternatives to weigh -- and the volume of decisions that must be made on an ongoing basis, especially in large organizations -- makes the implementation of an effective decision-making process a crucial element of managing successful business operations.

BUSINESSINTELLIGENCEINDECISIONSUPPORTSYSTEMS

A **decision support system** (**DSS**) is a computer-based information system that supports business or organizational decision-making activities; typically this results in ranking, sorting, or choosing from among alternatives. DSSs serve the management, operations, and planning levels of an organization (usually mid and higher management) and help people make decisions about problems that may be rapidly changing and not easily specified in advance. There are several types of DSSs that include:

1. **Communication-driven DSS** which enables cooperation, supporting more than one person working on a shared task; examples include integrated tools like Google Docs or Microsoft Groove.
2. **Document-driven DSS** which manages, retrieves, and manipulates unstructured information in a variety of electronic formats.
3. **Knowledge-driven DSS** provides specialized problem-solving expertise stored as facts, rules, procedures, or in similar structures
4. **Model-driven DSS** emphasizes access to and manipulation of a statistical, financial, optimization, or simulation model. Model-driven DSS use data and parameters provided by users to assist decision makers in analyzing a situation; they are not necessarily data-intensive.

5. **Data-driven DSS** (or data-oriented DSS) emphasizes access to and manipulation of a time series of internal company data and, sometimes, external data. A data-driven DSS, which we will focus on, emphasizes access to and manipulation of a time series of internal company data and sometimes external data. Simple file systems accessed by query and retrieval tools provide the most elementary level of functionality. Data warehouse systems that allow the manipulation of data by computerized tools tailored to a specific task and setting or by more general tools and operators provide additional functionality. Data-driven DSS with online analytical processing (OLAP) provide the highest level of functionality.



What is a Decision Support System (DSS)?

A decision support system (DSS) is an information system that aids a business in decision-making activities that require judgment, determination, and a sequence of actions. The information system assists the mid- and high-level management of an organization by analyzing huge volumes of unstructured data and accumulating information that can help to solve problems and help in decision-making. A DSS is either human-powered, automated, or a combination of both.

Purpose of a Decision Support System

A decision support system produces detailed information reports by gathering and analyzing data. Hence, a DSS is different from a normal operations application, whose goal is to collect data and not analyze it.

In an organization, a DSS is used by the planning departments – such as the operations department – which collects data and creates a report that can be used by managers for decision-making. Mainly, a DSS is used in sales projection, for inventory and operations-related data, and to present information to customers in an easy-to-understand manner.

Theoretically, a DSS can be employed in various knowledge domains from an organization to forest management and the medical field. One of the main applications of a DSS in an organization is real-time reporting. It can be very helpful for organizations that take part in just-in-time (JIT) inventory management.

In a JIT inventory system, the organization requires real-time data of their inventory levels to place orders ―just in time‖ to prevent delays in production and cause a negative domino effect.

Therefore, a DSS is more tailored to the individual or organization making the decision than a traditional system.

COMPONENTS OF A DECISION SUPPORT SYSTEM

The three main components of a DSS framework are:

1. Model Management System

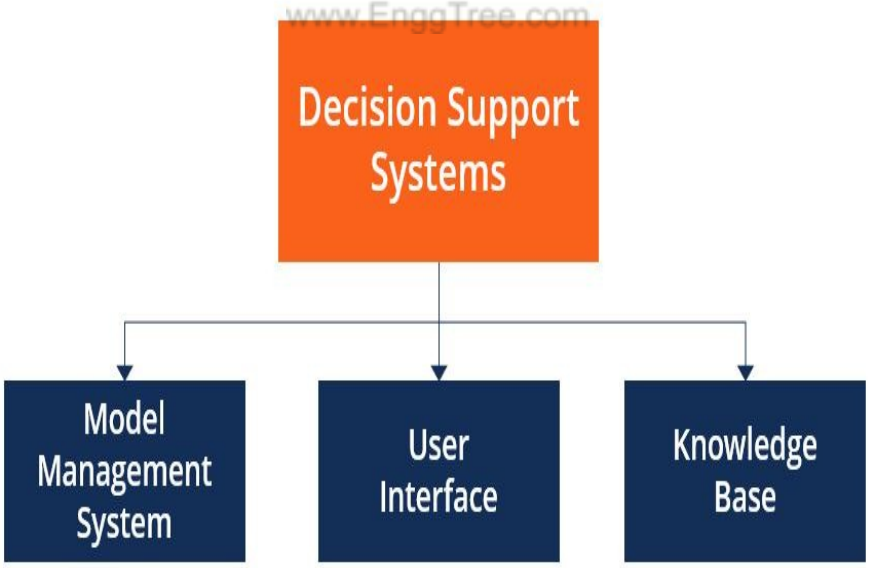
The model management system S=stores models that managers can use in their decision-making. The models are used in decision-making regarding the financial health of the organization and forecasting demand for a good or service.

2. User Interface

The user interface includes tools that help the end-user of a DSS to navigate through the system.

3. Knowledge Base

The knowledge base includes information from internal sources (information collected in a transaction process system) and external sources (newspapers and online databases).



Advantages of a Decision Support System

- A decision support system increases the speed and efficiency of decision-making activities. It is possible, as a DSS can collect and analyze real-time data.
- It promotes training within the organization, as specific skills must be developed to implement and run a DSS within an organization.

- It automates monotonous managerial processes, which means more of the manager‘s time can be spent on decision-making.
- It improves interpersonal communication within the organization.

Disadvantages of a Decision Support System

- The cost to develop and implement a DSS is a huge capital investment, which makes it less accessible to smaller organizations.
- A company can develop a dependence on a DSS, as it is integrated into daily decision-making processes to improve efficiency and speed. However, managers tend to rely on the system too much, which takes away the subjectivity aspect of decision-making.
- A DSS may lead to information overload because an information system tends to consider all aspects of a problem. It creates a dilemma for end-users, as they are left with multiple choices.
- Implementation of a DSS can cause fear and backlash from lower-level employees. Many of them are not comfortable with new technology and are afraid of losing their jobs to technology.

OLAP AND BUSINESS INTELLIGENCE

Business intelligence (BI) is an umbrella term for data analysis techniques, applications and practices used to support the decision-making processes in business. The term was proposed by Howard Dresner in 1989 and became widespread in the late 1990s.

Business intelligence assists business owners in making important decisions based on their business data. Rather than directly telling business owners what to do, business intelligence allows them to analyze the data they have to understand trends and get insights, thus scaffolding the decision-making process.

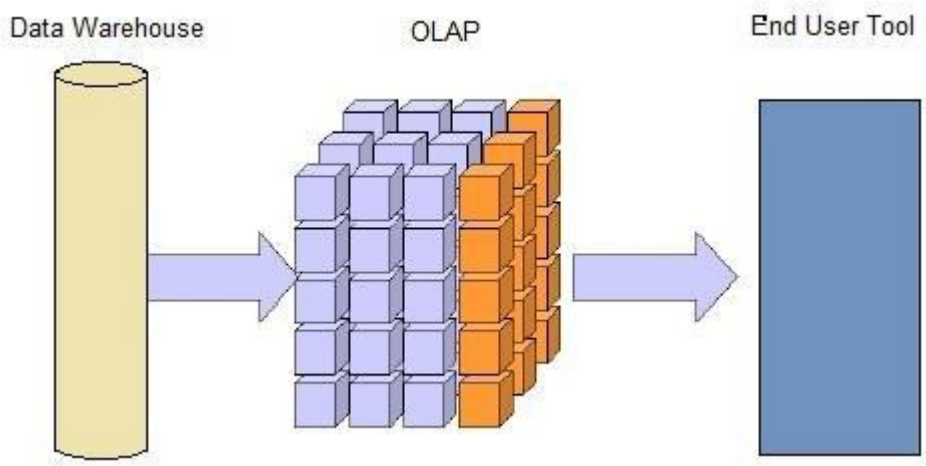
BI includes a wide variety of techniques and tools for data analytics, including tools for ad-hoc analytics and reporting, OLAP tools, real-time business intelligence, SaaS BI, etc. Another important area of BI is data visualization software, dashboards, and scorecards.

THE ROLE OF OLAP IN BUSINESS INTELLIGENCE

OLAP (online analytical processing) is sometimes used as a synonym of business intelligence. However, it is not correct - it could be better described a function of BI software that enables a user to extract and view data from different viewpoints.

There are several reasons why OLAP is popular in BI:

- It represents data in a multidimensional form, which makes it convenient for analysts and other business users to analyze numeric values from different perspectives.
- OLAP is good for storing, extracting and analyzing large amounts of data. Business intelligence specialists are able to analyze data accumulated over a long period of time, which enables more precise results and better forecasting. The architecture of OLAP systems allows fast access to the data as they typically pre-aggregate data.
- OLAP provides wide opportunities for data slicing and dicing, drill down/up/through, which helps analysts narrow down the data used for BI analysis and reporting.
- OLAP systems usually have an intuitive and easy-to-use interface, which allows nontechnical users to analyze data and generate reports without involving IT department. Also, OLAP dimension uses familiar business terms so that employees don't have to receive any additional training.



We can say that OLAP occupies a place between a data warehouse and end-user tools in BI, thus allowing users to get the data they need in a fast and efficient way.

What is OLAP?

OLAP (for *online analytical processing*) is software for performing multidimensional analysis at high speeds on large volumes of data from a data warehouse, data mart, or some other unified, centralized data store.

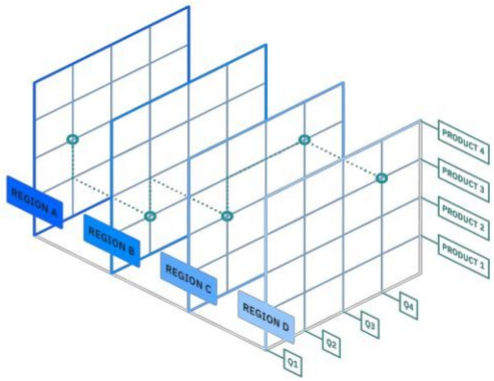
Most business data have multiple dimensions—multiple categories into which the data are broken down for presentation, tracking, or analysis. For example, sales figures might have several dimensions related to location (region, country, state/province, store), time (year, month, week, day), product (clothing, men/women/children, brand, type), and more.

But in a data warehouse, data sets are stored in tables, each of which can organize data into just two of these dimensions at a time. OLAP extracts data from multiple relational data sets and reorganizes it into a multidimensional format that enables very fast processing and very insightful analysis.

What is an OLAP cube?

This is where the OLAP cube comes in. The OLAP cube extends the single table with additional layers, each adding additional dimensions—usually the next level in the ―concept hierarchy‖ of the dimension. For example, the top layer of the cube might organize sales by region; additional layers could be country, state/province, city and even specific store.

In theory, a cube can contain an infinite number of layers. (An OLAP cube representing more than three dimensions is sometimes called a hypercube.) And smaller cubes can exist within layers—for example, each store layer could contain cubes arranging sales by salesperson and product. In practice, data analysts will create OLAP cubes containing just the layers they need, for optimal analysis and performance.



OLAP cubes enable four basic types of multidimensional data analysis:

Drill-down

The drill-down operation converts less-detailed data into more-detailed data through one of two methods—moving down in the concept hierarchy or adding a new dimension to the cube. For example, if you view sales data for an organization‘s calendar or fiscal quarter, you can drill-down to see sales for each month, moving down in the concept hierarchy of the ―time‖ dimension.

Roll up

Roll up is the opposite of the drill-down function—it aggregates data on an OLAP cube by moving up in the concept hierarchy or by reducing the number of dimensions. For example, you could move up in the concept hierarchy of the ―location‖ dimension by viewing each country's data, rather than each city.

Slice and dice

The slice operation creates a sub-cube by selecting a single dimension from the main OLAP cube. For example, you can perform a slice by highlighting all data for the organization's first fiscal or calendar quarter (time dimension).

The dice operation isolates a sub-cube by selecting several dimensions within the main OLAP cube. For example, you could perform a dice operation by highlighting all data by an organization‘s calendar or fiscal quarters (time dimension) and within the U.S. and Canada (location dimension).

Pivot

The pivot function rotates the current cube view to display a new representation of the data—enabling dynamic multidimensional views of data. The OLAP pivot function is comparable to the pivot table feature in spreadsheet software, such as Microsoft Excel, but while pivot tables in

Excel can be challenging, OLAP pivots are relatively easier to use (less expertise is required) and have a faster response time and query performance.

Despite the variety and complexity of data stored in the corporate environment, everything is typically recorded in simple columns and rows. This is the classic spreadsheet look we're all familiar with, and that's how most databases file data.

An example of database tables, structuring music by artists, albums, and ratings dimensions

For the most part, businesses use databases to record transactions. This is an operational need, as we have to save our sales results, customer information, etc. Later, this data can be

- modified to maintain the relevance of what was stored;
- used by business applications to perform its functions, for example check product availability, etc.; and
- used for analytical purposes to understand how our business is running.

The database type that stores transactions is called *OLTP* or *Online Transaction Processing*. It perfectly suited for simple operations like to insert, update, or delete an item. However, when it comes to analyzing large volumes of data from different angles, the logic of OLTP has serious limitations. So, we need a solution that's capable of representing data from multiple dimensions.

In this article, we'll talk about such a solution — *Online Analytical Processing* or *OLAP* technology. We'll cover the fundamentals of OLAP and see how it works in contrast to transactional databases. Namely, we'll explain what functions it can perform, and how to use it for data analysis.

What is OLAP: Online Analytical Processing

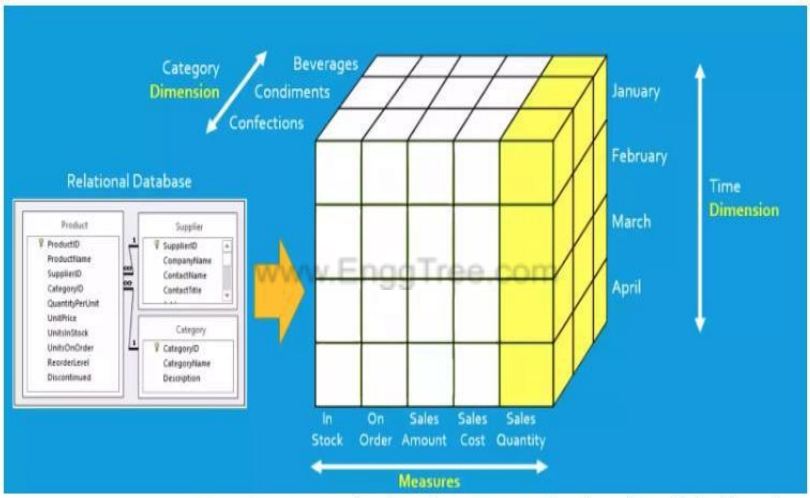
Online Analytical Processing can be defined as a set of tools and approaches to represent data from multiple dimensions. In a broader sense, it includes a bunch of practices aimed at modeling data/databases and creating specific analytical solutions. OLAP systems are capable of combining classic tables in a sort of table of tables, which can be visualized as a 3D OLAP Cube for simplicity.

A typical OLAP system will include the following components that perform dedicated functions to handle analytical queries.

Data source. This could be a transactional database or any other storage we take data from. The data in its standard format isn‘t optimized for OLAP queries, so it requires transformation and remodeling before it can be used.

OLAP database is where we store data for analysis. Usually, transformation takes place before the data is uploaded to a database, but the approach may vary.

OLAP cube is basically a tool for representing multidimensional data for analysis. As we‘re talking about online analytical processing, cubes are deployed on a dedicated server.



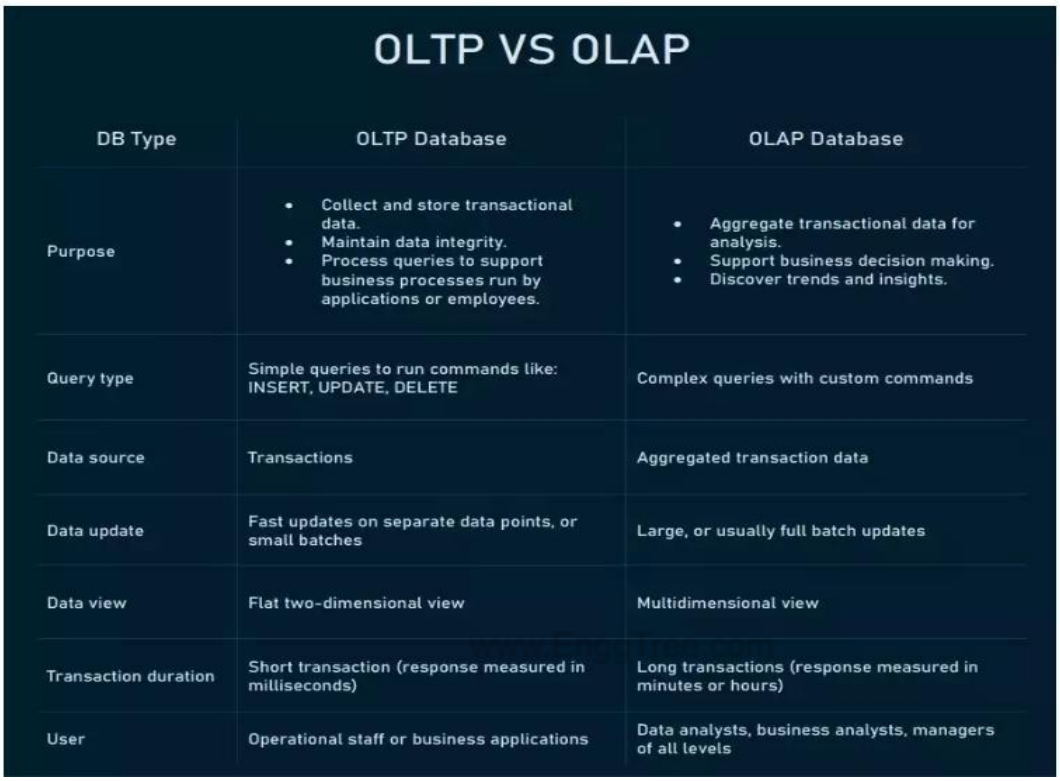
OLAP Cube representing data from an OLTP database in multiple dimensions

An OLAP cube allows analytics to group or slice items by different categories. They are primarily designed to run complex queries, which can‘t be handled by the usual OLTP databases. Here, a user can perform cube-specific operations with data, so we‘ll cover them in a dedicated section.

Analytical interface- The interactions with cubes and other analytical tools for data visualization and reporting is done via a dedicated interface. The majority of interfaces are represented by business intelligence dashboards. Cubes can be accessed via these dashboards, providing more control to a user.The easiest way to understand how OLAP works is to compare OLAP and OLTP databases and explore how they structure and process data.

OLTP VS OLAP: TECHNOLOGY COMPARISON

There are numerous differences between OLTP and OLAP databases in terms of purpose, information structure, and data access capabilities. The table below compares the main aspects of these two systems.



OLTP VS OLAP

DB Type	OLTP Database	OLAP Database
Purpose	• Collect and store transactional data. • Maintain data integrity. • Process queries to support business processes run by applications or employees.	• Aggregate transactional data for analysis. • Support business decision making. • Discover trends and insights.
Query type	Simple queries to run commands like: INSERT, UPDATE, DELETE	Complex queries with custom commands
Data source	Transactions	Aggregated transaction data
Data update	Fast updates on separate data points, or small batches	Large, or usually full batch updates
Data view	Flat two-dimensional view	Multidimensional view
Transaction duration	Short transaction (response measured in milliseconds)	Long transactions (response measured in minutes or hours)
User	Operational staff or business applications	Data analysts, business analysts, managers of all levels

Now, we'll look in more detail at how both types can be used, what operations they run, and how the data is structured for OLTP and OLAP purposes.

Data operations in OLTP

A transactional or OLTP database is a common storage solution we deal with to record any business information. Say, we're selling a new type of a smartphone to the customer and we want to record this transaction, including the product type, price, date, customer info, sales person name, etc. All of these items will be stored in a flat view, which allows us to quickly operate and search for the required information.

The data will be saved as a set of items and values that relate to this transaction. An OLTP solution will allow a user to perform the following operations with this data:

- insert,
- copy,

- paste,
- edit/update, and
- delete.

Such transactions have a short response time – measured in seconds – as they are natural to OLTP. But when it comes to more complex queries that involve aggregating data from multiple tables, a transactional database will run into trouble. The more data is inquired, the more problematic and resource-intensive it is for OLTP.

Analytical requests are often much more complex than ―show me total sales amount.‖ More often than not, we need to compare things to each other and look at the data from different dimensions. That‘s where an OLAP technology kicks in.

Data operations in OLAP

OLAP or Online Analytical Processing aggregates transactional data from a storage to transform it into a feasible form for analysis. As a source of data, OLAP can use some type of unified storage like a data warehouse, data lake, or data mart, or simply any place you store the historical data.

But to run complex custom queries, we must structure data properly. That‘s why in most cases, there is a need for a separate OLAP database or warehouse that will model data for multidimensional analysis.

The query in OLAP may look something like this:

- *"show 64GB smartphone sales in Winnipeg for the last 6 month,"*
- *"compare 64GB model sales across Canada to 256GB in the 4thQ,"*
- *"group all 64GB model returns for the 2021 sold by John Doe salesperson,"* and
- *"show average margin for a given smartphone vendor for this year."*

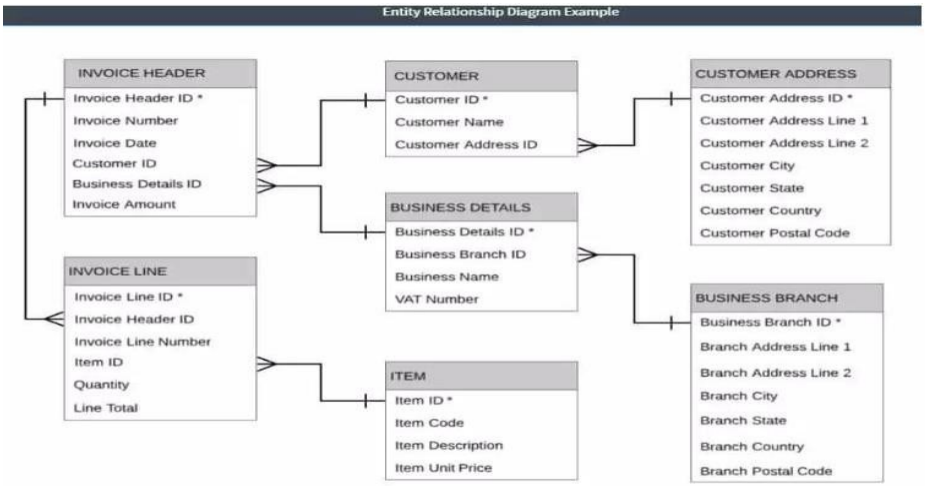
Such analytical queries require the database to gather information from multiple tables that categorize data by ―dimensions.‖ An example of dimension can be time, product, location, customer, etc.

OLAP models a database in such a way that it becomes possible to quickly gather the data and present it to analysts in a multidimensional mode rather than a flat table. That‘s why OLTP and OLAP databases will differ in numerous ways.

Now, we have to answer two simple questions. How is OLAP data modeling different from transactional databases? And why can‘t we run such complex queries in OLTP?

Data modeling in OLTP

Traditional databases (OLTP) use a **relational data model**, hence the name ―relational database.‖ The relations are nothing but tables of values. Each row in the table denotes a real-world relation of an item to its attribute. For example, a customer may have related attributes such as address, email, credit card, name, etc.



Relational data model example

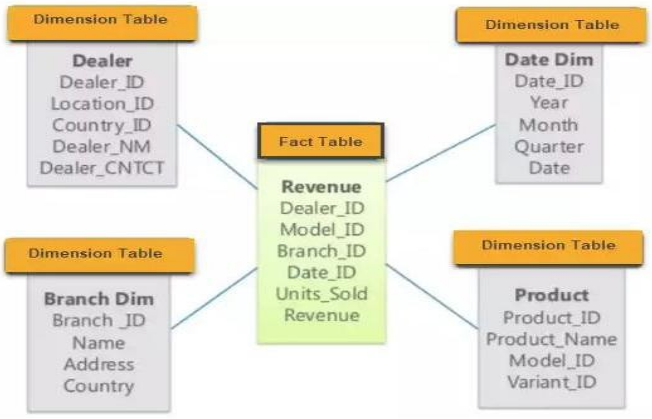
This is the most standard way we store data and make modifications to transactional information. Such an approach works great for simple queries to modify transactional data. But if we need to query something like ―compare sales of a given item in the 3rd quarter for the last three years in the US‖ — the relational database will require enormous resources because it will scan each table entirely to find all the related values.

Moreover, the query will return disparate data items with a lot of unnecessary information, as the relational model doesn‘t support filtering by multiple dimensions at once (product type, time period, location).

Data modeling in OLAP

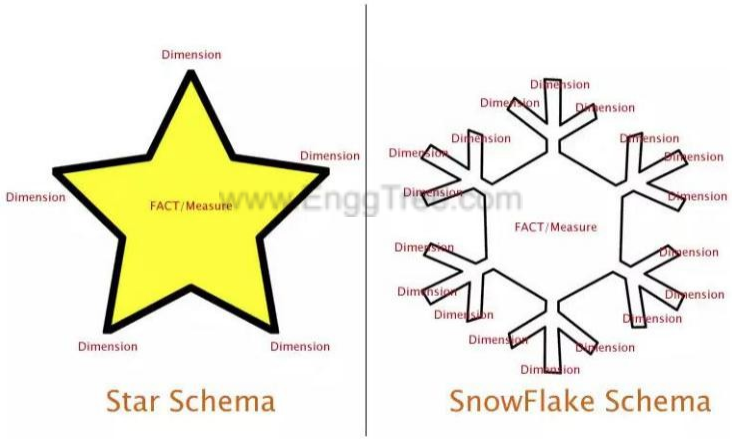
In contrast, OLAP uses *star* and *snowflake schemas* for data modeling.

In a **star schema** we structure data around facts, providing the keys to every dimension for measurement. A fact, in this case, is a category of related business items, e.g., product, sales amount, revenue, customers, time, location, etc. Each of these items is a separate dimension that includes subcategories. So we can divide, for example, time by year, quarter, month, week, and day.



Star schema in OLAP

A **snowflake schema** is an extension to a star schema: Basically, it adds more dimensions to the existing ones. But data is still organized around factual tables. So if we add more dimension tables, the database starts to take a ―snowflake shape.‖



A snowflake schema extends the star schema with more dimensions

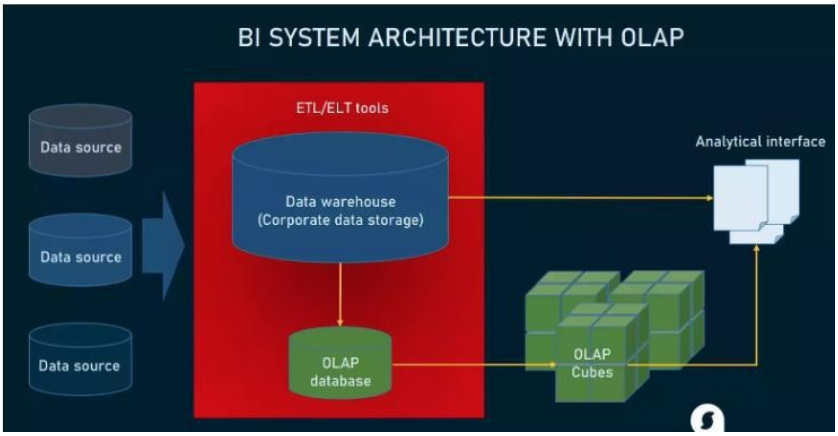
A multidimensional model of data is what makes it possible for OLAP systems to extract the required information, perform complex filtering, and allow for analysis of this data.

Online Analytical Processing Architecture

When we talk about analytics, we generally mean business intelligence systems, where a data warehouse is a central point uniting all the corporate data. A data warehouse can be used differently depending on the goals of the organization.

- A corporate DW can be used as a unified storage for historical data, optimized for transaction or simple analytical tasks.
- Or it can be optimized for OLAP queries applying star or snowflake schemas.

Depending on how we plan to design the business intelligence system, OLAP may or may not require a separate database to run queries. The architecture of a BI system with a standalone OLAP repository looks something like this:



So let's analyze OLAP workflow in such architecture.

Data extraction. First, the data is extracted from its original sources and uploaded to a unified data storage. In the case of BI, a data warehouse will be the place we upload data to.

Data preparation. Once we've got the data, it requires optimization and modeling for multidimensional analysis. In some cases, corporate DW can be optimized to run OLAP queries, but a more typical case is to use a separate OLAP database. Here are a few reasons why.

- Running analytical and transactional queries on separate databases eliminates the risk of overloads and database downtimes, while guaranteeing decent performance of the two.
- Applying data models is easier when we use a storage for a single purpose.

Data transformation and integration is usually done via ETL/ELT tools, which help developers to automate data extraction, transformation, and uploading.

Building a cube. Once the data is prepared, a group of responsible data engineers will model cubes and deploy them on the dedicated server. Creating a cube is a custom process each time, because data can't be updated once it was modeled in a cube. So, for each specific query, a new cube will be created.

Accessing data. As an end point in the system, OLAP cubes will be accessed through analytical interfaces. Here, analytics can type in commands and perform cube-specific operations to analyze data.

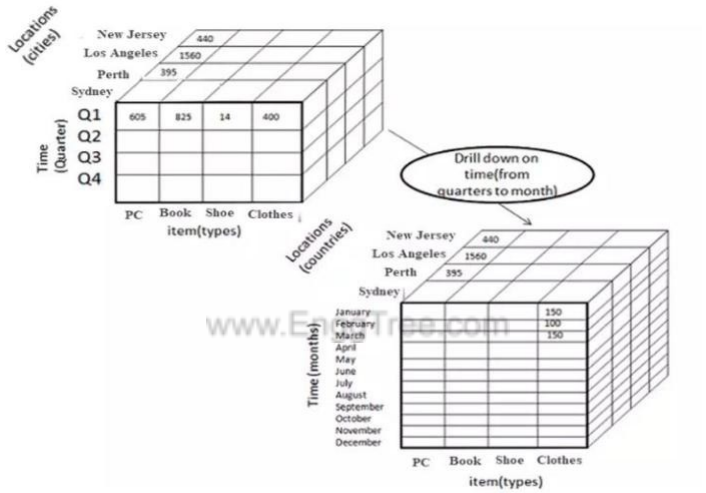
Now, let's look at the cubes themselves and define the capabilities they give to the analyst.

How OLAP cubes work

The cube may consist of several dimensions that can be used to filter the required information and form reports. OLAP systems use a specific SQL language called *MDX* or *Multidimensional Expressions*. Standard SQL queries are also supported by the most databases to perform OLAP analysis.

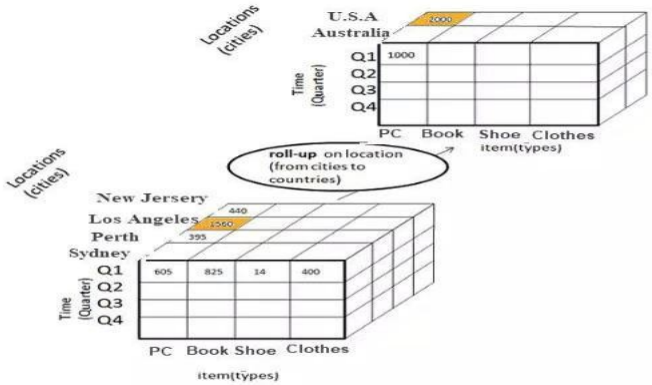
There are five basic types of OLAP multidimensional analysis operations.

Drill down allows a user to move from high-level data (e.g., annual sales) to a lower level (e.g., monthly sales). Here we use the concept of hierarchy that applies to every single dimension. So, in the ―time‖ dimension, we can move down from yearly figures to weekly or even daily records. This depends on how you store your data and model the actual cube.



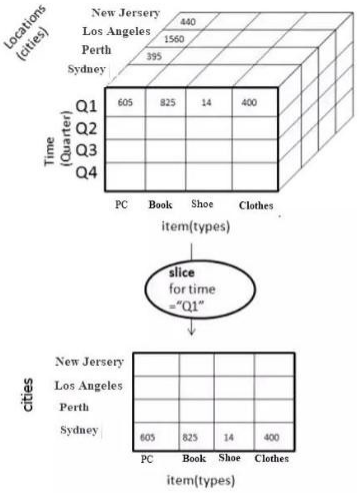
Drill down into the time dimension

Roll up is the opposite of drill down, as it basically lifts the data in hierarchy levels. Both operations either make the data more or less detailed, or add/remove dimensions for the analysis.



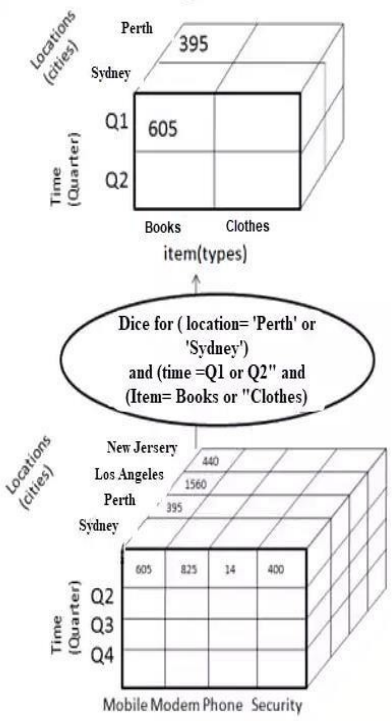
Roll up the location dimension

Slice operations help you divide a certain dimension into a separate table (one-dimension view). ―Slice‖ can detach, say, the city‘s dimension from the rest of the cube, which will create a separate spreadsheet. This way we can analyze low-level information in the isolated environment.



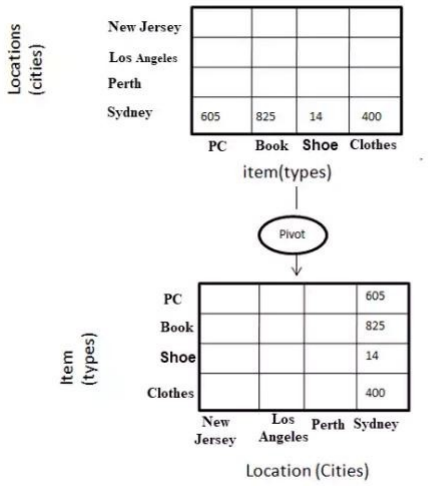
Slicing a location dimension in a hierarchy level of cities

Dice provides the same separation functionality, but allows you to choose more than one dimension, producing a separate cube.



A dice operation with the choice of time and location dimensions

Pivot is a similar operation to create pivot tables in Excel. This function allows us to rotate a cube to get a different representation of data in between the dimensions.



Pivot example on a single dimension of the cube

All in all, the functions can be used in conjunction, which gives huge flexibility to use a single cube for multiple purposes. But, as we mentioned before, each time there is a modification to data, the cube will require reuploading the information or remodeling the existing OLAP DB.

OLAP PROVIDERS

OLAP is a vital part of any BI system. Despite its resource-intensive nature, OLAP remains a standard solution for complex analytics that can‘t be done in the usual databases. As the technology appeared in the early _90s, the market of solutions is quite large. And the main proposal comes from data warehouse/business intelligence providers.

Nearly any provider these days supports all of the basic functions of OLAP and allows the creation of multidimensional cube systems as a part of their BI platform. Now, let‘s look at some popular products that can be used as a separate OLAP tool.

OLAP PROVIDERS

	Apache Kylin	IBM Cognos TM1	Microsoft SSAS
Supported OS	Linux/Unix	Windows, Linux/Unix	Windows
Supported APIs	JSON, REST APIs	JSON, REST APIs	JSON, REST APIs
Relational database support	NO	NO	YES
Offline access to cubes	YES	YES	YES
Supported Query language	SQL	XML, MDX, LINQ	XML, MDX, SQL, LINQ
Cube limitations	Unrestricted to dimension and cubes number	256 dimensions max limit for a single cube	Unrestricted to dimension and cubes number
License pricing	Free	By inquiry	Calculated from an hourly/monthly data transmission

Apache Kylin is an open-source distributed data warehouse for big data and OLAP. Kylin was developed for internal analytics on Ebay. Since 2014, it has gone open source and is distributed by a free license. While it focuses on analyzing big data, Kylin can also be used for corporate warehouses of medium size. Plus, Kylin integrates with the popular BI interfaces such as Tableau, Superset, Qlik, and Zeppelin.

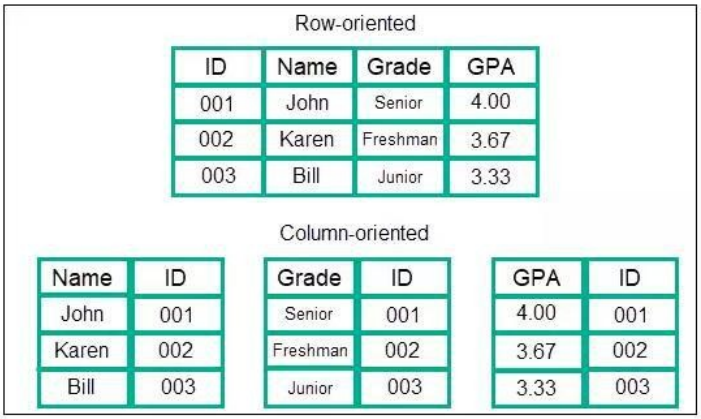
Microsoft SQL Server Analysis Services **(SSAS)**. As a part of its Azure Cloud Platform and PowerBI analytical solutions, Microsoft offers a separate product for OLAP. Currently, they call it Azure Analysis Services.Basically, it‘s an OLAP modeling and processing tool integrated with PowerBI. The pricing is calculated like all the Azure products, based on computation resources. You can check pricing on the corresponding page.

IBM Cognos TM1 is another platform that consists of multiple tools for data analysis, cube modeling, and data visualization. As with Microsoft, TM1 includes a broad range of Watson Analytics products and a dedicated analytical server. The pricing for TM1 can be gotten from IBM on their price planning page.

But while software vendors offer tools for data modeling and analysis, you‘ll still need data engineers/data analysts to model and analyze the information. In other words, OLAP falls into a category of specific analytical tools that require data engineering or BI development expertise to work with. In this case, you may think of hiring a data specialists team to handle a custom project for your corporate needs.

THE RISE OF COLUMN DATABASES OR A NEW OLAP

Currently, OLAP remains quite a cumbersome technology, because it requires modeling a separate database to build cubes. And the more data you need for analysis, the more likely you‘ll need a data warehouse only for OLAP needs. But things may change with the emergence of **column databases**.



A comparison of a relational DB row-table, and a column-table.

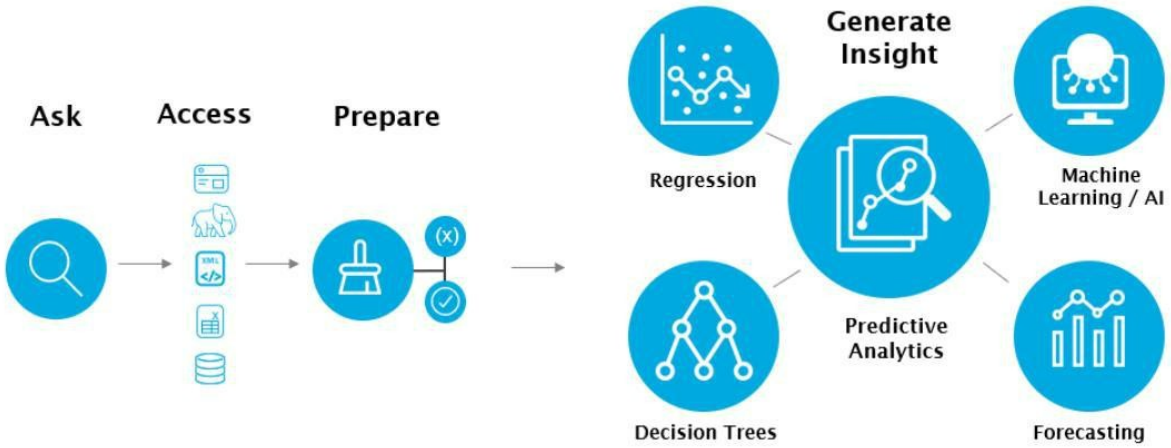
As you might remember, a traditional relational database stores values in rows, while columns denote categories of items. A column database is a type of schema that uses columns to organize tables in DB. As simple as that, this type of schema provides capabilities similar to what an OLAP database does. Each table will represent a dimension that can be quickly scanned and analyzed.Column databases can potentially be used as a data warehouse capable of handling OLAP queries by nature. While this approach was described way back in 2012 in different studies, it gained popularity only a few years ago. So this led to the emergence of column-oriented cloud data warehouses.

- **AWS Redshift** offers columnar storage as an option for high-volume analytical queries. The concept of a column database in Redshift is described on a dedicated page.
- **Apache Kudu** is an analytical data store that relates to the Apache Hadoop Kudu is an open-source solution designed specifically for analyzing dynamically changing data.
- **MariaDB ColumnStore** is a distributed data storage solution based on the MariaDB Enterprise server.
- **Google Cloud Bigtable** is a part of the Google Cloud ecosystem designed for large volume data analysis, big data, and streaming analytics.
- **Azure Synapse Analytics** connects a range of services for data warehousing, data integration (ETL), and big data analytics.

Choosing a column-oriented database eliminates the need to create a separate ecosystem for OLAP.But there is a drawback to keep in mind. In case you'll have to run a massive update of your data, a column database will need to read every single row one by one. The process of updating currently remains much more time-consuming and complex for column databases than it is for traditional SQL databases.What does it mean in the context of analytics? Historical data often doesn't require any updates, so if you're analyzing large amounts of transactional data from the past, the updating issue is not really valid. But in case you're trying to analyze dynamically updating data, a traditional SQL database remains the best choice.

UNIT III BUSINESS FORECASTING

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modeling – Machine Learning for Predictive analytics.



Analyzing a large volume of data is already a crucial part of the decision-making process for any business, irrespective of its volume. Available big data resolve everyday problems like improving the conversion rate or to attaining customer loyalty for an e-commerce business. But do you know that you can also use this data to forecast events before they actually happen? It adds the value of Predictive Analytics Solutions to predict user behavior based on historical data and act consequently to optimize sales.

For online businesses, occasionally executing predictive analytics is equal to improving your understanding of the customer and classifying changes in the market before they occur. The **predictive analytics models** take out patterns from past and transactional data to recognize risks and opportunities. Self-learning software will automatically evaluate the existing data and provide tools for future problems. It will enable you to build new sales strategies to adjust according to the changes and increase profit growth.

INTRODUCTION TO BUSINESS FORECASTING TECHNIQUES

Companies conduct business forecasts to determine their goals, targets, and project plans for each new period, whether quarterly, annually, or even 2–5-year planning. Some companies utilize **predictive analytics software** to collect and analyze the data necessary to make an accurate business forecast. Predictive analytics solutions give you the tools to store data, organize information into comprehensive datasets, develop predictive models to forecast business opportunities, adapt datasets to data changes, and allow import/export from other data channels.

Forecasting helps managers guide strategy and make informed decisions about critical business operations such as sales, expenses, revenue, and resource allocation. When done right, forecasting adds a competitive advantage and can be the difference between successful and unsuccessful companies.

In this to business forecasting, we'll cover:

- What is business forecasting?
- What are the best forecasting techniques?
- Why forecasting in management is important?
- How to conduct business forecasts?
- A few forecasting examples for businesses

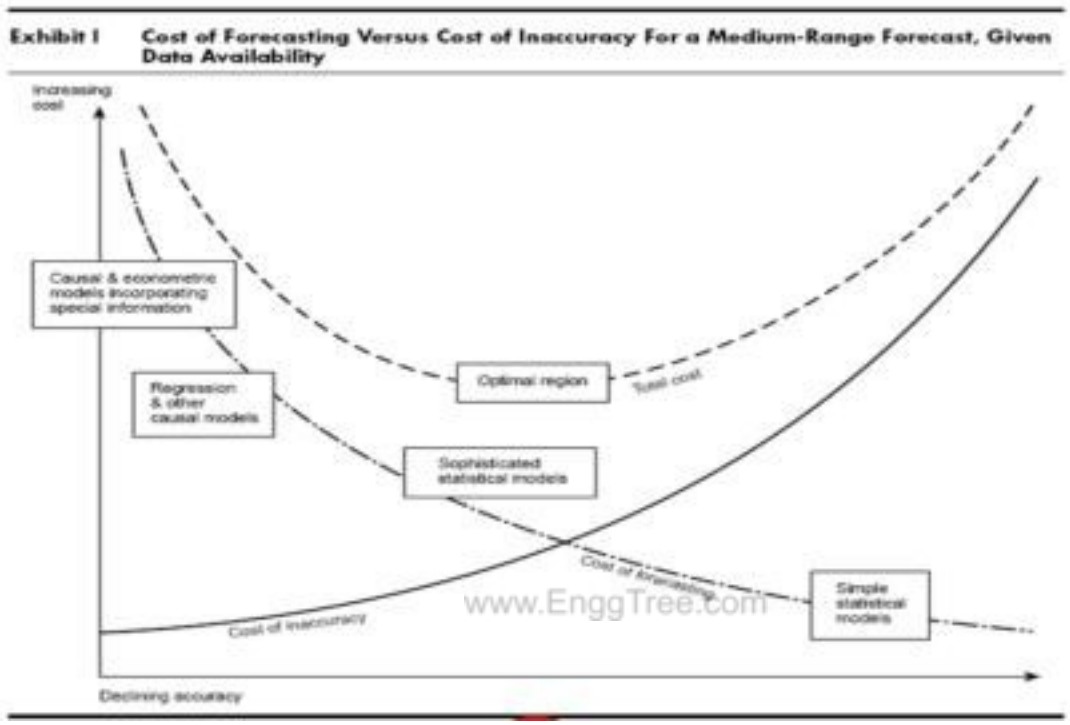
To deal with the increasing variety and complexity of management forecasting problems, many forecasting methods have been documented in recent years. All the methods have distinct usage and attention must be paid to select the right method for a specific application. The administrator and the manager of the forecast share a significant role in choosing the technique; and the better they recognize the various forecast opportunities, the more likely the company's estimated effort will pay off.

What is business forecasting?

Business forecasting is a projection of future developments of a business or industry based on trends and patterns of past and present data.

Choosing a right forecasting method depends on many factors –

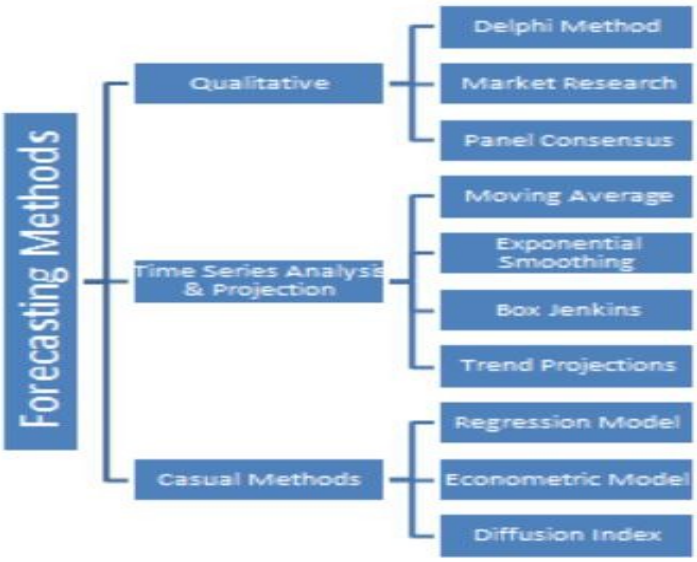
- significance and accessibility of historical data,
- the background of the prediction,
- time available for analysis,
- the degree of precision anticipated,
- value to the Company,
- And desired time period for forecast.



Manager and forecaster need to collectively work to achieve successful forecasting, they must try to answer the following questions:

1. How the forecast is going to be useful? – precisely the purpose of it
2. Understand the mechanisms and sensitivities of the system for which forecast is made?
3. How relevant is past in predicting future?

TYPES OF PREDICTING MODELS



Qualitative Techniques:

Qualitative Technique is applied when enough data is not available – i.e. when the product is launched in the market for the first time. They use human evaluation and rating schemes to convert qualitative data into quantitative calculations.

The goal is to gather all information and considerations related to the factors being evaluated in a logical, impartial, and systematic manner. Such methods are often used in the field of new technologies, where the development of product ideas may require more "invention", so it is difficult to study the research and development requirements, and the perception and entry of the market is very uncertain.

Qualitative business forecasting is predictions and projections based on experts' and customers' opinions. This method is best when there is insufficient past data to analyze to reach a quantitative forecast. In these cases, industry experts and forecasters piece together available data to make qualitative predictions.

Qualitative models are most successful with short-term projections. They are expert-driven, bringing up contrasting opinions and reliance on judgment over calculable data. Examples of qualitative models in business forecasting include:

- **Market research**: This involves polling people – experts, customers, employees – to get their preferences, opinions, and feedback on a product or service.

- **Delphi method**: The Delphi method relies on asking a panel of experts for their opinions and recommendations and compiling them into a forecast.

BASIC FORECASTING TECHNIQUES

Technique	A. Qualitative Methods		
	1. Delphi Method	2. Market Research	3. Panel Consensus
Description	A panel of experts is interrogated by a sequence of questionnaires in which the responses to one questionnaire are used to produce the next questionnaire. Any set of information available to some experts and not others is thus passed on to the others, enabling all the experts to have access to all the information for forecasting. This technique eliminates the bandwagon effect of majority opinion.	The systematic, formal, and conscious procedure for evolving and testing hypotheses about real markets.	This technique is based on the assumption that several experts can arrive at a better forecast than one person. There is no secrecy, and communication is encouraged. The forecasts are sometimes influenced by social factors, and may not reflect a true consensus.
Accuracy Short term (0–3 months) Medium term (3 months–2 years) Long term (2 years & up)	 Fair to very good Fair to very good Fair to very good	 Excellent Good Fair to good	 Poor to fair Poor to fair Poor
Identification of turning points	Fair to good	Fair to very good	Poor to fair
Typical applications	Forecasts of long-range and new-product sales, forecasts of margins.	Forecasts of long-range and new-product sales, forecasts of margins.	Forecasts of long-range and new-product sales, forecasts of margins.
Data required	A coordinator issues the sequence of questionnaires, editing and consolidating the responses.	As a minimum, two set of reports over time. One needs a considerable collection of market data from questionnaires, surveys, and time series analyses of market variables.	Information from a panel of experts is presented openly in group meetings to arrive at a consensus forecast. Again, a minimum is two sets of reports over time.
Cost of forecasting* With a computer Is calculation possible without a computer?	 $2,000+ Yes	 $5,000+ Yes	 $1,000+ Yes
Time required to develop an application & make a forecast	2 months+	3 months+	2 weeks +
References	North & Pyke, " 'Probes' of the Technological Future," HBR May–June 1969, p. 68.	Bass, King & Pessemeier, *Applications of the Sciences in Marketing Management* (New York, John Wiley & Sons, Inc., 1968).	———

*These estimates are based on our own experience, using this machine configuration: an IBM 360-40, 256 K system and a Univac 1108 Time-sharing System, together with such smaller equipment as GE Time-sharing and IBM 360-30's and 1130's.

Time Series Analysis

Time Series is a set of observations on the values that a variable takes at different times. Example: Sales trend, stock market prices, weather forecasts etc. In simple terms. Let's take a sales data. You would have cells that are connected on every month basis. Like for January, you sold 150, and in February, you sold about a bit more let us assume three hundred and so on for all the 12 months. So, you have your sales data, right? This becomes a time series for you. And given that there is a pattern, we can predict the future sales of the same unit.

Casual Methods:

Causal forecasting recognizes that the predicted dependent variable affects one or more other independent variables. Causal methods take into account all possible factors that may affect the dependent variable. Consequently, the data necessary for such forecasting can vary from internal data to external data, such as surveys, macroeconomic indicators, product characteristics, social chatter, etc. Typically, casual models are infinitely modified to ensure that the latest data are included in the model.

A. Qualitative Methods *(continued)*		B. Time Series Analysis & Projection	
4. Visionary Forecast	**5. Historical Analogy**	**1. Moving Average**	**2. Exponential Smoothing**
A prophecy that uses personal insights, judgment, and, when possible, facts about different scenarios of the future. It is characterized by subjective guesswork and imagination; in general, the methods used are non-scientific.	This is a comparative analysis of the introduction and growth of similar new products that bases the forecast on similarity patterns.	Each point of a moving average of a time series is the arithmetic or weighted average of a number of consecutive points of the series, where the number of data points is chosen so that the effects of seasonals or irregularity or both are eliminated.	This technique is similar to the moving average, except that more recent data points are given more weight. Descriptively, the new forecast is equal to the old one plus some proportion of the past forecasting error. Adaptive forecasting is somewhat the same except that seasonals are also computed. There are many variations of exponential smoothing: some are more versatile than others, some are computationally more complex, some require more computer time.
Poor Poor Poor	Poor Good to fair Good to fair	Poor to good Poor Very poor	Fair to very good Poor to good Very poor
Poor	Poor to fair	Poor	Poor
Forecasts of long-range and new-product sales, forecasts of margins.	Forecasts of long-range and new-product sales, forecasts of margins.	Inventory control for low-volume items.	Production and inventory control, forecasts of margins and other financial data.

A set of possible scenarios about the future prepared by a few experts in light of past events.	Several years' history of one or more products.	A minimum of two years of sales history, if seasonals are present. Otherwise, less data. (Of course, the more history the better.) The moving average must be specified.	The same as for a moving average.
$100+ Yes	$1,000+ Yes	$.005 Yes	$.005 Yes
1 week+	1 month+	1 day–	1 day–
———	Spencer, Clark & Hoguet, *Business & Economic Forecasting* (Homewood, Illinois, Richard D. Irwin, Inc., 1961).	Hadley, *Introduction to Business Statistics* (San Francisco, Holden-Day, Inc., 1968).	Brown, "Less Risk in Inventory Estimates," HBR July–August 1959, p. 104.

BASIC FORECASTING TECHNIQUES *(continued)*

	B. Time Series Analysis & Projection *(continued)*		
Technique	**3. Box-Jenkins**	**4. X-11**	**5. Trend Projections**
Description	Exponential smoothing is a special case of the Box-Jenkins technique. The time series is fitted with a mathematical model that is optimal in the sense that it assigns smaller errors to history than any other model. The type of model must be identified and the parameters then estimated. This is apparently the most accurate statistical routine presently available but also one of the most costly and time-consuming ones.	Developed by Julius Shiskin of the Census Bureau, this technique decomposes a time series into seasonals, trend cycles, and irregular elements. Primarily used for detailed time series analysis (including estimating seasonals); but we have extended its uses to forecasting and tracking and warning by incorporating other analytical methods. Used with special knowledge, it is perhaps the most effective technique for medium-range forecasting—three months to one year—allowing one to predict turning points and to time special events.	This technique fits a trend line to a mathematical equation and then projects it into the future by means of this equation. There are several variations: the slope-characteristic method, polynomials, logarithms, and so on.
Accuracy Short term (0–3 months) Medium term (3 months–2 years) Long term (2 years & up)	 Very good to excellent Poor to good Very poor	 Very good to excellent Good Very poor	 Very good Good Good
Identification of turning points	Fair	Very good	Poor
Typical applications	Production and inventory control for large-volume items, forecasts of cash balances.	Tracking and warning, forecasts of company, division, or department sales.	New-product forecasts (particularly intermediate- and long-term).

Data required	The same as for a moving average. However, in this case more history is very advantageous in model identification.	A minimum of three years' history to start. Thereafter, the complete history.	Varies with the technique used. However, a good rule of thumb is to use a minimum of five years' annual data to start. Thereafter, the complete history.
Cost of forecasting* With a computer Is calculation possible without a computer?	$10.00 Yes	$10.00 No	Varies with application Yes
Time required to develop an application & make a forecast	1–2 days	1 day	1 day–
References	Box-Jenkins, *Time Series Analysis, Forecasting & Control* (San Francisco, Holden-Day, Inc., 1970).	McLaughlin & Boyle, "Time Series Forecasting," American Marketing Association Booklet, 1962, Marketing Research Technique Series No. 6.	Hadley, *Introduction to Business Statistics* (San Francisco, Holden-Day, Inc., 1968); Oliver & Boyd, "Techniques of Production Control," Imperial Chemical Industries, 1964.

*These estimates are based on our own experience, using this machine configuration: an IBM 360-40, 256 K system and a Univac 1108 Time-sharing System, together with such smaller equipment as GE Time-sharing and IBM 360-30's and 1130's.

BASIC FORECASTING TECHNIQUES *(continued)*

Technique	C. Causal Methods *(continued)*			
	5. Economic Input-Output Model	**6. Diffusion Index**	**7. Leading Indicator**	**8. Life-Cycle Analysis**
Description	Econometric models and input-output models are sometimes combined for forecasting. The input-output model is used to provide long-term trends for the econometric model; it also stabilizes the econometric model.	The percentage of a group of economic indicators that are going up or down, this percentage then becoming the index.	A time series of an economic activity whose movement in a given direction precedes the movement of some other time series in the same direction is a leading indicator.	This is an analysis and forecasting of new-product growth rates based on S-curves. The phases of product acceptance by the various groups such as innovators, early adapters, early majority, late majority, and laggards are central to the analysis.
Accuracy Short term (0–3 months) Medium term (3 months–2 years) Long term (2 years & up)	Not applicable Good to very good Good to excellent	Poor to good Poor to good Very poor	Poor to good Poor to good Very poor	Poor Poor to good Poor to good
Identification of turning points	Good	Good	Good	Poor to good
Typical applications	Company sales for industrial sectors and subsectors.	Forecasts of sales by product class.	Forecasts of sales by product class.	Forecasts of new-product sales.
Data required	The same as for a moving average and X-11.	The same as an intention-to-buy survey.	The same as an intention-to-buy survey + 5 to 10 years' history.	As a minimum, the annual sales of the product being considered or of a similar product. It is often necessary to do market surveys.

*Cost of forecasting With a computer Is calculation possible without a computer?	$100,000 No	$1,000 Yes	$1,000 Yes	$1,500 Yes
Time required to develop an application & make a forecast	6 months+	1 month+	1 month+	1 month+
References	Evans & Preston, "Discussion Paper #138," Wharton School of Finance & Commerce, The University of Pennsylvania.	Evans, *Macro-economic Activity: Theory, Forecasting & Control* (New York, Harper & Row Publishers, Inc., 1969).	Evans, *Macro-economic Activity: Theory, Forecasting & Control* (New York, Harper & Row Publishers, Inc., 1969).	Bass, "A New Product Growth Model for Consumer Durables," *Management Science*, January 1969.

*These estimates are based on our own experience, using this machine configuration: an IBM 360-40, 256 K system and a Univac 1108 Time-sharing System, together with such smaller equipment as GE Time-sharing and IBM 360-30's and 1130's.

Quantitative business forecasting

Use quantitative forecasting when there is accurate past data available to analyze patterns and predict the probability of future events in your business or industry.

Quantitative forecasting extracts trends from existing data to determine the more probable results. It connects and analyzes different variables to establish cause and effect between events, elements, and outcomes. An example of data used in quantitative forecasting is past sales numbers.

Quantitative models work with data, numbers, and formulas. There is little human interference in quantitative analysis. Examples of quantitative models in business forecasting include:

- **The indicator approach**: This approach depends on the relationship between specific indicators being stable over time, e.g., GDP and the unemployment rate. By following the relationship between these two factors, forecasters can estimate a business's performance.
- **The average approach**: This approach infers that the predictions of future values are equal to the average of the past data. It is best to use this approach only when assuming that the future will resemble the past.
- **Econometric modeling**: Econometric modeling is a mathematically rigorous approach to forecasting. Forecasters assume the relationships between indicators stay the same and test the consistency and strength of the relationship between datasets.
- **Time-series methods**: Time-series methods use historical data to predict future outcomes. By tracking what happened in the past, forecasters expect to get a near-accurate view of the future

How do you choose the right business forecasting technique?

Choosing the right business forecasting technique depends on many factors. Some of these are:

- Context of the forecast

- Availability and relevance of past data
- Degree of accuracy required
- Allocated time to conduct the forecast
- Period to be forecast
- Costs and benefits of the forecast
- Stage of the product or business needing the forecast

Managers and forecasters must consider the stage of the product or business as this influences the availability of data and how you establish relationships between variables. A new startup with no previous revenue data would be unable to use quantitative methods in its forecast. The more you understand the use, capabilities, and impact of different forecasting techniques, the

Why is business forecasting important?

Forecasting is valuable to businesses because it gives the ability to make informed business decisions and develop data-driven strategies. Financial and operational decisions are made based on current market conditions and predictions on how the future looks. Past data is aggregated and analyzed to find patterns, used to predict future trends and changes. Forecasting allows your company to be proactive instead of reactive.

Any insight into the future puts your organization at an advantage. Forecasting helps you predict potential issues, make better decisions, and measure the impact of those decisions.

By combining quantitative and qualitative techniques, statistical and econometric models, and objectivity, forecasting becomes a formidable tool for your company.

Business forecasting helps managers develop the best strategies for current and future trends and events. Today, artificial intelligence, forecasting software, and big data make business forecasting easier, more accurate, and personalized to each organization.

Forecasting does not promise an accurate picture of the future or how your business will evolve, but it points in a direction informed by data, logic, and experiential reasoning.

What are the integral elements of business forecasting?

While there are different forecasting techniques and methods, all forecasts follow the same process on a conceptual level. Standard elements of business forecasting include:

- **Prepare the stage**: Before you begin, develop a system to investigate the current state of business.
- **Choose a data point**: An example for any business could be "What is our sales projection for next quarter?"
- **Choose indicators and data sets**: Identify the relevant indicators and data sets you need and decide how to collect the data.
- **Make initial assumptions**: To kick start the forecasting process, forecasters may make some assumptions to measure against variables and indicators.
- **Select forecasting technique**: Pick the technique that fits your forecast best.
- **Analyze data**: Analyze available data using your selected forecasting technique.
- **Estimate forecasts**: Estimate future conditions based on data you've gathered to reach data-backed estimates.
- **Verify forecasts**: Compare your forecast to the eventual results. This helps you identify any problems, tweak errant variables, correct deviations, and continue to improve your forecasting technique.
- **Review forecasting process**: Review any deviations between your forecasts and actual performance data.

How do you do business forecasting?

Successful business forecasting begins with a collaboration between the manager and forecaster. They work together to answer the following questions:

1. What is the purpose of the forecast? How will it be used?
2. What are the components and dynamics of the system the forecast is focused on?
3. How relevant is past data in estimating the future?

Once these answers are clear, choose the best forecasting methods based on the stage of the product or business life cycle, availability of past data, and skills of the forecasters and managers leading the project.

With the right forecasting method, you can develop your process using the integral elements of business forecasting mentioned above.

How do you get data for business forecasting?

A forecast is only as good as the data supplied. Before collecting data, ask:

- Why do you need it?
- What kind of data do you need?
- When will you collect it?
- Where will you gather it?
- Who is in charge of collecting it?
- How will you collect it?
- How will you analyze it?

When you have these answers, you can start collecting data from two main sources:

- **Primary sources**: These sources are gathered first-hand using reporting tools — you or members of your team source data through interviews, surveys, research, or observations.
- **Secondary sources**: Secondary sources are second-hand information or data that others have collected. Examples include government reports, publications, financial statements, competitors' annual reports, journals, and other periodicals.

Ideally, prediction methods should be evaluated in the situations in which they will be used. The basis for conducting the evaluation is the need to test methods against reasonable alternatives.

The evaluation consists of four steps:

- test assumptions,
- test data and methods,
- repeat results,
- and evaluate results.

Most of the principles for testing prediction methods are based on generally accepted methodological procedures, such as defining criteria or obtaining a large sample of prediction errors. However, forecasters often violate such principles, even in academic studies.

Some principles may be surprising, such as

- not using the R squared,
- not using themean squared error,
- and not using fit within the sample to define the most accurate time series model.

A checklist of 32 principles is provided to assist in the systematic assessment of prediction methods

Evaluation Principles Checklist

Using reasonable alternatives
- Compare reasonable forecasting methods

Testing assumptions
- Use objective tests of assumptions
- Test assumptions for construct validity
- Describe conditions of the problem
- Match tests to the problem
- Tailor analysis to the decision

Testing data and methods
- Describe potential biases
- Assess reliability and validity of data
- Provide easy access to data
- Disclose details of methods
- Find out whether clients understand the methods

Replicating outputs
- Use direct replication to identify mistakes
- Replicate studies to assess reliability
- Extend studies to assess generalizability
- Conduct extensions in realistic situations
- Compare with forecasts obtained by different methods

Assessing outputs
- Examine all important criteria
- Prespecify criteria
- Assess face validity
- Adjust error measures for scale
- Ensure error measures are valid
- Avoid error measures sensitive to degree of difficulty
- Avoid biased error measures
- Avoid sensitivity to outliers
- Do not use R^2 to compare models
- Do not use Root Mean Square Error
- Use multiple error measures
- Use ex ante tests for accuracy
- Use statistical significance only to test accuracy of reasonable models
- Use ex post tests for policy effects
- Obtain large samples of independent forecast errors
- Conduct explicit cost/benefit analysis

BUSINESS FORECASTING PROCESS

The way a company forecasts is always unique to its needs and resources, but the primary forecasting process can be summed up in five steps. These steps outline how business forecasting starts with a problem and ends with not only a solution but valuable learnings.

1.Choose an issue to address

The first step in predicting the future is choosing the problem you're trying to solve or the question you're trying to answer. This can be as simple as determining whether your audience will be interested in a new product your company is developing. Because this step doesn't yet involve any data, it relies on internal considerations and decisions to define the problem at hand.

2. Create a data plan

The next step in forecasting is to collect as much data as possible and decide how to use it. This may require digging up some extensive historical company data and examining the past and present market trends. Suppose your company is trying to launch a new product. In this case, the gathered data can be a culmination of the performance of your previous product and the current performance of similar competing products in the target market.

3. Pick a forecasting technique

After collecting the necessary data, it's time to choose a business forecasting technique that works with the available resources and the type of prediction. All the forecasting models are effective and get you on the right track, but one may be more favorable than others in creating a unique, comprehensive forecast.

For example, if you have extensive data on hand, quantitative forecasting is ideal for interpretation. Qualitative forecasting is best if you have less hard data available and are willing to invest in extensive market research.

4. Analyze the data

Once the ball starts rolling, you can begin identifying patterns in the past and predict the probability of their repetition. This information will help your company's decision-makers determine what to do beforehand to prepare for the predicted scenarios.

5. Verify your findings

The end of business forecasting is simple. You wait to see if what you predicted actually happens. This step is especially important in determining not only the success of your forecast but also the effectiveness of the entire process. Having done some forecasting, you can compare the present experience with these forecasts to identify potential areas for growth.

When in doubt, never throw away "old" data. The final information of one forecasting process can also be used as the past data for another forecast. It's like a life cycle of business development predictions.

Business forecasting examples

Some forecasting examples for business include:

1. Calculating cash flow forecasts, i.e., predicting your financial needs within a timeframe
2. Estimating the threat of new entrants into your market
3. Measuring the opportunity of developing a new product or service

4. Estimating the costs of recurring bills
5. Predicting future sales growth based on past sales performance
6. Analyzing relationships between variables, e.g., Facebook ads and potential revenue
7. Budgeting contingencies and efficient allocation of resources
8. Comparing customer acquisition costs and customer lifetime value over time

Business Forecasting: How it Works & Real-Life Examples

A rapidly evolving modern business climate has proven how fast things can change, with businesses evolving beside it to succeed. In fact, today's world requires agile strategy and management.

This is where business forecasting can help, enabling businesses to plan for un expected events. In this, you'll learn the basic principles of business forecasting and how to implement forecasting techniques in your business planning.

What is business forecasting?

Business forecasting involves forecasting tools and techniques to help businesses predict certain developments, such as revenue, sales, and growth. Through analytics, data, insights, and experience, business forecasting provides organizations with the information they can use to improve their decision-making. Whether you have a large or small company or offer products or services, accurate forecasts can help your business prepare for future events and future trends.

For example, let's say a new company started the year with few sales. During Q3, their sales began to skyrocket because of a new marketing technique spreading brand awareness. Applying a business forecasting technique, the team can better gauge Q4 sales —preparing inventory, expanding their team, and taking the necessary steps to have a successful quarter.

3 examples of business forecasting in action

Now that you understand the basics of business forecasting, it's time to see how it works in practice. Read the following examples to better understand the different approaches to business forecasting.

1. A company forecasting its sales through the end of the year

Let's suppose a small greeting card company wants to forecast its sales through the end of the year. The company has just a year and a half of experience and limited data to use for predictions. Though the first few quarters were slow to start, they have gained a great reputation in the last three quarters. For this reason, sales are on the rise.

Since the business has limited historical data, they might consider a qualitative model for predicting future sales. By polling their customers, the greeting card company can gauge the willingness of their audience to buy new cards and pricing for the remaining quarters of the year. Market surveys are a type of qualitative forecasting, which utilizes que stionnaires to estimate future customer behavior.

2. A company forecasting sales for the next quarter

In this example, let's suppose a well-established shoe brand is forecasting profits for the next quarter. Normally, this company would use the time series forecasting technique to estimate profits for the next quarter. However, economic conditions have shifted, and the unemployment rate is higher than normal. As a result, the company chooses the indicator approach to predict the actual performance of its product.

In this scenario, the company might compare two variables: employment rate and spending rates. With this business forecasting approach, the company predicts it will have a decrease in profits for the upcoming quarter. Following this prediction, it chooses to produce fewer items in response to economic changes and adjust budgets accordingly.

3. A company forecasting returns on a new product

In this next example, let's suppose a loungewear company plans on rolling out a new product: slippers. Since this product is new to the company, there are no official metrics for pricing and popularity. For this reason, the company needs to gauge the interest level of its target audience.

In this case, demand forecasting would be a great approach to gauge how much customers are willing to spend and how much the company will need to invest in terms of materials. By using this forecasting process, the loungewear company can decide if the product will perform well and what kind of demand exists. Ultimately, this will help the team make informed business decisions for production as well as sales.

What are the limits of business forecasting?

You can follow the rules, use the right methods, and still get your business forecast wrong. It is, after all, an attempt to predict the future. Some limits to business forecasting include:

- Biases and errors by the forecasters or managers
- Incorrect information from employees, experts, or customers
- Inaccurate past numbers
- Sudden change in market conditions
- New industry regulations

PREDICTIVE ANALYTICS

Predictive analytics uses historical data to predict future events. Typically, historical data is used to build a mathematical model that captures important trends. That predictive model is then used on current data to predict what will happen next, or to suggest actions to take for optimal outcomes.

Predictive analytics has received a lot of attention in recent years due to advances in supporting technology, particularly in the areas of big data and machine learning.

Rise of Big Data

Predictive analytics is often discussed in the context of big data, Engineering data, for example, comes from sensors, instruments, and connected systems out in the world. Business system data at a company might include transaction data, sales results, customer complaints, and marketing information. Increasingly, businesses make data-driven decisions based on this valuable trove of information.

Increasing Competition

With increased competition, businesses seek an edge in bringing products and services to crowded markets. Data-driven predictive models can help companies solve long-standing problems in new ways.

Equipment manufacturers, for example, can find it hard to innovate in hardware alone. Product developers can add predictive capabilities to existing solutions to increase value to the customer. Using predictive analytics for equipment maintenance, or predictive maintenance, can anticipate equipment failures, forecast energy needs, and reduce operating costs. For example, sensors that measure vibrations in automotive parts can signal the need for maintenance before the vehicle fails on the road.

Companies also use predictive analytics to create more accurate forecasts, such as forecasting the demand for electricity on the electrical grid. These forecasts enable resource planning (for example, scheduling of various power plants), to be done more effectively.

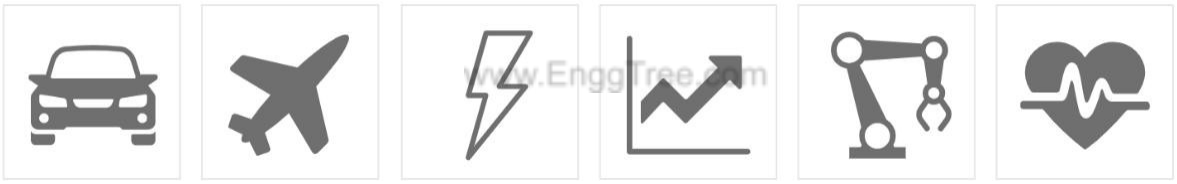
Cutting-Edge Technologies for Big Data and Machine Learning

To extract value from **big data**, businesses apply algorithms to large data sets using tools such as Hadoop and Spark. The data sources might consist of transactional databases, equipment log files, images, video, audio, sensor, or other types of data. Innovation often comes from combining data from several sources.

With all this data, tools are necessary to extract insights and trends. Machine learning techniques are used to find patterns in data and to build models that predict future outcomes. A variety of machine learning algorithms are available, including linear and nonlinear regression, neural networks, support vector machines, decision trees, and other algorithms.

Predictive Analytics Examples

Predictive analytics helps teams in industries as diverse as finance, healthcare, pharmaceuticals, automotive, aerospace, and manufacturing.



- **Automotive** – Breaking new ground with autonomous vehicles
  Companies developing driver assistance technology and new autonomous vehicles use predictive analytics to analyze sensor data from connected vehicles and to build driver assistance algorithms.
- **Aerospace** – Monitoring aircraft engine health
  To improve aircraft up-time and reduce maintenance costs, an engine manufacturer created a real-time analytics application to predict subsystem performance for oil, fuel, liftoff, mechanical health, and controls.
- **Energy Production** – Forecasting electricity price and demand
  Sophisticated forecasting apps use models that monitor plant availability, historical trends, seasonality, and weather.
- **Financial Services** – Developing credit risk models
  Financial institutions use machine learning techniques and quantitative tools to predict credit risk.
- **Industrial Automation and Machinery** – Predicting machine failures
  A plastic and thin film producer saves 50,000 Euros monthly using a health monitoring and predictive maintenance application that reduces downtime and minimizes waste.

- **Medical Devices** – Using pattern-detection algorithms to spot asthma and COPD An asthma management device records and analyzes patients' breathing sounds and provides instant feedback via a smart phone app to help patients manage asthma and COPD.

How Predictive Analytics Works

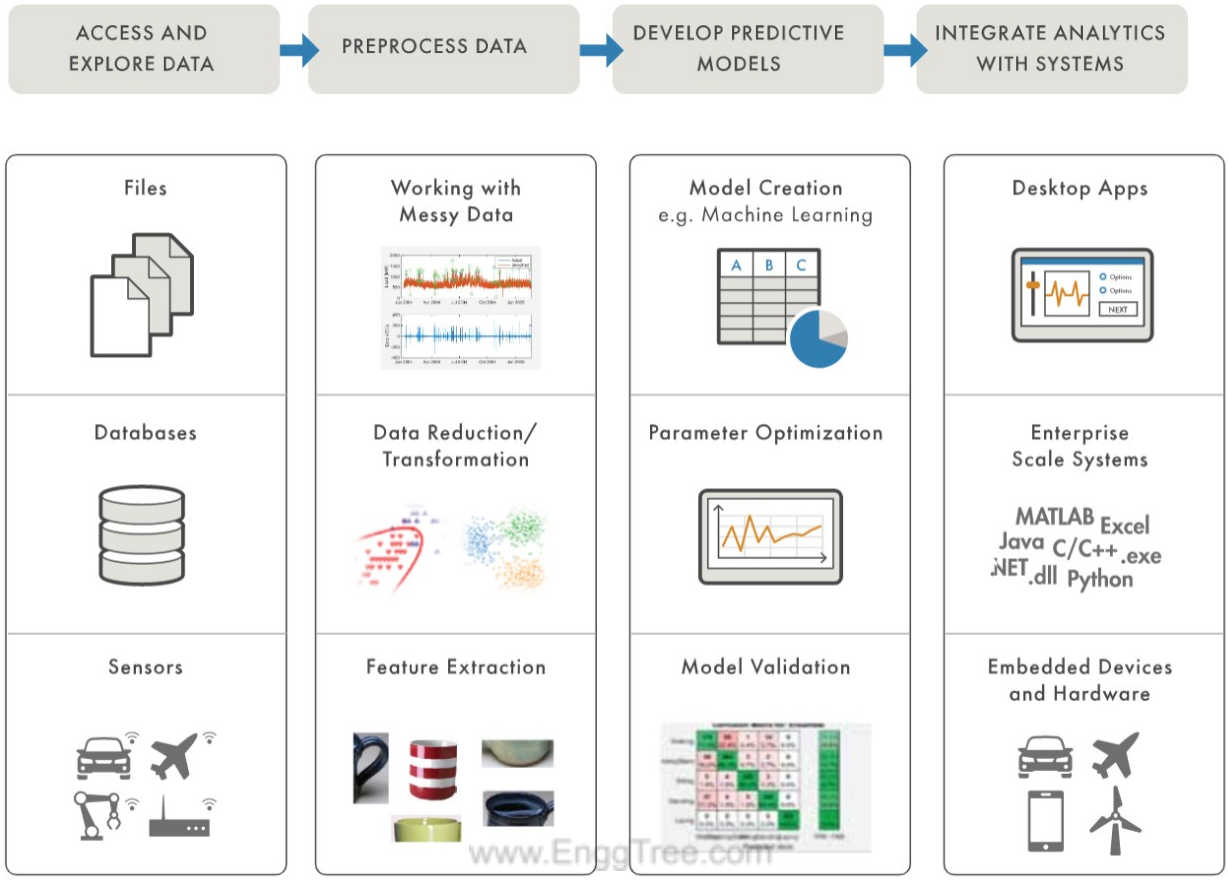
Predictive analytics is the process of using data analytics to make predictions based on data. This process uses data along with analysis, statistics, and **machine learning** techniques to create a predictive model for forecasting future events.

The term "predictive analytics" describes the application of a statistical or machine learning technique to create a quantitative prediction about the future. Frequently, supervised machine learning techniques are used to predict a future value (How long can this machine run before requiring maintenance?) or to estimate a probability (How likely is this customer to default on a loan?).

Predictive analytics starts with a business goal: to use data to reduce waste, save time, or cut costs. The process harnesses heterogeneous, often massive, data sets into models that can generate clear, actionable outcomes to support achieving that goal, such as less material waste, less stocked inventory, and manufactured product that meets specifications.

Predictive Analytics Workflow

We are all familiar with predictive models for weather forecasting. A vital industry application of predictive models relates to energy load forecasting to predict energy demand. In this case, energy producers, grid operators, and traders need accurate forecasts of energy load to make decisions for managing loads in the electric grid. Vast amounts of data are available, and using predictive analytics, grid operators can turn this information into actionable insights.



Predictive analytics workflow.

Step-by-Step Workflow for Predicting Energy Loads

Typically, the workflow for a predictive analytics application follows these basic steps:

1. **Import data from varied sources, such as web archives, databases, and spreadsheets.**
   Data sources include energy load data in a CSV file and national weather data showing temperature and dew point.
2. **Clean the data by removing outliers and combining data sources.**
   Identify data spikes, missing data, or anomalous points to remove from the data. Then aggregate different data sources together – in this case, creating a single table including energy load, temperature, and dew point.
3. **Develop an accurate predictive model based on the aggregated data using statistics, curve fitting tools, or machine learning.**
   Energy forecasting is a complex process with many variables, so you might choose to use neural networks to build and train a predictive model. Iterate through your training data set to try different approaches. When the training is complete, you can try the model against new data to see how well it performs.

4. **Integrate the model into a load forecasting system in a production environment.**
   Once you find a model that accurately forecasts the load, you can move it into your production system, making the analytics available to software programs or devices, including web apps, servers, or mobile devices.

Create models and forecast future outcomes

Predictive modeling is a technique that uses mathematical and computational methods to predict an event or outcome. A mathematical approach uses an equation-based model that describes the phenomenon under consideration. The model is used to forecast an outcome at some future state or time based upon changes to the model inputs. The model parameters help explain how model inputs influence the outcome. Examples include time-series regression models for predicting airline traffic volume or predicting fuel efficiency based on a linear regression model of engine speed versus load.

The computational predictive modeling approach differs from the mathematical approach because it relies on models that are not easy to explain in equation form and often require simulation techniques to create a prediction. This approach is often called "black box" predictive modeling because the model structure does not provide insight into the factors that map model input to outcome. Examples include using neural networks to predict which winery a glass of wine originated from or bagged decision trees for predicting the credit rating of a borrower.

Predictive modeling is often performed using curve and surface fitting, time series regression, or machine learning approaches. Regardless of the approach used, the process of creating a predictive model is the same across methods. The steps are:

1. Clean the data by removing outliers and treating missing data
2. Identify a parametric or nonparametric predictive modeling approach to use
3. Preprocess the data into a form suitable for the chosen modeling algorithm
4. Specify a subset of the data to be used for training the model
5. Train, or estimate, model parameters from the training data set
6. Conduct model performance or goodness-of-fit tests to check model adequacy
7. Validate predictive modeling accuracy on data not used for calibrating the model
8. Use the model for prediction if satisfied with its performance

Types of Predictive Models

While data analysts are required to make decisions regarding which mathematical model to use in a given situation, they are not actually the ones crunching the data. Statisticians and programmers develop computer programs that carry out these processes, each of which operates using a different mathematical model.

"The tools we're using for predictive analytics now have improved and become much more sophisticated," Goulding says, explaining that these advanced models have allowed us to "handle massive amounts of data in ways we couldn't before."

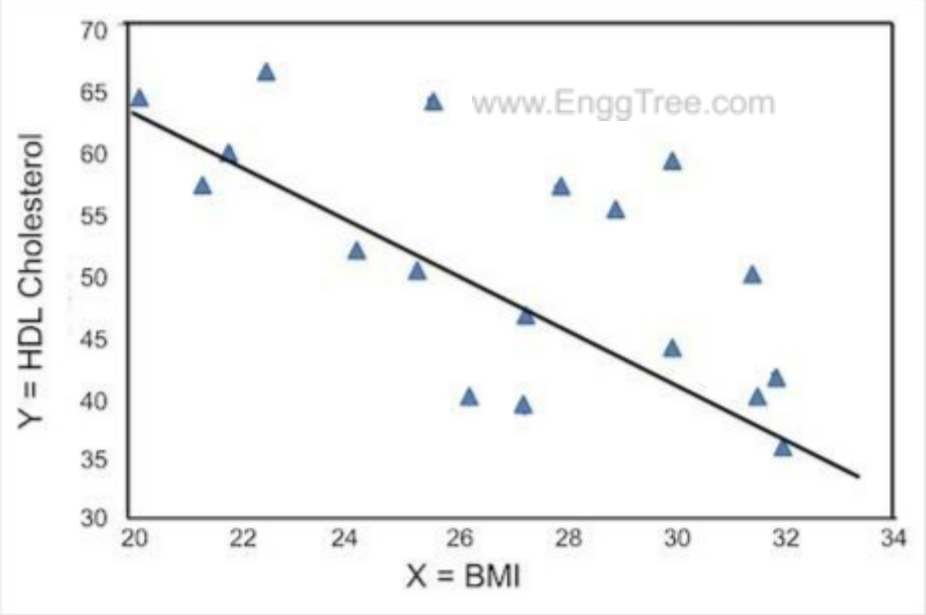
The advancement of these tools has also resulted in the use of predictive analytics to identify "unknowns" that previously could not be addressed, leading to an overall need for analysts that can succinctly identify which model best aligns with the type of unknown in each scenario.

Below, we explore four common predictive models and the types of questions they can be best used to answer.

1. Linear Regression

Linear regression is one of the most famous and historic modeling tools, according to Goulding. This model considers all the known data points on a graph and creates a straight line that travels through the center of those data points. This line represents the smallest possible distance between all the points on the graph. A linear regression mathematical modeling tool can then base predictions about nonexistent data off of the relationship between this line and the existing data points.

Real-World Example



A linear regression model would be useful when a doctor wants to predict a new patient's cholesterol based only on their body mass index (BMI). In this example, the analyst would know to put the data the doctor gathered from his 5,000 other patients—including each of their BMIs and cholesterol levels—into the linear regression model. They are hoping to predict an unknown based on a predetermined set of quantifiable data.

The linear regression model would take the data, plot it onto a graph, and establish a line down the center that properly depicts the smallest distance between all plotted data points. In this scenario, when that new patient arrives knowing only that their BMI is 31, a data analyst will be able to predict the patient's cholesterol by looking at that line and seeing what cholesterol level most closely aligns with other patients who have a BMI of 31.

2. Text Mining

Whereas linear regression uses only numeric data, mathematical models can also be used to make predictions about non-numerical factors. Text mining is a perfect example.

"Text mining is part of predictive analytics in the sense that analytics is all about finding the information I previously knew nothing about," Goulding says. In this scenario, the tool takes data points in the form of text-based words or phrases and searches a giant database for those specific points.

Sound Familiar? The algorithm used by Google or other search engines to bring up relevant links when you search for a specific keyword is an example of text mining.

Real-World Example

Although tools like search engines—or even the "find" function you may use when searching for a word in a digital body of text—represent some common examples of text mining, there are also industry-specific instances where this type of predictive analytics comes into play.

Goulding describes another medical application of predictive analytics, explaining how doctors rely on text mining when analyzing patient symptoms and trying to determine the root cause. "If I'm a doctor and I have 50 children in front of me with flu symptoms, my brain can figure out that the next patient to walk in the door [with similar symptoms] also has the flu," he says. "But if I see an unusual set of symptoms from just one patient, I may need the case history of patients from all over the world to make a correct diagnosis. My brain can't help me do this; analytics, however, can."

Especially in complex patient cases, an analyst can use text mining modeling tools to comb databases, locate similar symptoms among patients of the past, and generate a prediction as to what this new patient is "most likely" suffering from based on that data.

3. Optimal Estimation

Optimal estimation is a modeling technique that is used to make predictions based on observed factors. This model has been used in analytics for over 50 years and has laid the groundwork for many of the other predictive tools used today. According to Goulding, past applications of this method include determining "how to best recalibrate equipment on a manufacturing floor…[and] estimating where a bullet might go when shot," as well as in other aspects of the defense industry.

Real-World Example

If two planes were flying toward one another, an analyst might use the optimal estimation model to predict if or when they will collide. To do this, the analyst would put a variety of observed factors into the mathematical modeling tool, including the airplanes' height, altitude, speed, angle, and more. The mathematical model would then be able to help predict at which point, if any, the planes would meet.

4. Clustering Models

Clustering models are focused on finding different groups with similar qualities or elements within the data. Many mathematical modeling tools fall within this category, including:

K-Means

Hierarchical Clustering

TwoStep

Density-Based Scan Clustering

Gaussian Clustering Model

Kohonen

Real-World Example

If a fast-food restaurant wanted to open a new location in a new city, the corporate team may work with a data analyst to figure out exactly where that new location should go. The analyst would start by gathering an array of specific, relevant data about each location—including factors like demographics, where the high-end houses are, how close the location is to a college, etc.—then input all of that data into a clustering mathematical model. This model would most efficiently analyze this particular type of data and predict where the most strategic location in the city for that restaurant is based on the data alone.

5. Neural Networks

Neural networks are complex algorithms inspired by the structure of the human brain. They process historical and current data and identify complex relationships within the data to predict the future, similar to how the human brain can spot trends and patterns.

A typical neural network is composed of artificial neurons, called units, arranged in different layers. The neural network uses input units to learn about and process data. On the other hand, output units are on the opposite side and outline how the neural network should respond to the input units. Between the two are hidden layers, which are layers of mathematical functions that produce a specific output.

Real-World Example

If an e-commerce retailer wants to accurately predict which products its customers are likely to consider purchasing in the future, a data analyst or data scientist might use neural networks to inform the company's product recommendation algorithm. The analyst will pull purchase data and

feed it to the neural network, giving the network real examples to learn from. This data will travel through the neural network through various mathematical functions until the output is produced and a product recommendation populates.

Other Common Predictive Models

In addition to the mathematical models above, there are additional models that data analysts use to make predictions, including:

Decision trees

Random forests

Logistic regression

Bayesian methods

Why Is Predictive Analytics Important?

While organizations have recognized the importance of gathering data as a means of looking back on industry trends for years, business teams have only just started scratching the surface of possibility when it comes to predictive analytics.

"Analytics is getting exciting in every industry because we're [more] equipped than ever to…use the data in the back room that has been gathering dust…to make better business decisions," Goulding says.

From insurance to retail to healthcare, organizations are starting to adapt to this model of informed decision-making and are using it to their advantage:

- Today, insurance companies can predict if a new client is a risk based on their age, history, health conditions, etc. They can weigh this data and make an informed decision about whether or not they want to cover that individual.
- Retail organizations can predict how new brands or items might sell in their local market based on consumer demographics. They can then make strategic decisions about how much product to stock.
- Doctors can use predictive data to help determine not only what ailment someone's conditions point to but also their chances of survival, whether or not they need immediate surgery, and their condition's expected decline over a certain period of time.

No matter the industry, the recent advancements in mathematical modeling and the overall lean into data as a prescriptive form of insight have changed the way businesses operate today. Businesses can make data-driven decisions based on predictive models, allowing them to mitigate potential risks and maximize profits. These changes have created an overall trend in decision-making that is sure to continue developing and expanding for years to come.

Predictive Analytics vs. Prescriptive Analytics

Organizations that have successfully implemented predictive analytics see prescriptive analytics as the next frontier. Predictive analytics creates an estimate of what will happen next; *prescriptive* analytics tells you how to react in the best way possible given the prediction.

Prescriptive analytics is a branch of data analytics that uses predictive models to suggest actions to take for optimal outcomes. Prescriptive analytics relies on optimization and rules-based techniques for decision making. Forecasting the load on the electric grid over the next 24 hours is an example of *predictive analytics*, whereas deciding how to operate power plants based on this forecast represents *prescriptive analytics*.

PREDICTIVE ANALYSIS VS FORECASTING – HOW CAN IT HELP COMPANIES?

Forecasting is a method by which companies find out trends that will dominate the market in the company years. It has many advantages not just for new startups but for established and old companies. Forecasting is defined as a planning tool that can help the management to cope with an uncertain future, mainly through the use of past data and analysis of market trends. The process of forecasting begins with certain assumptions that are based on the management experience, knowledge and astute judgement sense of the management team. These estimates are then projected on techniques like Box-Jenkins models, Delphi method, exponential smoothing, moving averages, regression analysis, and trend projection. Since any error in the assumptions will also result in a similar or magnified error in forecasting results, the technique of sensitivity analysis is used where a range of values is assigned to uncertain factors, which are also called variables.

4 Major Benefits of Forecasting. Given below are the major benefits of forecasting.

1. **Forecasting helps in establishing new startups and promoting new brands:** Forecasting is an important element when new brands are being set up in the industry. This is especially true when the industry is filled with multiple challenges and there are many hurdles in the path of seeing up a successful brand. Forecasting can help

entrepreneurs to find out the best way that they can overcome these challenges and thereby establish a successful company. Through forecasting brands can understand how they will be perceived in the market and whether their products have the capability to meet the expectations and demands of the target audience. In short, good and strong forecasting can help startup companies to increase their chances of success by helping them plan and strategies their entry in a much better manner. At the same time, good forecasting can help new brands to meet the supply and demand situation, thereby increasing their brand power and loyalty.

2. **Forecasting can help brands to use their financial resources in a much better manner, than before:** Financial concerns, especially for new and small companies is a very important aspect. That is why it is important that in such situations, the available resources are utilised in a proper and effective manner. As no brand can survive without adequate capital, financial forecasting plays a very important role in such a scenario. By helping companies to divide their resources in a proper manner, financial forecasting can hold the key to proper and effective financial planning in a company.
3. **Forecasting can help the administration take good and successful management decisions:** Every company is based on good administrative decisions. Without a strong administrative backbone, companies will completely turn into a failure, sooner or later. The administration team of any company is essentially a decision making process and has responsibility for making decisions and for ascertaining that the decisions made are carried out. That is why it is important that the wheels of the administrative department is working in a continue manner and it is here that forecasting plays a very important role as it helps companies to take decisions at the right time.

4. **Forecasting helps companies to plan in a systematic manner:** Planning is a very important component of any company, be it in the long term or short term. Forecasting can help companies to plan their growth strategy while keeping in mind the needs of the consumers while at the same time having an intricate understanding of the market trends as well. In other words, good and proper planning whether it is for the overall growth of the company or for a section of the company is completely dependent on good forecasting techniques.

Conclusion

In the end, both Predictive Analysis vs Forecasting are two techniques through which brands can correctly forecast and understand market techniques while at the same time meet customer expectations as well. In short, the need today is not for better Predictive Analysis vs Forecasting methods, but for better application of the techniques at hand.

LOGIC AND DATA DRIVEN MODELS

Predictive modeling means the developing models that can be used to forecast or predict future events. Models can be developed either through logic or data.

- 1. **Logic driven models** remain based on experience, knowledge and logical relationships of variables and constants connected to the desired business performance outcome situation.
- 2. **Data-driven Models** refers to the models in which data is collected from many sources to qualitatively establish model relationships. Logic driven models is often used as a first step to establish relationships through data-driven models. Data driven models include sampling and estimation, regression analysis, correlation analysis, forecasting models and stimulation.

It leverages statistics to predict outcomes. Most often the event one wants to predict is in the future, but predictive modeling can be applied to any type of unknown event, regardless of when it occurred. For example, predictive models are often used to detect crimes and identify suspects, after the crime has taken place.

In many cases the model is chosen on the basis of detection theory to try to guess the probability of an outcome given a set amount of input data, for example given an email determining how likely that it is spam.

Models can use one or more classifiers in trying to determine the probability of a set of data belonging to another set, say spam or 'ham'.

Depending on definitional boundaries, predictive modeling is synonymous with, or largely overlapping with, the field of machine learning, as it is more commonly referred to in academic or research and development contexts. When deployed commercially, predictive modeling is often referred to as predictive analytics.

Usage

Predictive models can either be used directly to estimate a response (output) given a defined set of characteristics (input), or indirectly to drive the choice of decision rules.

Depending on the methodology employed for the prediction, it is often possible to derive a formula that may be used in a spreadsheet software. This has some advantages for end users or decision makers, the main one being familiarity with the software itself, hence a lower barrier to adoption.

Nomograms are useful graphical representation of a predictive model. As in spreadsheet software, their use depends on the methodology chosen. The advantage of nomograms is the immediacy of computing predictions without the aid of a computer.

Point estimates tables are one of the simplest form to represent a predictive tool. Here combination of characteristics of interests can either be represented via a table or a graph and the associated prediction read off the y-axis or the table itself.

Tree based methods (e.g. CART, survival trees) provide one of the most graphically intuitive ways to present predictions. However, their usage is limited to those methods that use this type of modelling approach which can have several drawbacks. Trees can also be employed to represent decision rules graphically.

Score charts are graphical tabular or graphical tools to represent either predictions or decision rules.

A statistical model embodies a set of assumptions concerning the generation of the observed data, and similar data from a larger population. A model represents, often in considerably idealized form, the data-generating process. The model assumptions describe a set of probability distributions, some of which are assumed to adequately approximate the distribution from which a particular data set is sampled.

A logic-driven is based on experience, knowledge and logical relationships of variable and constants connected to the desired performance outcome. To help conceptualize the relationships inherent in a system, diagramming methods are useful.

Cause and effect diagram enables a user to hypothesize relationships between potential causes and of an outcome.

Influence diagram are another tool to conceptualize relationships with business performance relationships.

Example –

A restaurant customer dines 6 times a year and spends an average of $50 per visit. The restaurant realizes a 40% margin on the average bill for food and drinks.

Annual gross profit on a customer = $50(6)(0.40) = $120

30% of customers do not return each year. Average lifetime of a customer = 1/.3 = 3.33 years.

Average gross profit for a customer = $120(3.33) = $400

OR Average gross profit for a customer = $120/.3 = $400

$$V = \frac{R \times F \times M}{D}$$

Thus, the economic value of a customer is

- V = value of a loyal customer
- R = revenue per purchase
- F = purchase frequency (number visits per year)
- M = gross profit margin
- D = defection rate (proportion customers not returning each year)

- Logic-Driven Modeling
- Data-Driven Modeling
- Analyzing Uncertainty and Model Assumptions
- Model Analysis Using *Risk Solver Platform*

Logic-Driven Modeling

- Predictive modeling is the heart and soul of business decisions.
- Building decision models is more of an art than a science.
- Creating good decision models requires:
  - solid understanding of business functional areas
  - knowledge of business practice and research
  - logical skills
- It is best to start simple and enrich models as necessary.

Logic-Driven Modeling

Example 8.1 The Economic Value of a Customer

- A restaurant customer dines 6 times a year and spends an average of $50 per visit.
- The restaurant realizes a 40% margin on the average bill for food and drinks.
- **Annual** gross profit on a customer = $50(6)(0.40)
  = $120
- 30% of customers do not return each year.
- Average lifetime of a customer = 1/.3 = 3.33 years
- Average gross profit for a customer = $120(3.33)
  = $400
- **OR Average** gross profit for a customer = $120/.3 = $400

Logic-Driven Modeling

Example 8.1 (continued)
The Economic Value of a Customer

$$V = \frac{R \times F \times M}{D}$$

- V = value of a loyal customer
- R = revenue per purchase
- F = purchase frequency (number visits per year)
- M = gross profit margin
- D = defection rate (proportion customers not returning each year)

Logic-Driven Modeling

Example 8.2 A Profit Model

- Develop a decision model for predicting profit in face of uncertain demand.

P = profit
R = revenue
C = cost

p = unit price
c = unit cost
F = fixed cost
S = quantity sold
D = demand
Q = quantity produced

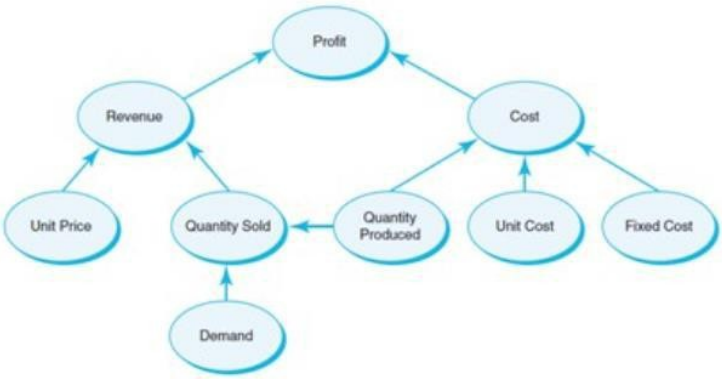


Figure 8.1

Logic-Driven Modeling

Example 8.2 (continued) A Profit Model

- Cost = fixed cost + variable cost

  $C = F + cQ$

- Revenue = price times quantity sold

  $R = pS$

- Quantity sold = Minimum{demand, quantity sold}

  $S = \min\{D, Q\}$

- Profit = Revenue − Cost

  $P = p^*\min\{D, Q\} - (F + cQ)$

Logic-Driven Modeling

Example 8.2 (continued) A Profit Model

- $p = \$40$
- $c = \$24$
- $F = \$400{,}000$
- $D = 50{,}000$
- $Q = 40{,}000$

Compute:

- $R = p^* \min\{D, Q\}$
  $= 40(40{,}000) = 1{,}600{,}000$
- $C = F + cQ = 1{,}360{,}000$
- $= 400{,}000 + 24(40{,}000)$
- $P = R - C = 1{,}600{,}000 - 1{,}360{,}000 = \$240{,}000$

	A	B	C
1	Profit Model		
2			
3	Data		
4			
5	Unit Price	$40.00	
6	Unit Cost	$24.00	
7	Fixed Cost	$400,000.00	
8	Demand	50000	
9			
10			
11	Model		
12			
13	Unit Price	$40.00	
14	Quantity Sold	40000	
15	Revenue		$1,600,000.00
16			
17	Unit Cost	$24.00	
18	Quantity Produced	40000	
19	Variable Cost		$960,000.00
20	Fixed Cost		$400,000.00
21			
22	Profit		$240,000.00

Figure 8.2a

Logic-Driven Modeling

Example 8.2 (continued) A Profit Model

	A	B	C
1	Profit Model		
2			
3	Data		
4			
5	Unit Price	$40.00	
6	Unit Cost	$24.00	
7	Fixed Cost	$400,000.00	
8	Demand	50000	
9			
10			
11	Model		
12			
13	Unit Price	$40.00	
14	Quantity Sold	40000	
15	Revenue		$1,600,000.00
16			
17	Unit Cost	$24.00	
18	Quantity Produced	40000	
19	Variable Cost		$960,000.00
20	Fixed Cost		$400,000.00
21			
22	Profit		$240,000.00

Figure 8.2a

	A	B	C
1	Profit Model		
2			
3	Data		
4			
5	Unit Price	40	
6	Unit Cost	24	
7	Fixed Cost	400000	
8	Demand	50000	
9			
10			
11	Model		
12			
13	Unit Price	=B5	
14	Quantity Sold	=MIN(B8,B18)	
15	Revenue		=B13*B14
16			
17	Unit Cost	=B6	
18	Quantity Produced	40000	
19	Variable Cost		=B17*B18
20	Fixed Cost		=B7
21			
22	Profit		=C15-C19-C20

Figure 8.2b

Logic-Driven Modeling

Example 8.3 New-Product Development

- Moore Pharmaceuticals needs to decide whether to conduct clinical trials and seek FDA approval for a newly developed drug.

Estimated figures:

- R&D cost = $700 million
- Clinical trials cost = $150 million
- Market size = 2 million people
- Market size growth = 3% per year

Logic-Driven Modeling

Example 8.3 (continued) New-Product Development

Additional estimated figures

- Market share = 8%
- Market share growth = 20% per year (for 5 years)
- Revenue from a monthly prescription = $130
- Variable cost for a monthly prescription = $40
- Discount rate for net present value = 9%

Moore Pharmaceuticals wants to determine net present value for the next 5 years and to determine how long it will take to recover fixed costs.

Logic-Driven Modeling

Example 8.3 (continued) New-Product Development

	A	B	C	D	E	F
1	Moore Pharmaceuticals					
2						
3	Data					
4						
5	Market size	2000000				
6	Unit (monthly Rx) revenue	130				
7	Unit (monthly Rx) cost	40				
8	Discount rate	0.09				
9						
10	Project Costs					
11	R&D	700000000				
12	Clinical Trials	150000000				
13	Total Project Costs	=B11+B12				
14						
15	Model					
16						
17	Year	1	2	3	4	5
18	Market growth factor		0.03	0.03	0.03	0.03
19	Market size	=B5	=B19*(1+C18)	=C19*(1+D18)	=D19*(1+E18)	=E19*(1+F18)
20	Market share growth rate		0.2	0.2	0.2	0.2
21	Market share	0.08	=B21*(1+C20)	=C21*(1+D20)	=D21*(1+E20)	=E21*(1+F20)
22	Sales	=B19*B21	=C19*C21	=D19*D21	=E19*E21	=F19*F21
23						
24	Annual Revenue	=B22*$B$6*12	=C22*$B$6*12	=D22*$B$6*12	=E22*$B$6*12	=F22*$B$6*12
25	Annual Costs	=B22*$B$7*12	=C22*$B$7*12	=D22*$B$7*12	=E22*$B$7*12	=F22*$B$7*12
26	Profit	=B24-B25	=C24-C25	=D24-D25	=E24-E25	=F24-F25
27						
28	Cumulative Net Profit	=B26-B13	=B28+C26	=C28+D26	=D28+E26	=E28+F26
29						
30	Net Present Value	=NPV(B8,B26:F26)-B13				

Figure 8.3b

Logic-Driven Modeling

Example 8.3 (continued) New-Product Development

	A	B	C	D	E	F
1	Moore Pharmaceuticals					
2						
3	Data					
4						
5	Market size	2,000,000				
6	Unit (monthly Rx) revenue	$ 130.00				
7	Unit (monthly Rx) cost	$ 40.00				
8	Discount rate	9%				
9						
10	Project Costs					
11	R&D	$ 700,000,000				
12	Clinical Trials	$ 150,000,000				
13	Total Project Costs	$ 850,000,000				
14						
15	Model					
16						
17	Year	1	2	3	4	5
18	Market growth factor		3.00%	3.00%	3.00%	3.00%
19	Market size	2,000,000	2,060,000	2,121,800	2,185,454	2,251,018
20	Market share growth rate		20.00%	20.00%	20.00%	20.00%
21	Market share	8.00%	9.60%	11.52%	13.82%	16.59%
22	Sales	160,000	197,760	244,431	302,117	373,417
23						
24	Annual Revenue	$ 249,600,000	$ 308,505,600	$ 381,312,922	$ 471,302,771	$ 582,530,225
25	Annual Costs	$ 76,800,000	$ 94,924,800	$ 117,327,053	$ 145,016,237	$ 179,240,069
26	Profit	$ 172,800,000	$ 213,580,800	$ 263,985,869	$ 326,286,534	$ 403,290,156
27						
28	Cumulative Net Profit	$ (677,200,000)	$ (463,619,200)	$ (199,633,331)	$ 126,653,203	$ 529,943,358
29						
30	Net Present Value	$ 185,404,860				

NPV = $185 million

Profitable in 4th year

Figure 8.3a

Logic-Driven Modeling

Single-Period Purchase Decisions

- One-time purchase decisions often must be made in the face of uncertain demand.

Newsvendor Problem:

How many newspapers to purchase each day?

- C = cost to purchase a newspaper
- Q = number of newspapers the vendor purchases
- D = number of newspapers demanded
- R = revenue from selling a newspaper
- S = salvage value of unsold newspapers
- Net profit = $R(\min\{Q,D\}) + S(\max\{0,Q-D\}) - CQ$

Logic-Driven Modeling

Example 8.4

A Single-Period Purchase Decision Model

- Net profit $= 18(\min\{Q,D\}) + 9(\max\{0,Q-D\}) - 12Q$

	A	B
1	Newsvendor Model	
2		
3	Data	
4		
5	Selling price	$ 18.00
6	Cost	$ 12.00
7	Discount price	$ 9.00
8		
9	Model	
10		
11	Demand	41
12	Purchase Quantity	44
13		
14	Quantity Sold	41
15	Surplus Quantity	3
16		
17	Profit	$ 237.00

	A	B
1	Newsvendor Model	
2		
3	Data	
4		
5	Selling price	18
6	Cost	12
7	Discount price	9
8		
9	Model	
10		
11	Demand	41
12	Purchase Quantity	44
13		
14	Quantity Sold	=MIN(B11,B12)
15	Surplus Quantity	=MAX(0,B12-B11)
16		
17	Profit	=B14*B5+B15*B7-B12*B6

Figure 8.4

Logic-Driven Modeling

Example 8.5 A Hotel Overbooking Model

- A popular resort hotel has 300 rooms.
- The room rate is $120 per night.
- Reservations can be cancelled by 6:00 p.m.
- Cost of overbooking is $100 per occurrence.

Determine net revenue on the rooms.

- $Q = 300$, $P = 120$, $C = 100$
- D = Reservations − Cancellations
- Net revenue = $P(\min\{300, D\}) - C(\max\{0, D-Q\})$
  $= 120(\min\{300, D\}) - 100(\max\{0, D-300\})$

Logic-Driven Modeling

Example 8.5 (continued)

A Hotel Overbooking Model

Net revenue = $120(\min\{300, D\}) - 100(\max\{0, D-300\})$

	A	B
1	Hotel Overbooking Model	
2		
3	Data	
4		
5	Rooms available	300
6	Price	$120
7	Overbooking cost	$100
8		
9	Model	
10		
11	Reservation limit	300
12	Customer demand	290
13	Reservations made	290
14	Cancellations	15
15	Customer arrivals	275
16	Overbooked customers	0
17		
18	Net revenue	$33,000

	A	B
1	Hotel Overbooking Model	
2		
3	Data	
4		
5	Rooms available	300
6	Price	120
7	Overbooking cost	100
8		
9	Model	
10		
11	Reservation limit	300
12	Customer demand	290
13	Reservations made	=MIN(B11,B12)
14	Cancellations	15
15	Customer arrivals	=B13-B14
16	Overbooked customers	=MAX(0,B15-B5)
17		
18	Net revenue	=MIN(B15,B5)*B6-B16*B7

Figure 8.5

Logic-Driven Modeling

Example 8.6 A Retirement-Planning Model

- Start work at age 22, earning $50,000 per year.
- Expect a salary increase of 3% per year.
- Required to contribute 8% to retirement.
- Employer contributes 35% of that amount.
- Expect an annual return of 8% on the portfolio.

Determine the value of the retirement account when the employee is 50 years old.

Logic-Driven Modeling

Example 8.6 (continued) Retirement-Planning Model

- Salary = 1.03(previous year's salary)
- Employee contribution = 0.08(salary)
- Employer contribution = 0.35(employee contrib.)
- Value of account = 1.08(previous value) + employee contribution + employer contribution

	A	B	C	D	E
1	Retirement Plan Model				
2					
3	Data				
4					
5	Retirement contribution (% of salary)	0.08			
6	Employer match	0.35			
7	Annual salary increase	0.03			
8	Annual return on investment	0.08			
9					
10	Model				
11					
12			Employee	Employer	
13	Age	Salary	Contribution	Contribution	Balance
14	22	50000	=B14*$B$5	=$B$6*C14	=C14+D14
15	23	= B14*(1+$B$7)	=B15*$B$5	=$B$6*C15	=E14*(1+$B$8) + C15+D15
16	24	= B15*(1+$B$7)	=B16*$B$5	=$B$6*C16	=E15*(1+$B$8) + C16+D16
17	25	= B16*(1+$B$7)	=B17*$B$5	=$B$6*C17	=E16*(1+$B$8) + C17+D17

Figure 8.6a

Logic-Driven Modeling

Example 8.6 (continued) Retirement Planning Model

	A	B	C	D	E
1	Retirement Plan Model				
2					
3	Data				
4					
5	Retirement contribution (% of salary)	8%			
6	Employer match	35%			
7	Annual salary increase	3%			
8	Annual return on investment	8%			
9					
10	Model				
11					
12			Employee	Employer	
13	Age	Salary	Contribution	Contribution	Balance
14	22	$50,000	$4,000	$1,400	$5,400
15	23	$ 51,500	$4,120	$1,442	$11,394
16	24	$ 53,045	$4,244	$1,485	$18,034
17	25	$ 54,636	$4,371	$1,530	$25,378
18	26	$ 56,275	$4,502	$1,576	$33,486
19	27	$ 57,964	$4,637	$1,623	$42,425
20	28	$ 59,703	$4,776	$1,672	$52,267
21	29	$ 61,494	$4,919	$1,722	$63,089
22	30	$ 63,339	$5,067	$1,773	$74,977
23	31	$ 65,239	$5,219	$1,827	$88,021
24	32	$ 67,196	$5,376	$1,881	$102,320
25	33	$ 69,212	$5,537	$1,938	$117,980
26	34	$ 71,288	$5,703	$1,996	$135,118
27	35	$ 73,427	$5,874	$2,056	$153,857
28	36	$ 75,629	$6,050	$2,118	$174,334
29	37	$ 77,898	$6,232	$2,181	$196,694
30	38	$ 80,235	$6,419	$2,247	$221,094
31	39	$ 82,642	$6,611	$2,314	$247,707
32	40	$ 85,122	$6,810	$2,383	$276,717
33	41	$ 87,675	$7,014	$2,455	$308,323
34	42	$ 90,306	$7,224	$2,529	$342,742
35	43	$ 93,015	$7,441	$2,604	$380,207
36	44	$ 95,805	$7,664	$2,683	$420,971
37	45	$ 98,679	$7,894	$2,763	$465,306
38	46	$ 101,640	$8,131	$2,846	$513,507
39	47	$ 104,689	$8,375	$2,931	$565,894
40	48	$ 107,830	$8,626	$3,019	$622,811
41	49	$ 111,064	$8,885	$3,110	$684,631
42	50	$ 114,396	$9,152	$3,203	$751,757

Value at 22 years old = $5,400

Value at 50 years old = $751,757

Figure 8.6b

Data-Driven Modeling

Example 8.7

Modeling Retail Markdown Pricing Decisions

- In the spring, a department store introduces a new line of bathing suits that sells for $70.
- The store purchases 1000 of these bathing suits.
- During the prime selling season, the store sells an average of 7 units per day at full price (40 days).
- On 10 sale days, the price is discounted 30% and sales increase to 32.2 units per day.
- Around July 4th, the price is marked down 70% to sell off remaining inventory.
- Determine total revenue from the bathing suits.

Data-Driven Modeling

Example 8.7 (continued)

Modeling Retail Markdown Pricing Decisions

Assume a linear trend model between sales and price:

daily sales = $a - b$(price)

$7 = a - b(70)$

$32.2 = a - b(49)$

Daily sales = $91 - 1.2$(price)

	A	B	C
1	Markdown Pricing Model		
2			
3	Data		
4	Retail price	70	
5	Inventory	1000	
6	Selling season (days)	50	
7	Days at full retail	40	
8	Intermediate markdown	0.3	
9	Clearance markdown	0.7	
10	Demand function		
11	a	91	
12	b	1.2	
13			
14	Model		
15			
16	Full Retail Sales		
17	Retail price	=B4	
18	Daily sales	=B11-B12*B17	
19	Days at retail price	=B7	
20	Units sold at retail	=B18*B19	
21	Retail revenue		=B20*B17
22	Discount Sales		
23	Discount	=B8	
24	Discount price	=B17*(1-B23)	
25	Daily sales	=B11 - B12*B24	
26	Unit sold	=MIN(B25*(B6-B19),B5-B20)	
27	Discount revenue		=B26*B24
28	Clearance Sales		
29	Clearance price	=B4*(1-B9)	
30	Units sold at clearance	=MAX(0,B5-B20-B26)	
31	Clearance revenue		=B29*B30
32			
33	Total revenue		=C21+C27+C31

Figure 8.7

Data-Driven Modeling

Example 8.7 (continued)

Revenue from full retail sales

= units sold * days * price

= (7)*(40)*(70)

= $19,600

Revenue from sale weekends

= (32.2)*(10)*(49)

= $15,778

Revenue from clearance sales

= leftovers * price

= (1000−7(40) − 32.2(10))*(21)

= (398)(21)

= $8,358

	A	B	C
1	Markdown Pricing Model		
2			
3	Data		
4	Retail price	70	
5	Inventory	1000	
6	Selling season (days)	50	
7	Days at full retail	40	
8	Intermediate markdown	0.3	
9	Clearance markdown	0.7	
10	Demand function		
11	a	91	
12	b	1.2	
13			
14	Model		
15			
16	Full Retail Sales		
17	Retail price	=B4	
18	Daily sales	=B11-B12*B17	
19	Days at retail price	=B7	
20	Units sold at retail	=B18*B19	
21	Retail revenue	=B20*B17	
22	Discount Sales		
23	Discount	=B8	
24	Discount price	=B17*(1-B23)	
25	Daily sales	=B11 - B12*B24	
26	Unit sold	=MIN(B25*(B6-B19),B5-B20)	
27	Discount revenue	=B26*B24	
28	Clearance Sales		
29	Clearance price	=B4*(1-B9)	
30	Units sold at clearance	=MAX(0,B5-B20-B26)	
31	Clearance revenue	=B29*B30	
32			
33	Total revenue	=C21+C27+C31	

Figure 8.7

Data-Driven Modeling

Example 8.7 (continued)

Modeling Retail Markdown Pricing Decisions

	A	B	C
1	Markdown Pricing Model		
2			
3	Data		
4	Retail price	70	
5	Inventory	1000	
6	Selling season (days)	50	
7	Days at full retail	40	
8	Intermediate markdown	0.3	
9	Clearance markdown	0.7	
10	Demand function		
11	a	91	
12	b	1.2	
13			
14	Model		
15			
16	Full Retail Sales		
17	Retail price	=B4	
18	Daily sales	=B11-B12*B17	
19	Days at retail price	=B7	
20	Units sold at retail	=B18*B19	
21		Retail revenue	=B20*B17
22	Discount Sales		
23	Discount	=B8	
24	Discount price	=B17*(1-B23)	
25	Daily sales	=B11 - B12*B24	
26	Unit sold	=MIN(B25*(B6-B19),B5-B20)	
27		Discount revenue	=B26*B24
28	Clearance Sales		
29	Clearance price	=B4*(1-B9)	
30	Units sold at clearance	=MAX(0,B5-B20-B26)	
31		Clearance revenue	=B29*B30
32			
33		Total revenue	=C21+C27+C31

	A	B	C
1	Markdown Pricing Model		
2			
3	Data		
4	Retail price	$70.00	
5	Inventory	1000	
6	Selling season (days)	50	
7	Days at full retail	40	
8	Intermediate markdown	30%	
9	Clearance markdown	70%	
10	Demand function		
11	a	91	
12	b	1.2	
13			
14	Model		
15			
16	Full Retail Sales		
17	Retail price	$70.00	
18	Daily sales	7.00	
19	Days at retail price	40	
20	Units sold at retail	280	
21		Retail revenue	$19,600.00
22	Discount Sales		
23	Discount	30%	
24	Discount price	$49.00	
25	Daily sales	32.20	
26	Unit sold	322	
27		Discount revenue	$15,778.00
28	Clearance Sales		
29	Clearance price	$21.00	
30	Units sold at clearance	398	
31		Clearance revenue	$8,358.00
32			
33		Total revenue	$43,736.00

Total revenue = $43,736

Figure 8.7

Data-Driven Modeling

Modeling Relationships and Trends in Data

- Create charts to better understand data sets.
- For cross-sectional data, use a scatter chart.
- For time series data, use a line chart.
- Consider using mathematical functions to model relationships.

Data-Driven Modeling

Excel *Trendline* tool

Click on a chart

- *Chart tools*
- *Layout*
- *Trendline*

Choose a Trendline.
Choose whether to display equation and *R*-squared.

R-squared values closer to 1 indicate better fit of the Trendline to the data.

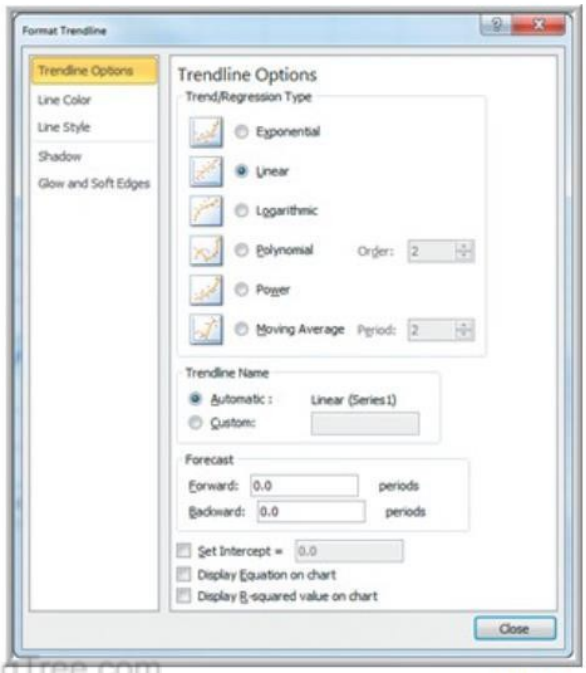


Figure 8.8

Data-Driven Modeling

Example 8.8 Modeling a Price-Demand Function

Linear demand function:

Sales = -9.5116(price) + 20512

	A	B
1	Price-Sales Data	
2		
3	Price	Demand
4	$50.00	19964.085
5	$60.00	19706.855
6	$70.00	20240.83
7	$80.00	19698.807
8	$90.00	20095.808
9	$100.00	19390.994
10	$110.00	19430.071
11	$120.00	19273.695
12	$130.00	18716.381
13	$140.00	18925.364
14	$150.00	19484.776
15	$160.00	18934.879
16	$170.00	18915.765
17	$180.00	18893.373
18	$190.00	18961.622
19	$200.00	18443.294
20	$210.00	18811.981
21	$220.00	18561.917
22	$230.00	18158.619
23	$240.00	18412.56
24	$250.00	17771.387

Figure 8.9

Analyzing Uncertainty and Model Assumptions

What-If Analysis

- Spreadsheet models allow you to easily evaluate what-if questions.
- How do changes in model inputs (that reflect key assumptions) affect model outputs?
- Systematic approaches to what-if analysis make the process easier and more useful.

Analyzing Uncertainty and Model Assumptions

Data Tables

- Data Tables summarize the impact of one or two inputs on a specified output.
- Excel data table types:
  - One-way data tables – for one input variable
  - Two-way data table – for two input variables

To construct a data table:

- *Data*
- *What-If Analysis*
- *Data Table*

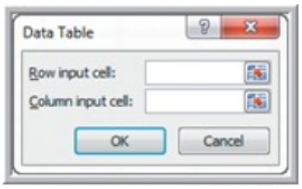


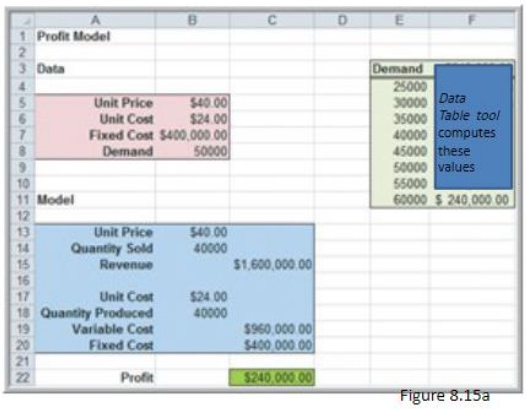
Figure 8.14

Analyzing Uncertainty and Model Assumptions

Example 8.11

A One-Way Data Table for Uncertain Demand

Create a column of demand values (column E).
Enter =C22 in cell F3 (to reference the output cell).
Highlight the range E3:F11.
Choose *Data Table*.
Enter B8 for *Column input cell.* *(tells Excel that column E is demand values)*



	A	B	C	D	E	F
1	Profit Model					
2						
3	Data				Demand	
4					25000	
5	Unit Price	$40.00			30000	Data Table tool computes these values
6	Unit Cost	$24.00			35000	
7	Fixed Cost	$400,000.00			40000	
8	Demand	50000			45000	
9					50000	
10					55000	
11	Model				60000	$ 240,000.00
12						
13	Unit Price	$40.00				
14	Quantity Sold	40000				
15	Revenue		$1,600,000.00			
16						
17	Unit Cost	$24.00				
18	Quantity Produced	40000				
19	Variable Cost		$960,000.00			
20	Fixed Cost		$400,000.00			
21						
22	Profit		$240,000.00			

Figure 8.15a

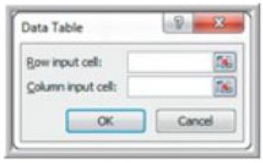


Figure 8.14

Analyzing Uncertainty and Model Assumptions

Example 8.11 (continued)

A One-Way Data Table for Uncertain Demand

The Data Table tool computes the profit values in column F (below $240,000).

	A	B	C	D	E	F
1	Profit Model					
2						
3	Data				Demand	$240,000.00
4					25000	$(360,000.00)
5	Unit Price	$40.00			30000	$(160,000.00)
6	Unit Cost	$24.00			35000	$ 40,000.00
7	Fixed Cost	$400,000.00			40000	$ 240,000.00
8	Demand	50000			45000	$ 240,000.00
9					50000	$ 240,000.00
10					55000	$ 240,000.00
11	Model				60000	$ 240,000.00
12						
13	Unit Price	$40.00				
14	Quantity Sold	40000				
15	Revenue		$1,600,000.00			
16						
17	Unit Cost	$24.00				
18	Quantity Produced	40000				
19	Variable Cost		$960,000.00			
20	Fixed Cost		$400,000.00			
21						
22	Profit		$240,000.00			

Figure 8.15b

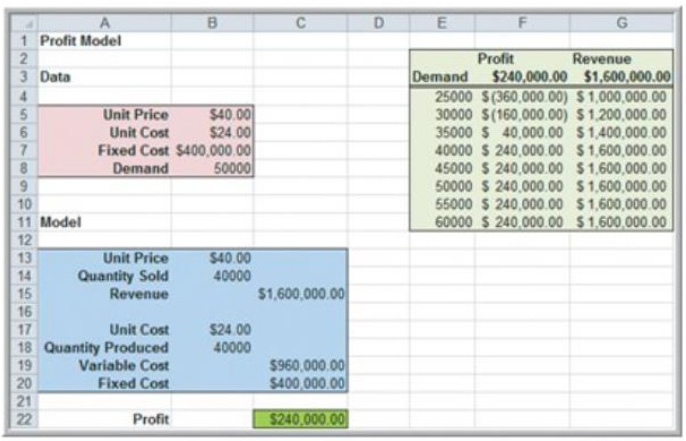
Analyzing Uncertainty and Model Assumptions

Example 8.12

One-Way Data Tables with Multiple Outputs

- Create a second output, revenue.

Enter =C15 in cell G3.
Highlight E3:G11.
Choose *Data Table*
Proceed as in the previous example.
Excel computes the revenues values.



	A	B	C	D	E	F	G
1	Profit Model						
2							
3	Data					Profit	Revenue
4					Demand	$240,000.00	$1,600,000.00
5	Unit Price	$40.00			25000	$(360,000.00)	$1,000,000.00
6	Unit Cost	$24.00			30000	$(160,000.00)	$1,200,000.00
7	Fixed Cost	$400,000.00			35000	$ 40,000.00	$1,400,000.00
8	Demand	50000			40000	$ 240,000.00	$1,600,000.00
9					45000	$ 240,000.00	$1,600,000.00
10					50000	$ 240,000.00	$1,600,000.00
11	Model				55000	$ 240,000.00	$1,600,000.00
12					60000	$ 240,000.00	$1,600,000.00
13	Unit Price	$40.00					
14	Quantity Sold	40000					
15	Revenue		$1,600,000.00				
16							
17	Unit Cost	$24.00					
18	Quantity Produced	40000					
19	Variable Cost		$960,000.00				
20	Fixed Cost		$400,000.00				
21							
22	Profit		$240,000.00				

Figure 8.15

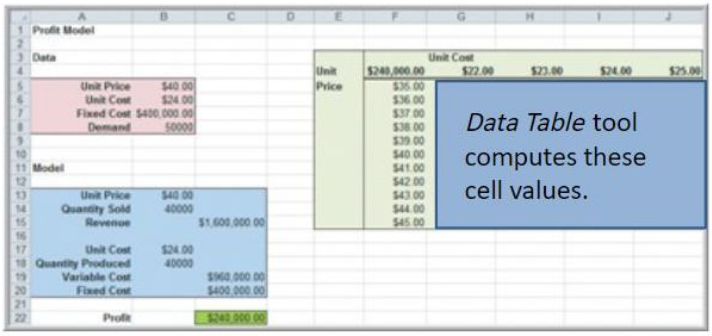
Analyzing Uncertainty and Model Assumptions

Example 8.13

A Two-Way Data Table for the Profit Model

- Evaluate the impact of both unit price and unit cost

Create a column of unit prices (F5:F15).
Create a row of unit costs (G4:J4).
Enter =C22 in cell F4.
Select F4:J15.
Choose *Data Table*.



	A	B	C	D	E	F	G	H	I	J
1	Profit Model									
2										
3	Data						Unit Cost			
4					Unit	$240,000.00	$22.00	$23.00	$24.00	$25.00
5	Unit Price	$40.00			Price	$35.00				
6	Unit Cost	$24.00				$36.00				
7	Fixed Cost	$400,000.00				$37.00				
8	Demand	50000				$38.00				
9						$39.00				
10						$40.00				
11	Model					$41.00				
12						$42.00				
13	Unit Price	$40.00				$43.00				
14	Quantity Sold	40000				$44.00				
15	Revenue		$1,600,000.00			$45.00				
16										
17	Unit Cost	$24.00								
18	Quantity Produced	40000								
19	Variable Cost		$960,000.00							
20	Fixed Cost		$400,000.00							
21										
22	Profit		$240,000.00							

Data Table tool computes these cell values.

Figure 8.17a

Enter B6 for *Row input cell*.
Enter B5 for *Column input cell*.

Analyzing Uncertainty and Model Assumptions

Example 8.13 (continued)

A Two-Way Data Table for the Profit Model

	A	B	C	D	E	F	G	H	I	J
1	Profit Model									
2										
3	Data					Unit Cost				
4					Unit	$240,000.00	$22.00	$23.00	$24.00	$25.00
5	Unit Price	$40.00			Price	$35.00	$120,000.00	$80,000.00	$40,000.00	$0.00
6	Unit Cost	$24.00				$36.00	$160,000.00	$120,000.00	$80,000.00	$40,000.00
7	Fixed Cost	$400,000.00				$37.00	$200,000.00	$160,000.00	$120,000.00	$80,000.00
8	Demand	50000				$38.00	$240,000.00	$200,000.00	$160,000.00	$120,000.00
9						$39.00	$280,000.00	$240,000.00	$200,000.00	$160,000.00
10						$40.00	$320,000.00	$280,000.00	$240,000.00	$200,000.00
11	Model					$41.00	$360,000.00	$320,000.00	$280,000.00	$240,000.00
12						$42.00	$400,000.00	$360,000.00	$320,000.00	$280,000.00
13	Unit Price	$40.00				$43.00	$440,000.00	$400,000.00	$360,000.00	$320,000.00
14	Quantity Sold	40000				$44.00	$480,000.00	$440,000.00	$400,000.00	$360,000.00
15	Revenue		$1,600,000.00			$45.00	$520,000.00	$480,000.00	$440,000.00	$400,000.00
16										
17	Unit Cost	$24.00								
18	Quantity Produced	40000								
19	Variable Cost		$960,000.00							
20	Fixed Cost		$400,000.00							
21										
22	Profit		$240,000.00							

Figure 8.17b

Analyzing Uncertainty and Model Assumptions

Goal Seek

Goal Seek allows you to alter the data used in a formula in order to find out what the results will be.

- *Set cell* contains the formula that will return the result you're seeking.
- *To value* is the target value you want the formula to return.
- *By changing cell* is the location of the input value that Excel can change to reach the target.

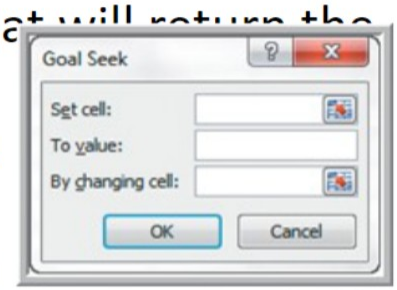


Figure 8.21

Analyzing Uncertainty and Model Assumptions

Example 8.15 Finding the Breakeven Point in the Outsourcing Model (using *Goal Seek*)

- Find the value of demand at which manufacturing cost equals purchased cost
- *Set cell*: B19
- *To value*: 0
- *By changing cell*: B12.

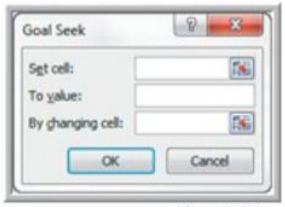


Figure 8.21

The breakeven volume is 1000 units.

	A	B
1	Outsourcing Decision Model	
2		
3	Data	
4		
5	Manufactured in-house	
6	Fixed cost	$50,000
7	Unit variable cost	$125
8		
9	Purchased from supplier	
10	Unit cost	$175
11		
12	Production volume	1000
13		
14	Model	
15		
16	Total manufacturing cost	$175,000
17	Total purchased cost	$175,000
18		
19	Cost difference	$0
20	Decision	Manufacture

Figure 8.22

Model Analysis Using *Risk Solver Platform*

Tornado Chart

- Shows the impact that variation in a model input has on some output while holding all other inputs constant.
- Shows which inputs are the least and most influential on the output.
- Helps you select the inputs that you would want to further analyze.

Model Analysis Using *Risk Solver Platform*

Example 8.17

Creating a Tornado Chart in *Risk Solver Platform*

Profit Model

Select cell C22.
Parameters
Identify

A 10% change in unit price (B5)
affects profit the most.
Next is unit cost (B6).

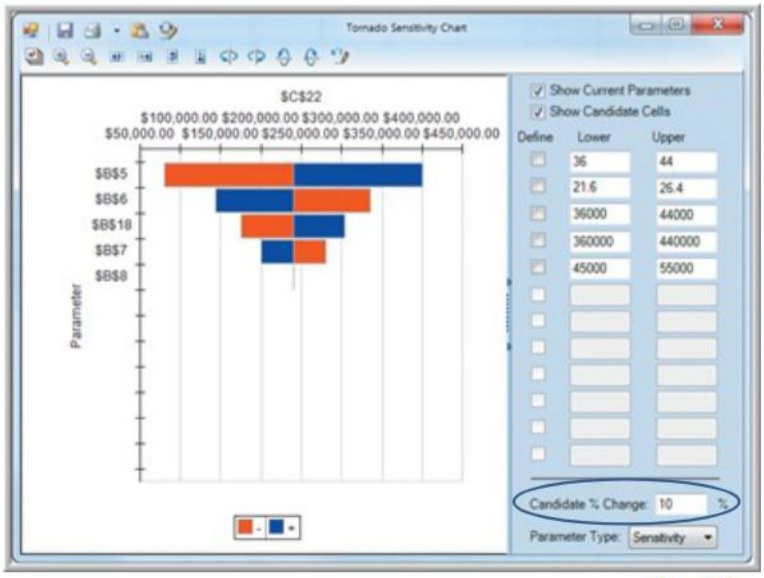


Figure 8.28

PREDICTIVE MODELING

Predictive modeling is a method of predicting future outcomes by using data modeling. It's one of the premier ways a business can see its path forward and make plans accordingly. While not foolproof, this method tends to have high accuracy rates, which is why it is so commonly used.

In short, predictive modeling is a statistical technique using machine learning and data mining to predict and forecast likely future outcomes with the aid of historical and existing data. It works by analyzing current and historical data and projecting what it learns on a model generated to forecast likely outcomes. Predictive modeling can be used to predict just about anything, from TV ratings and a customer's next purchase to credit risks and corporate earnings.

A predictive model is not fixed; it is validated or revised regularly to incorporate changes in the underlying data. In other words, it's not a one-and-done prediction. Predictive models make assumptions based on what has happened in the past and what is happening now. If incoming, new data shows changes in what is happening now, the impact on the likely future outcome must be recalculated, too. For example, a software company could model historical sales data against marketing expenditures across multiple regions to create a model for future revenue based on the impact of the marketing spend.

Most predictive models work fast and often complete their calculations in real time. That's why banks and retailers can, for example, calculate the risk of an online mortgage or credit card application and accept or decline the request almost instantly based on that prediction.

Some predictive models are more complex, such as those used in computational biology and quantum computing; the resulting outputs take longer to compute than a credit card application but are done much more quickly than was possible in the past thanks to advances in technological capabilities, including computing power.

Top 5 Types of Predictive Models

Fortunately, predictive models don't have to be created from scratch for every application. Predictive analytics tools use a variety of vetted models and algorithms that can be applied to a wide spread of use cases.

Predictive modeling techniques have been perfected over time. As we add more data, more muscular computing, AI and machine learning and see overall advancements in analytics, we're able to do more with these models.

The top five predictive analytics models are:

1. **Classification model:** Considered the simplest model, it categorizes data for simple and direct query response. An example use case would be to answer the question "Is this a fraudulent transaction?"
2. **Clustering model:** This model nests data together by common attributes. It works by grouping things or people with shared characteristics or behaviors and plans strategies for each group at a larger scale. An example is in determining credit risk for a loan applicant based on what other people in the same or a similar situation did in the past.
3. **Forecast model:** This is a very popular model, and it works on anything with a numerical value based on learning from historical data. For example, in answering how much lettuce a restaurant should order next week or how many calls a customer support agent should be able to handle per day or week, the system looks back to historical data.
4. **Outliers model:** This model works by analyzing abnormal or outlying data points. For example, a bank might use an outlier model to identify fraud by asking whether a transaction is outside of the customer's normal buying habits or whether an expense in a given category is normal or not. For example, a $1,000 credit card charge for a washer and dryer in the cardholder's preferred big box store would not be alarming, but $1,000 spent on designer clothing in a location where the customer has never charged other items might be indicative of a breached account.
5. **Time series model:** This model evaluates a sequence of data points based on time. For example, the number of stroke patients admitted to the hospital in the last four months is used to predict how many patients the hospital might expect to admit next week, next month or the rest of the year. A single metric measured and compared over time is thus more meaningful than a simple average.

Common Predictive Algorithms

Predictive algorithms use one of two things: machine learning or deep learning. Both are subsets of artificial intelligence (AI). Machine learning (ML) involves structured data, such as spreadsheet or machine data. Deep learning (DL) deals with unstructured data such as video, audio, text, social media posts and images—essentially the stuff that humans communicate with that are not numbers or metric reads.

Some of the more common predictive algorithms are:

1. **Random Forest:** This algorithm is derived from a combination of decision trees, none of which are related, and can use both classification and regression to classify vast amounts of data.

2. **Generalized Linear Model (GLM) for Two Values:** This algorithm narrows down the list of variables to find "best fit." It can work out tipping points and change data capture and other influences, such as categorical predictors, to determine the "best fit" outcome, thereby overcoming drawbacks in other models, such as a regular linear regression.

3. **Gradient Boosted Model:** This algorithm also uses several combined decision trees, but unlike Random Forest, the trees are related. It builds out one tree at a time, thus enabling the next tree to correct flaws in the previous tree. It's often used in rankings, such as on search engine outputs.
4. **K-Means:** A popular and fast algorithm, K-Means groups data points by similarities and so is often used for the clustering model. It can quickly render things like personalized retail offers to individuals within a huge group, such as a million or more customers with a similar liking of lined red wool coats.
5. **Prophet:** This algorithm is used in time-series or forecast models for capacity planning, such as for inventory needs, sales quotas and resource allocations. It is highly flexible and can easily accommodate heuristics and an array of useful assumptions.

Predictive Modeling and Data Analytics

Predictive modeling is also known as predictive analytics. Generally, the term "predictive modeling" is favored in academic settings, while "predictive analytics" is the preferred term for commercial applications of predictive modeling.

Successful use of predictive analytics depends heavily on unfettered access to sufficient volumes of accurate, clean and relevant data. While predictive models can be extraordinarily complex, such as those using decision trees and k-means clustering, the most complex part is always the neural network; that is, the model by which computers are trained to predict outcomes. Machine learning uses a neural network to find correlations in exceptionally large data sets and "to learn" and identify patterns within the data.

Benefits of Predictive Modeling

In a nutshell, predictive analytics reduce time, effort and costs in forecasting business outcomes. Variables such as environmental factors, competitive intelligence, regulation changes and market conditions can be factored into the mathematical calculation to render more complete views at relatively low costs.

Examples of specific types of forecasting that can benefit businesses include demand forecasting, headcount planning, churn analysis, external factors, competitive analysis, fleet and IT hardware maintenance and financial risks.

Challenges of Predictive Modeling

It's essential to keep predictive analytics focused on producing useful business insights because not everything this technology digs up is useful. Some mined information is of value only in satisfying a curious mind and has few or no business implications. Getting side-tracked is a distraction few businesses can afford.

Also, being able to use more data in predictive modeling is an advantage only to a point. Too much data can skew the calculation and lead to a meaningless or an erroneous outcome. For example, more coats are sold as the outside temperature drops. But only to a point. People do not buy more coats when it's -20 degrees Fahrenheit outside than they do when it's -5 degrees below freezing. At a certain point, cold is cold enough to spur the purchase of coats and more frigid temps no longer appreciably change that pattern.

And with the massive volumes of data involved in predictive modeling, maintaining security and privacy will also be a challenge. Further challenges rest in machine learning's limitations.

Limitations of Predictive Modeling

According to a McKinsey report, common limitations and their "best fixes" include:

1. **Errors in data labeling:** These can be overcome with reinforcement learning or generative adversarial networks (GANs).
2. **Shortage of massive data sets needed to train machine learning:** A possible fix is "one-shot learning," wherein a machine learns from a small number of demonstrations rather than on a massive data set.
3. **The machine's inability to explain what and why it did what it did:** Machines do not "think" or "learn" like humans. Likewise, their computations can be so exceptionally complex that humans have trouble finding, let alone following, the logic. All this makes it difficult for a machine to explain its work, or for humans to do so. Yet model transparency is necessary for a number of reasons, with human safety chief among them. Promising potential fixes: local-interpretable-model-agnostic explanations (LIME) and attention techniques.
4. **Generalizability of learning, or rather lack thereof:** Unlike humans, machines have difficulty carrying what they've learned forward. In other words, they have trouble applying what they've learned to a new set of circumstances. Whatever it has learned is applicable to one use case only. This is largely why we need not worry about the rise of AI overlords anytime soon. For predictive modeling using machine learning to be reusable— that is, useful in more than one use case—a possible fix is transfer learning.
5. **Bias in data and algorithms:** Non-representation can skew outcomes and lead to mistreatment of large groups of humans. Further, baked-in biases are difficult to find and purge later. In other words, biases tend to self-perpetuate. This is a moving target, and no clear fix has yet been identified.

The Future of Predictive Modeling

Predictive modeling, also known as predictive analytics, and machine learning are still young and developing technologies, meaning there is much more to come. As techniques, methods, tools and technologies improve, so will the benefits to businesses and societies.

However, these are not technologies that businesses can afford to adopt later, after the tech reaches maturity and all the kinks are worked out. The near-term advantages are simply too strong for a late adopter to overcome and remain competitive.

DATA MINING

The data mining process is used to get the pattern and probabilities from the large dataset due to which it is highly used in business for forecasting the trends, along with this it is also used in fields like Market, Manufacturing, Finance, and Government to make predictions and analysis using the tools and techniques like R-language and Oracle data mining, which involves the flow of six different steps.

One of the essential tasks of data mining relates to the automatic and semi-automatic analysis of large quantities of raw data and information to extract the previously unknown exciting set of patterns such as clusters or a group of data records, anomaly detection (unusual forms) and also in the case of dependencies which makes use of sequential pattern mining and association rule mining. This makes use of spatial indices. These patterns can be known to be among the kinds in the input data and can be used in further analysis, such as predictive analysis and machine learning. More accurate sets of results can be obtained once you start making use of support decision systems.

How does Data Mining Work?

There is an abundance of data in the industry across domains, and it becomes essential to treat and process the data accordingly. Basically, in a nutshell, it involves the ETL set of processes such as the extraction, transformation, and loading of the data and everything else required for this ETL to

happen. This involves the cleansing, change, and processing of data in various systems and representations. The clients can use this processed data to analyse the businesses and the trends of growth in their companies.

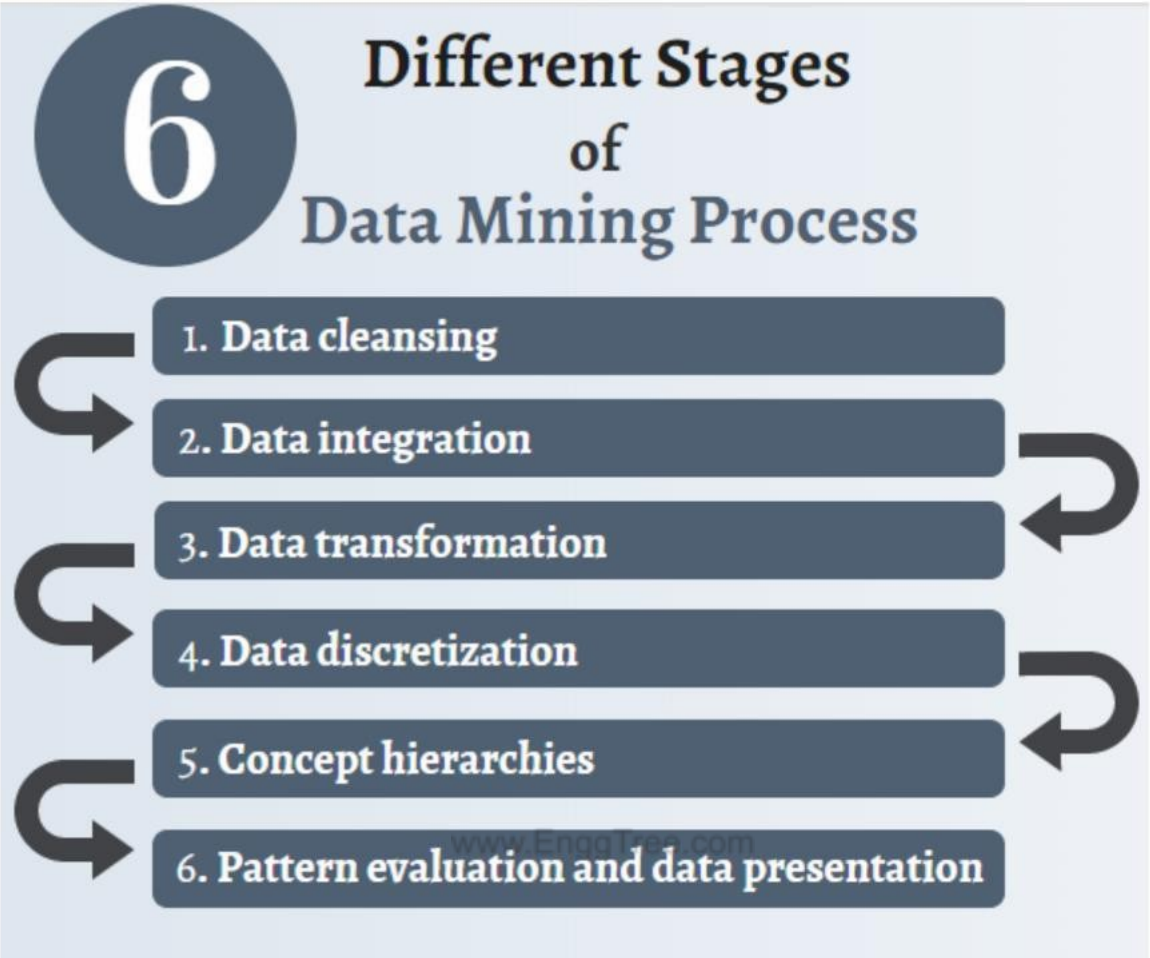
Advantages

The advantage of data mining includes the ones related to business and ones like medicine, weather forecast, healthcare, transportation, insurance, government, etc. Some of the advantages include:

1. **Marketing/Retail:** It helps all the marketing companies and firms to build models which are based on a historical set of data and information to predict the responsiveness to the marketing campaigns prevailing today, such as online marketing campaigns, direct mail, etc.
2. **Finance/Banking:** The data mining involves financial institutions provide information about loans and also credit reporting. When the model is built on historical information, good or bad loans can then be determined by the financial institutions. Furthermore, fraudulent and suspicious transactions are monitored by the banks.
3. **Manufacturing:** The faulty equipment and the quality of the manufactured products can be determined by using the optimal parameters for controlling. For example, for some of the semi-conductor development industries, water hardness and quality become a major challenge as they tend to affect the quality of their product's production.
4. **Government:** The governments can be benefitted from the monitoring and gauging the suspicious activities to avoid anti-money laundering activities.

Different Stages of Data Mining Process

The different stages of the data mining process are as follows



1. **Data cleansing:** This is the initial stage in data mining, where the classification of the data becomes an essential component to obtain final data analysis. It involves identifying and removing inaccurate and tricky data from a set of tables, databases, and record sets. Some techniques include the ignorance of tuple, which is mainly found when the class label is not in place; the next approach requires filling the missing values on its own, replacing missing values and incorrect values with global constants or predictable or mean values.
2. **Data integration:** It is a technique that involves merging the new set of information with the existing group. The source may, however, involve many data sets, databases or flat files. The customary implementation for data integration is creating an EDW (enterprise

data warehouse), which then talks about two concepts- tight and loose coupling, but let's not dig into the detail.

3. **Data transformation:** This requires transforming data within formats, generally from the source system to the required destination system. Some strategies include Smoothing, Aggregation, Normalization, Generalization, and attribute construction.
4. **Data discretization:** The technique that can split the continuous attribute domain along intervals is called data discretization. The datasets are stored in small chunks, thereby making our study much more efficient. Two strategies involve Top-down discretization and bottom-up discretization.
5. **Concept hierarchies:** They minimize the data by replacing and collecting low-level concepts from high-level concepts. Concept hierarchies define the multi-dimensional data with multiple levels of abstraction. The methods are Binning, histogram analysis, cluster analysis, etc.

6. **Pattern evaluation and data presentation:** If the data is presented efficiently, the client and the customers can make use of it in the best possible way. After going through the above set of stages, the data is presented in graphs and diagrams and thereby understanding it with minimum statistical knowledge.

Tools and Techniques

Data mining tools and techniques involve how these data can be mined and be put to fair and effective use. The following two are among the most popular set of tools and techniques of data mining:

1. R-language: It is an open-source tool that is used for graphics and statistical computing. It has a wide variety of classical statistical tests, classification, graphical techniques, time-series analysis, etc. It makes use of effective storage facilities and data handling.

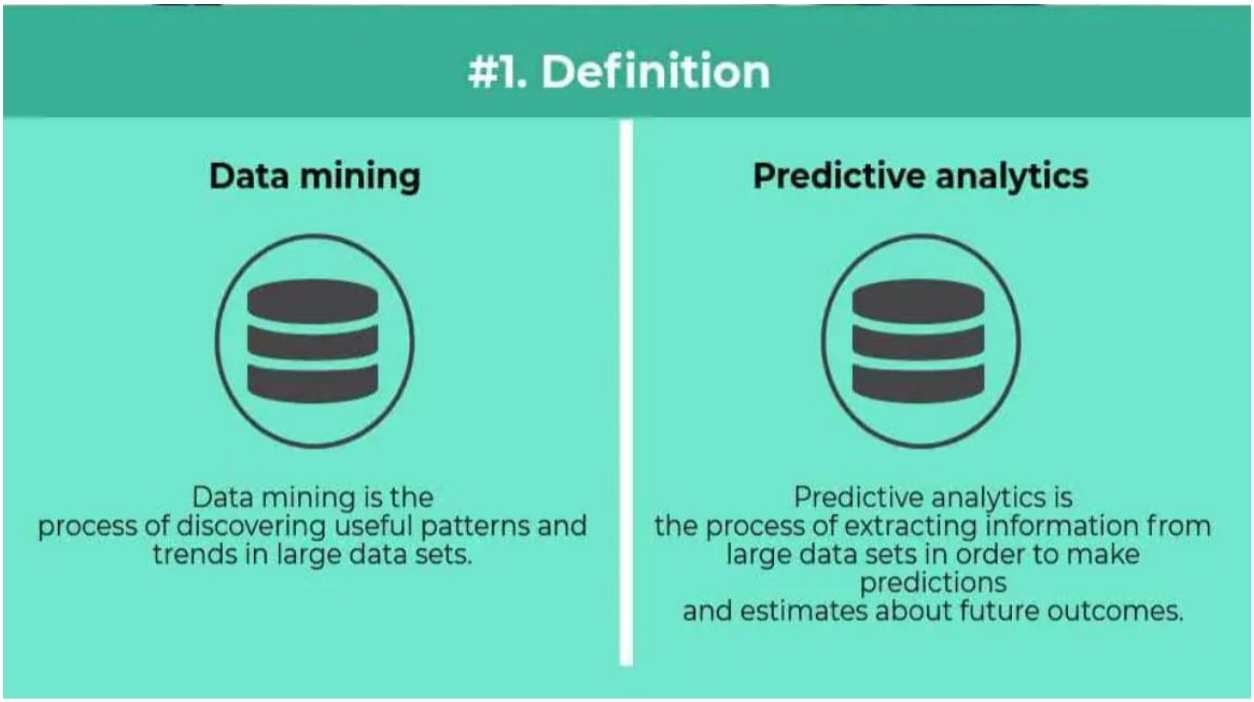
2. Oracle data mining: It is popularly known as ODM, which becomes a part of Oracle advanced analytics database, thereby generating detailed insights and predictions specifically used to detect customer behavior, develop customer profiles, and identify cross-selling ways opportunities.

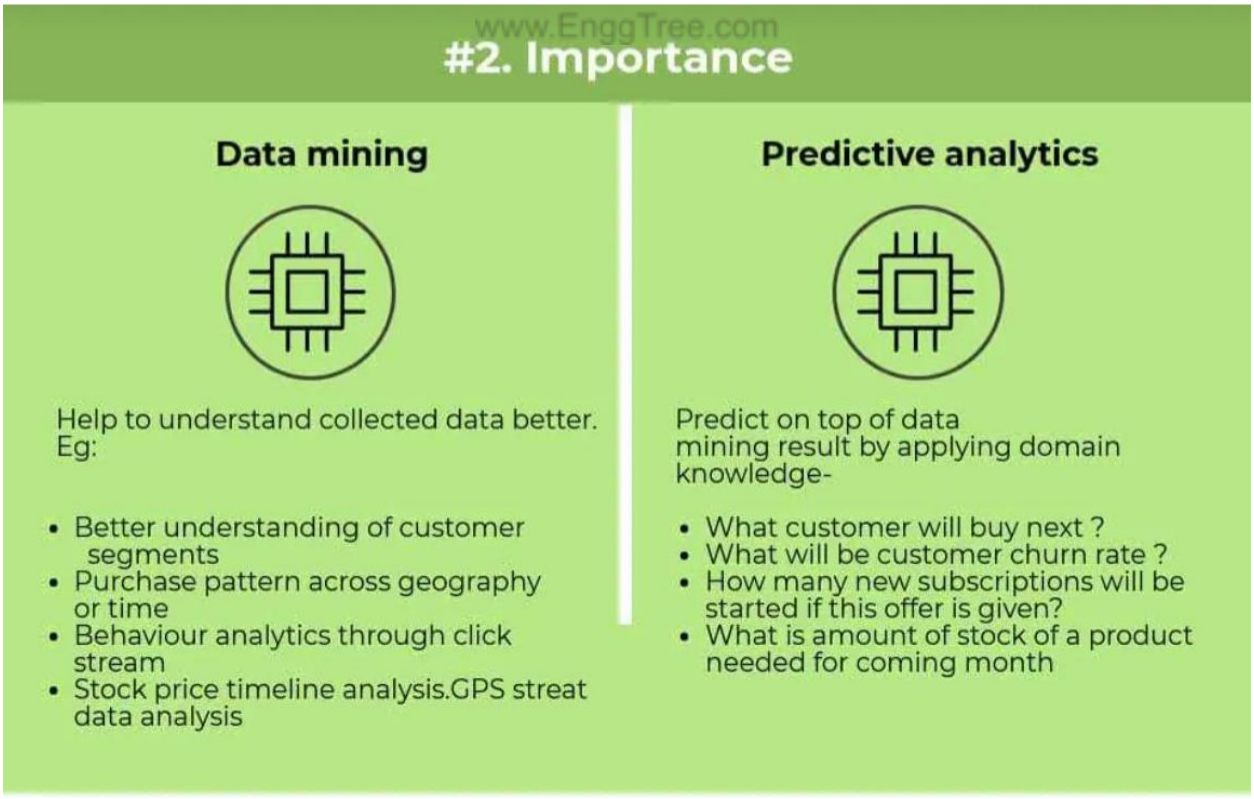
Conclusion

Data mining is all about explaining historical data and a real streaming set of data, thereby making use of predictions and analysis on top of the mined data. It is closely related to data science and machine learning algorithms such as classification, regression, clustering, XGboosting, etc., as they tend to form essential data mining techniques.

One of the drawbacks can include the training of resources on software, which can be a complicated and time-consuming task. Data mining becomes a necessary component of one's system today, and by making efficient use of it, businesses can grow and predict their future sales and revenue.

DATA MINING AND PREDICTIVE ANALYSIS MODELING





KEY DIFFERENCES OF PREDICTIVE ANALYTICS VS DATA MINING

Below is the difference between predictive analytics and data mining

●**Process** – Process of Data Mining can be summarized into six phases-

a. Business/Research Understanding Phase – Clearly enunciate the project objectives and requirements in terms of the business or research unit as a whole

b. Data Understanding Phase – collect and use exploratory data analysis to familiarize yourself with the data, and discover initial insights.

c. Data Preparation Phase – Clean and apply a transformation to raw data so that it is ready for the modeling tools

d. Modeling Phase – Select and apply appropriate modeling techniques and calibrate model settings to optimize results.

e. Evaluation Phase – Models must be evaluated for quality and effectiveness before we deploy. Also, determine whether the model, in fact, achieves the objectives set for it in phase 1.

f. Deployment Phase – Making use of models in production might be a simple deployment like generating a report or a complex one like Implementing a parallel data mining process in another department.

High-level steps in the Predictive Analytics process area

a. Define Business Goal – What business goal to be achieved and how data fits. For example, the business goal is more effective offers to new customers, and the data needed is the segmentation of customers with specific attributes.

b. Collect Additional Data – Additional data needed might be user profile data from online systems or data from third-party tools to better understand data. This helps to find a reason behind the pattern. Sometimes Marketing surveys are conducted to collect data.

c. Draft Predictive Model – Model created with newly collected data and business knowledge. A model can be a simple business rule like "There is a greater chance to get convert the users from age a to b from India if we give offer like this" or a complex mathematical model.

●**Business Value** – Data Ming itself adds values to business-like

a. Deeply understand customer segments across different dimensions

b. Get performance patterns specific to KPIs (Eg. Is subscription increasing with active users count?)

c. Identify Fraudulent activity attempts and prevent it.

d. System performance patterns (Eg -Page loading time across different devices – any pattern?)

Predictive analytics empowers organizations by providing three advantages:

a. Vision – Helps to see what is invisible to others. Predictive analytics can go through a lot of past customer data, associate it with other pieces of data, and assemble all the pieces in the right order.

b. Decision – A well-made predictive analytics model provides analytical results free of emotion and bias. It provides consistent and unbiased insights to support decisions.

c. Precision – Helps to use automated tools to do the reporting job for you — saving time and resources, reducing human error, and improving precision.

●**Performance measure** – Performance of Data Mining process measured on how well the model finding patterns in data. Most of the time it will be a regression, classification or clustering model and there is a well-defined performance measure for all these.
The performance of predictive analytics is measured on business impact. For example – How well the targeted ad campaign work compared to a general campaign? No matter how well data mining finding patterns, to work predictive models well, business insight is a must.

●**Future** – Data Mining field is evolving very fast. Trying to find patterns in data with lesser data points with a minimum number of features with help of more sophisticated models like Deep Neural Networks. A lot of pioneers in this field like Google also trying to make the process simple and accessible to everyone. One example is Cloud AutoML from Google. Predictive analytics expanding to a wide variety of new areas like Employee Retention prediction, Crime Prediction (aka predictive policing), etc. At the same time organizations trying to predict more accurately by collecting maximum information about users like where are they going, what type of videos watching etc.

Predictive Analytics and Data Mining Comparison Table
Below are the lists of points, that describe the comparisons between Predictive Analytics and Data Mining.

Basis of comparison	Data Mining	Predictive Analytics
Definition	Data mining is the process of discovering useful patterns and trends in large data sets.	Predictive analytics is the process of extracting information from large datasets in order to make predictions and estimates about future outcomes.
Importance	Help to understand collected data better. Eg: ●Better understanding of customer segments	Predict on top of data mining results by applying domain knowledge – ●What customer will buy next?

	●Purchase patterns across geography or time ●Behaviour analytics through clickstream ●Stock price timeline analysis. ●GPS street data analysis	●What will be the customer churn rate? ●How many new subscriptions will be started if this offer is given? ●What is the amount of stock of a product needed for the coming month
Scope	Apply Machine Learning algorithms like Regression, Classification to collected data to find hidden patterns	Apply business knowledge on data-mine patterns with any additional data needed to get business valid predictions
Outcome	The output of data mining will be a pattern in data in the form of a timeline varying distribution or clusters. But it won't answer why this pattern occurred?	Predictive analytics tries to find answers to the pattern by applying business knowledge and thus making it a more actionable piece of information.

People Involved	Mostly done by statisticians and Machine Learning engineers, who have a strong mathematical background to do feature engineering and creating ML model	Business-specific knowledge and a clear business objective are a must here. Business analysts and other domain experts can analyze and interpret the patterns discovered by the machines, making useful meaning out of the data patterns and deriving actionable insights

HOW DATA MINING WORKS

Imagine that you have gathered three friends and decided which pizza to buy - vegetarian, meat, or fish? You just poll everyone and conclude what exactly needs to be ordered in your favorite pizzeria. But what if, for example, you have three million friends and several hundred varieties of pizza from several dozen establishments? It's not so easy to deal with an order, is it? Nevertheless, it is what data mining specialists do.

According to this principle, when you go to an online store to buy earrings, you will immediately be offered a bracelet, pendant, and rings to match. And to the swimsuit - a straw hat, sunglasses, and sandals.

It is precisely the ideally structured array of specific information that make it possible to identify a suspicious declaration of income among millions of others of the same kind. Data mining is conventionally divided into three stages:

- Exploration, in which the data is sorted into essential and non-essential (cleaning, data transformation, selection of subsets)
- A model building or hidden pattern identification, the same datasets are applied to different models, allowing better choices. It is called competitive pricing of models
- Deployment - the selected data model is used to predict the results

Data mining is handled by highly qualified mathematicians and engineers as well as AI/ML experts.

HOW PREDICTIVE ANALYTICS WORKS

According to a report by Zion Market Research, the global predictive analytics market was valued at approximately $3.49 billion in 2016 and is expected to reach approximately $10.95 billion by 2022, with a CAGR between 2016 and 2022 at about 21%.

Predictive analytics works with behavioral factors, making it possible to predict customer behavior in the future - how many will come, how many will go, how to change the product, and what promotions to offer to prevent consumer churn.

You can make predictions based on one person's behavior or a group united by a specific criterion (gender, age, place of residence, etc.) Predictive analytics uses not only statistics, but ML, teaching itself.

Business analysts interpret forecasts from inferred patterns. If you don't predict how your regular and hypothetical customers will behave, you will lose the battle with your competitors.

Data Mining and Predictive Analytics in Healthcare

The healthcare system was one of the first to adopt AI technologies, including data mining and predictive analytics. It includes detecting fraud, managing customer relationships, and measuring the effectiveness of specific treatments. And, of course, there is such a massive layer of developments as predictive medicine based on predictive analytics.

Step-By-Step Guide On Mobile App Hipaa Compliance

Using the example of the latter, we will explain how it works. Let's say you have a cancer patient like thousands of other patients in your hospital. Based on their treatment, you decide which regimen to choose for this particular patient, taking into account all of the characteristics. The more patients you add to the database, the more relevant solution will be given by the self-learning application for future patients.

Video Streaming App Proof of Concept

Another example: you can adjust the number of medical personnel in a hospital depending on the reasons for the visit. If most of the patients who come to you are kids, it's time to expand the pediatric ward. AI will help the HR department see an impending problem before it becomes urgent. Also, such a system can predict peak loads in hours/days/months of hospital operation, which will make it possible to intelligently plan the shifts of doctors and nurses.

Clustering patients into groups will help assign a patient to a risk group for a particular disease before getting sick. For example, those prone to diabetes or disseminated sclerosis need to stick to diets so as not to worsen their health. If the patient prepares in advance, the course of the disease will be far less intense and more effectively treated.

But data analysis tools can be helpful not only for doctors. So, a special application can remind the patient that it is time to replenish the supply of prescription drugs, and if necessary, automatically pay for them at the nearest pharmacy and order home delivery

PREDICTIVE MODELING ANALYTICS AND MACHINE LEARNING

For many organisations, big data – incredible volumes of raw structured, semi-structured and unstructured data – is an untapped resource of intelligence that can support business decisions and enhance operations. As data continues to diversify and change, more and more organisations are embracing predictive analytics, to tap into that resource and benefit from data at scale.

What is predictive analytics?

A common misconception is that predictive analytics and machine learning are the same thing. This is not the case. (Where the two do overlap, however, is predictive modelling – but more on that later.)

At its core, predictive analytics encompasses a variety of statistical techniques (including machine learning, predictive modelling and data mining) and uses statistics (both historical and current) to estimate, or 'predict', future outcomes. These outcomes might be behaviours a customer is likely to exhibit or possible changes in the market, for example. Predictive analytics help us to understand possible future occurrences by analysing the past.

Machine learning, on the other hand, is a subfield of computer science that, as per Arthur Samuel's definition from 1959, gives 'computers the ability to learn without being explicitly programmed'. Machine learning evolved from the study of pattern recognition and explores the notion that algorithms can learn from and make predictions on data. And, as they begin to become more 'intelligent', these algorithms can overcome program instructions to make highly accurate, data-driven decisions.

How does predictive analytics work?

Predictive analytics is driven by predictive modelling. It's more of an approach than a process. Predictive analytics and machine learning go hand-in-hand, as predictive models typically include a machine learning algorithm. These models can be trained over time to respond to new data or values, delivering the results the business needs. Predictive modelling largely overlaps with the field of machine learning.

There are two types of predictive models. They are *Classification models,* that predict class membership, and *Regression models* that predict a number. These models are then made up of algorithms. The algorithms perform the data mining and statistical analysis, determining trends and patterns in data. Predictive analytics software solutions will have built in algorithms that can be used to make predictive models. The algorithms are defined as 'classifiers', identifying which set of categories data belongs to.

The most widely used predictive models are:

- **Decision trees:**
  Decision trees are a simple, but powerful form of multiple variable analysis. They are produced by algorithms that identify various ways of splitting data into branch-like segments. Decision trees partition data into subsets based on categories of input variables, helping you to understand someone's path of decisions.
- **Regression (linear and logistic)**
  Regression is one of the most popular methods in statistics. Regression analysis estimates relationships among variables, finding key patterns in large and diverse data sets and how they relate to each other.
- **Neural networks**

  Patterned after the operation of neurons in the human brain, neural networks (also called artificial neural networks) are a variety of deep learning technologies. They're typically used to solve complex pattern recognition problems – and are incredibly useful for analyzing large data sets. They are great at handling nonlinear relationships in data – and work well when certain variables are unknown

Other classifiers:

- **Time Series Algorithms:** Time series algorithms sequentially plot data and are useful for forecasting continuous values over time.
- **Clustering Algorithms:** Clustering algorithms organise data into groups whose members are similar.
- **Outlier Detection Algorithms:** Outlier detection algorithms focus on anomaly detection, identifying items, events or observations that do not conform to an expected pattern or standard within a data set.
- **Ensemble Models:** Ensemble models use multiple machine learning algorithms to obtain better predictive performance than what could be obtained from one algorithm alone.

- **Factor Analysis:** Factor analysis is a method used to describe variability and aims to find independent latent variables.
- **Naïve Bayes:** The Naïve Bayes classifier allows us to predict a class/category based on a given set of features, using probability.
- **Support vector machines:** Support vector machines are supervised machine learning techniques that use associated learning algorithms to analyze data and recognize patterns.

Each classifier approaches data in a different way, therefore for organizations to get the results they need, they need to choose the right classifiers and models.

Applications of predictive analytics and machine learning

For organizations overflowing with data but struggling to turn it into useful insights, predictive analytics and machine learning can provide the solution. No matter how much data an organization has, if it can't use that data to enhance internal and external processes and meet objectives, the data becomes a useless resource.

Predictive analytics is most commonly used for security, marketing, operations, risk and fraud detection. Here are just a few examples of how predictive analytics and machine learning are utilised in different industries:

1. **Banking and Financial Services**
   In the banking and financial services industry, predictive analytics and machine learning are used in conjunction to detect and reduce fraud, measure market risk, identify opportunities and much, much more.
2. **Security**
   With cybersecurity at the top of every business' agenda in 2017, it should come as no surprise that predictive analytics and machine learning play a key part in security. Security institutions typically use predictive analytics to improve services and performance, but also to detect anomalies, fraud, understand consumer behaviour and enhance data security.
3. **Retail**
   Retailers are using predictive analytics and machine learning to better understand consumer behaviour; who buys what and where? These questions can be readily answered with the right predictive models and data sets, helping retailers to plan ahead and stock items based on seasonality and consumer trends – improving ROI significantly.

Want to find out more about getting Predictive Analytics to work?

Developing the right environment

While machine learning and predictive analytics can be a boon for any organisation, implementing these solutions haphazardly, without considering how they will fit into everyday operations, will drastically hinder their ability to deliver the insights the organisation needs.

To get the most out of predictive analytics and machine learning, organisations need to ensure they have the architecture in place to support these solutions, as well as high-quality data to feed them and help them to learn. Data preparation and quality are key enablers of predictive analytics. Input data, which may span multiple platforms and contain multiple big data sources, must be centralised, unified and in a coherent format.

In order to achieve this, organisations must develop a sound data governance program to police the overall management of data and ensure only high-quality data is captured and recorded. Secondly, existing processes will need to be altered to include predictive analytics and machine learning as this will enable organisations to drive efficiency at every point in the business. Lastly, organisations need to know what problems they are looking to solve, as this will help them to determine the best and most applicable model to use.

Understanding predictive models

Typically, an organisation's data scientists and IT experts are tasked with the development of choosing the right predictive models – or building their own to meet the organisation's needs. Today, however, predictive analytics and machine learning is no longer just the domain of mathematicians, statisticians and data scientists, but also that of business analysts and consultants. More and more of a business' employees are using it to develop insights and improve business operations – but problems arise when employees do not know what model to use, how to deploy it, or need information right away.

At SAS, we develop sophisticated software to support organisations with their data governance and analytics. Our data governance solutions help organisations to maintain high-quality data, as well as align operations across the business and pinpoint data problems within the same environment., Our predictive analytics solutions help organisations to turn their data into timely insights for better, faster decision making. These predictive analytics solutions are designed to meet the needs of all types of users and enables them to deploy predictive models rapidly.

MACHINE LEARNING

What is Machine learning?

Machine learning methods enable computers to operate autonomously without explicit programming. ML applications are fed with new data, and they can independently learn, grow, develop, and adapt.

Machine learning derives insightful information from large volumes of data by leveraging algorithms to identify patterns and learn in an iterative process. ML algorithms use computation methods to learn directly from data instead of relying on any predetermined equation that may serve as a model.

The performance of ML algorithms adaptively improves with an increase in the number of available samples during the 'learning' processes. For example, deep learning is a sub-domain of machine learning that trains computers to imitate natural human traits like learning from examples. It offers better performance parameters than conventional ML algorithms.

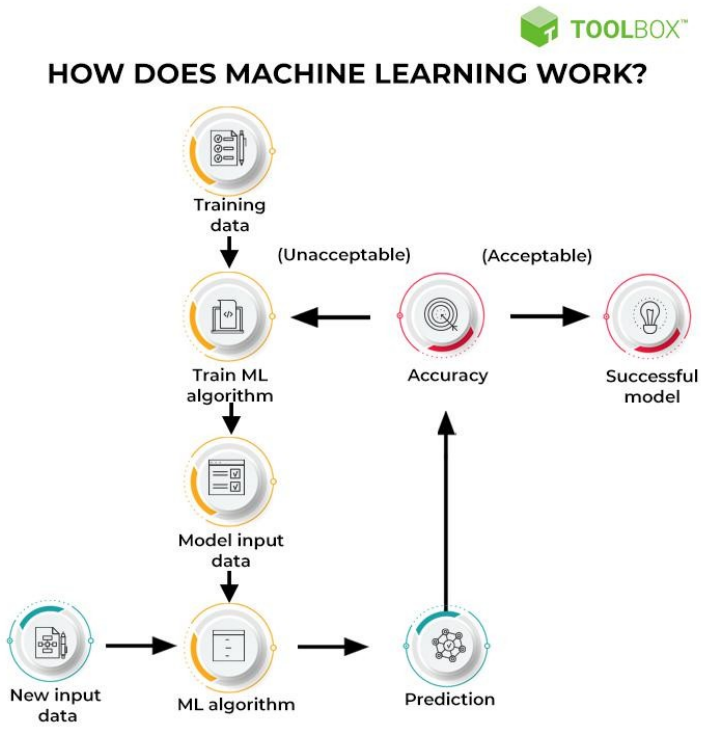
While machine learning is not a new concept – dating back to World War II when the Enigma Machine was used – the ability to apply complex mathematical calculations automatically to growing volumes and varieties of available data is a relatively recent development.

Today, with the rise of big data, IoT, and ubiquitous computing, machine learning has become essential for solving problems across numerous areas, such as

- Computational finance (credit scoring, algorithmic trading)
- Computer vision (facial recognition, motion tracking, object detection)
- Computational biology (DNA sequencing, brain tumor detection, drug discovery)
- Automotive, aerospace, and manufacturing (predictive maintenance)
- Natural language processing (voice recognition)

How does machine learning work?

Machine learning algorithms are molded on a training dataset to create a model. As new input data is introduced to the trained ML algorithm, it uses the developed model to make a prediction.



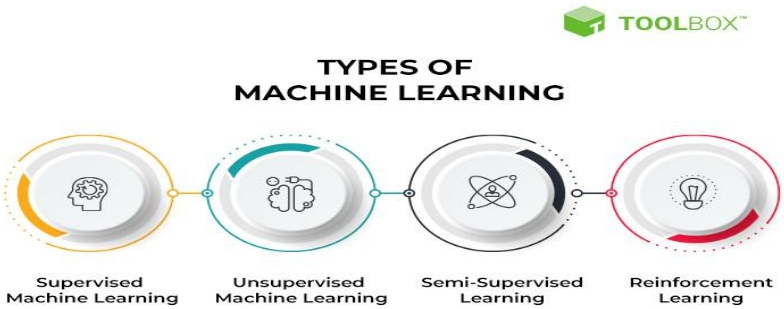
How Machine Learning Works

***Note**: The above illustration discloses a high-level use case scenario. However, typical machine learning examples may involve many other factors, variables, and steps.*

Further, the prediction is checked for accuracy. Based on its accuracy, the ML algorithm is either deployed or trained repeatedly with an augmented training dataset until the desired accuracy is achieved.

Types of Machine Learning

Machine learning algorithms can be trained in many ways, with each method having its pros and cons. Based on these methods and ways of learning, machine learning is broadly categorized into four main types:



Types of Machine Learning

1. Supervised machine learning

This type of ML involves supervision, where machines are trained on labeled datasets and enabled to predict outputs based on the provided training. The labeled dataset specifies that some input and output parameters are already mapped. Hence, the machine is trained with the input and corresponding output. A device is made to predict the outcome using the test dataset in subsequent phases.

For example, consider an input dataset of parrot and crow images. Initially, the machine is trained to understand the pictures, including the parrot and crow's color, eyes, shape, and size. Post-training, an input picture of a parrot is provided, and the machine is expected to identify the object and predict the output. The trained machine checks for the various features of the object, such as color, eyes, shape, etc., in the input picture, to make a final prediction. This is the process of object identification in supervised machine learning.

The primary objective of the supervised learning technique is to map the input variable (a) with the output variable (b). Supervised machine learning is further classified into two broad categories:

- **Classification**: These refer to algorithms that address classification problems where the output variable is categorical; for example, yes or no, true or false, male or female, etc. Real-world applications of this category are evident in spam detection and email filtering.

Some known classification algorithms include the Random Forest Algorithm, Decision Tree Algorithm, Logistic Regression Algorithm, and Support Vector Machine Algorithm.

- **Regression**: Regression algorithms handle regression problems where input and output variables have a linear relationship. These are known to predict continuous output variables. Examples include weather prediction, market trend analysis, etc.

Popular regression algorithms include the Simple Linear Regression Algorithm, Multivariate Regression Algorithm, Decision Tree Algorithm, and Lasso Regression.

2. Unsupervised machine learning

Unsupervised learning refers to a learning technique that's devoid of supervision. Here, the machine is trained using an unlabeled dataset and is enabled to predict the output without any supervision. An unsupervised learning algorithm aims to group the unsorted dataset based on the input's similarities, differences, and patterns.

For example, consider an input dataset of images of a fruit-filled container. Here, the images are not known to the machine learning model. When we input the dataset into the ML model, the task of the model is to identify the pattern of objects, such as color, shape, or differences seen in the

input images and categorize them. Upon categorization, the machine then predicts the output as it gets tested with a test dataset.

Unsupervised machine learning is further classified into two types:

- **Clustering**: The clustering technique refers to grouping objects into clusters based on parameters such as similarities or differences between objects. For example, grouping customers by the products they purchase.

Some known clustering algorithms include the K-Means Clustering Algorithm, Mean-Shift Algorithm, DBSCAN Algorithm, Principal Component Analysis, and Independent Component Analysis.

- **Association:** Association learning refers to identifying typical relations between the variables of a large dataset. It determines the dependency of various data items and maps associated variables. Typical applications include web usage mining and market data analysis.

Popular algorithms obeying association rules include the Apriori Algorithm, Eclat Algorithm, and FP-Growth Algorithm.

3. Semi-supervised learning

Semi-supervised learning comprises characteristics of both supervised and unsupervised machine learning. It uses the combination of labeled and unlabeled datasets to train its algorithms. Using both types of datasets, semi-supervised learning overcomes the drawbacks of the options mentioned above.

Consider an example of a college student. A student learning a concept under a teacher's supervision in college is termed supervised learning. In unsupervised learning, a student self-learns the same concept at home without a teacher's guidance. Meanwhile, a student revising the concept after learning under the direction of a teacher in college is a semi-supervised form of learning.

4. Reinforcement learning

Reinforcement learning is a feedback-based process. Here, the AI component automatically takes stock of its surroundings by the hit & trial method, takes action, learns from experiences, and improves performance. The component is rewarded for each good action and penalized for every wrong move. Thus, the reinforcement learning component aims to maximize the rewards by performing good actions.

Unlike supervised learning, reinforcement learning lacks labeled data, and the agents learn via experiences only. Consider video games. Here, the game specifies the environment, and each move of the reinforcement agent defines its state. The agent is entitled to receive feedback via punishment and rewards, thereby affecting the overall game score. The ultimate goal of the agent is to achieve a high score.

Reinforcement learning is applied across different fields such as game theory, information theory, and multi-agent systems. Reinforcement learning is further divided into two types of methods or algorithms:

- **Positive reinforcement learning**: This refers to adding a reinforcing stimulus after a specific behavior of the agent, which makes it more likely that the behavior may occur again in the future, e.g., adding a reward after a behavior.
- **Negative reinforcement learning**: Negative reinforcement learning refers to strengthening a specific behavior that avoids a negative outcome.

Top 5 Machine Learning Applications

Industry verticals handling large amounts of data have realized the significance and value of machine learning technology. As machine learning derives insights from data in real-time, organizations using it can work efficiently and gain an edge over their competitors.

Every industry vertical in this fast-paced digital world, benefits immensely from machine learning tech. Here, we look at the top five ML application sectors.

1. Healthcare industry

Machine learning is being increasingly adopted in the healthcare industry, credit to wearable devices and sensors such as wearable fitness trackers, smart health watches, etc. All such devices monitor users' health data to assess their health in real-time.

Moreover, the technology is helping medical practitioners in analyzing trends or flagging events that may help in improved patient diagnoses and treatment. ML algorithms even allow medical experts to predict the lifespan of a patient suffering from a fatal disease with increasing accuracy.

Additionally, machine learning is contributing significantly to two areas:

- **Drug discovery**: Manufacturing or discovering a new drug is expensive and involves a lengthy process. Machine learning helps speed up the steps involved in such a multi-step process. For example, Pfizer uses IBM's Watson to analyze massive volumes of disparate data for drug discovery.
- **Personalized treatment**: Drug manufacturers face the stiff challenge of validating the effectiveness of a specific drug on a large mass of the population. This is because the drug works only on a small group in clinical trials and possibly causes side effects on some subjects.

To address these issues, companies like Genentech have collaborated with GNS Healthcare to leverage machine learning and simulation AI platforms, innovating biomedical treatments to address these issues. ML technology looks for patients' response markers by analyzing individual genes, which provides targeted therapies to patients.

2. Finance sector

Today, several financial organizations and banks use machine learning technology to tackle fraudulent activities and draw essential insights from vast volumes of data. ML-derived insights aid in identifying investment opportunities that allow investors to decide when to trade.

Moreover, data mining methods help cyber-surveillance systems zero in on warning signs of fraudulent activities, subsequently neutralizing them. Several financial institutes have already partnered with tech companies to leverage the benefits of machine learning.

For example,

- Citibank has partnered with fraud detection company Feedzai to handle online and in-person banking frauds.
- PayPal uses several machine learning tools to differentiate between legitimate and fraudulent transactions between buyers and sellers.

3. Retail sector

Retail websites extensively use machine learning to recommend items based on users' purchase history. Retailers use ML techniques to capture data, analyze it, and deliver personalized shopping experiences to their customers. They also implement ML for marketing campaigns, customer insights, customer merchandise planning, and price optimization.

According to a September 2021 report by Grand View Research, Inc., the global recommendation engine market is expected to reach a valuation of $17.30 billion by 2028. Common day-to-day examples of recommendation systems include:

- When you browse items on Amazon, the product recommendations that you see on the homepage result from machine learning algorithms. Amazon uses artificial neural networks (ANN) to offer intelligent, personalized recommendations relevant to customers based on their recent purchase history, comments, bookmarks, and other online activities.
- Netflix and YouTube rely heavily on recommendation systems to suggest shows and videos to their users based on their viewing history.

Moreover, retail sites are also powered with virtual assistants or conversational chatbots that leverage ML, natural language processing (NLP), and natural language understanding (NLU) to automate customer shopping experiences.

4. Travel industry

Machine learning is playing a pivotal role in expanding the scope of the travel industry. Rides offered by Uber, Ola, and even self-driving cars have a robust machine learning backend.

Consider Uber's machine learning algorithm that handles the dynamic pricing of their rides. Uber uses a machine learning model called 'Geosurge' to manage dynamic pricing parameters. It uses

real-time predictive modeling on traffic patterns, supply, and demand. If you are getting late for a meeting and need to book an Uber in a crowded area, the dynamic pricing model kicks in, and you can get an Uber ride immediately but would need to pay twice the regular fare.

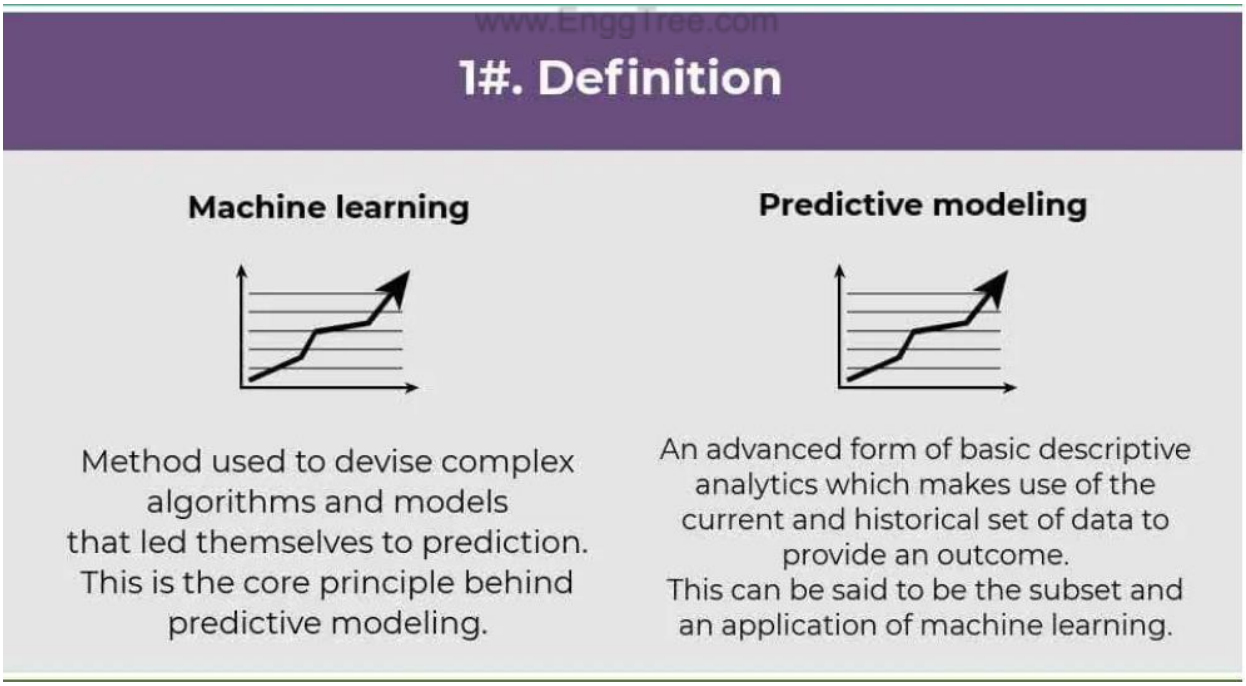
Moreover, the travel industry uses machine learning to analyze user reviews. User comments are classified through sentiment analysis based on positive or negative scores. This is used for campaign monitoring, brand monitoring, compliance monitoring, etc., by companies in the travel industry.

5. Social media

With machine learning, billions of users can efficiently engage on social media networks. Machine learning is pivotal in driving social media platforms from personalizing news feeds to delivering user-specific ads. For example, Facebook's auto-tagging feature employs image recognition to identify your friend's face and tag them automatically. The social network uses ANN to recognize familiar faces in users' contact lists and facilitates automated tagging.

Similarly, LinkedIn knows when you should apply for your next role, whom you need to connect with, and how your skills rank compared to peers. All these features are enabled by machine learning.

Below is the top 8 Comparison between Machine Learning and Predictive Modelling:



2#. Modus Operandi

Machine learning	Predictive modeling
Adaptive technique where the systems are smart enough to adapt and learn as and when new set of data is added, without the need of being directly programmed. Previous calculations will be used to provide effective results.	Models are known to make use of classifiers and detection theory to guess the probability of an outcome given a set of input data.

3#. Approaches and Models

Machine learning

- Decision tree learning
- Associate rule learning
- Artificial neural networks
- Deep learning
- Inductive logic programming
- Support vector machines
- Clustering
- Bayesian networks
- Reinforcement learning
- Representation learning
- Similarity and metric learning
- Sparse dictionary learning
- Genetic algorithms
- Rule based machine learning
- Learning classifier systems

Predictive modeling

- Group method of data handling
- Naïve Bayes
- K-nearest
- Majority classifier
- Support vector machines
- Boosted trees
- Random forests
- CART(Classification and Regression trees)
- MARS
- Neural Networks
- ACE and AVAS
- Ordinary Least Squares
- Generalized Linear Models (GLM)
- Logistic regression
- Generalized additive models
- Robust Regression
- Semiparametric regression

4#. Applications

Machine learning

- Bioinformatics
- Brain machine interfaces
- Classifying DNA sequences
- Computational anatomy
- Computer vision
- Object recognition
- Detecting credit card fraud
- Internet fraud detection
- Linguistics
- Marketing
- Machine perception
- Medical diagnosis
- Economics
- Insurance·NLP
- Optimization and metaheuristic
- Online
- advertising
- Recommendation and search engines
- Robot locomotives
- Sequence mining
- Sentiment analysis
- Speech and handwriting recognition
- Financial market analysisTime series forecasting

Predictive modeling

- Uplift modelling
- Archeology
- Customer relationship management
- Auto insurance
- Health care
- Algorithmic trading
- Notable features of predictive modeling
- Limitations on data fitting
- Marketing campaigns optimization
- Fraud detection
- Risk reduction
- Improved and streamlined operations
- Customer retention
- Sales funnel insights
- Crisis Management
- Risk mitigation and corrective measures
- Disaster Management
- Customer segmentation
- Churn prevention
- Financial modeling
- Market trend and analysisCredit scoring

5#. Update Handling

Machine learning

Statistical model is updated automatically.

Predictive modeling

Data scientists need to run the model manually multiple times.

6#. Requirement Clarification

Machine learning

Proper set of requirements and business justifications need to be provided.

Predictive modeling

Proper set of business justifications and requirements need to be clarified.

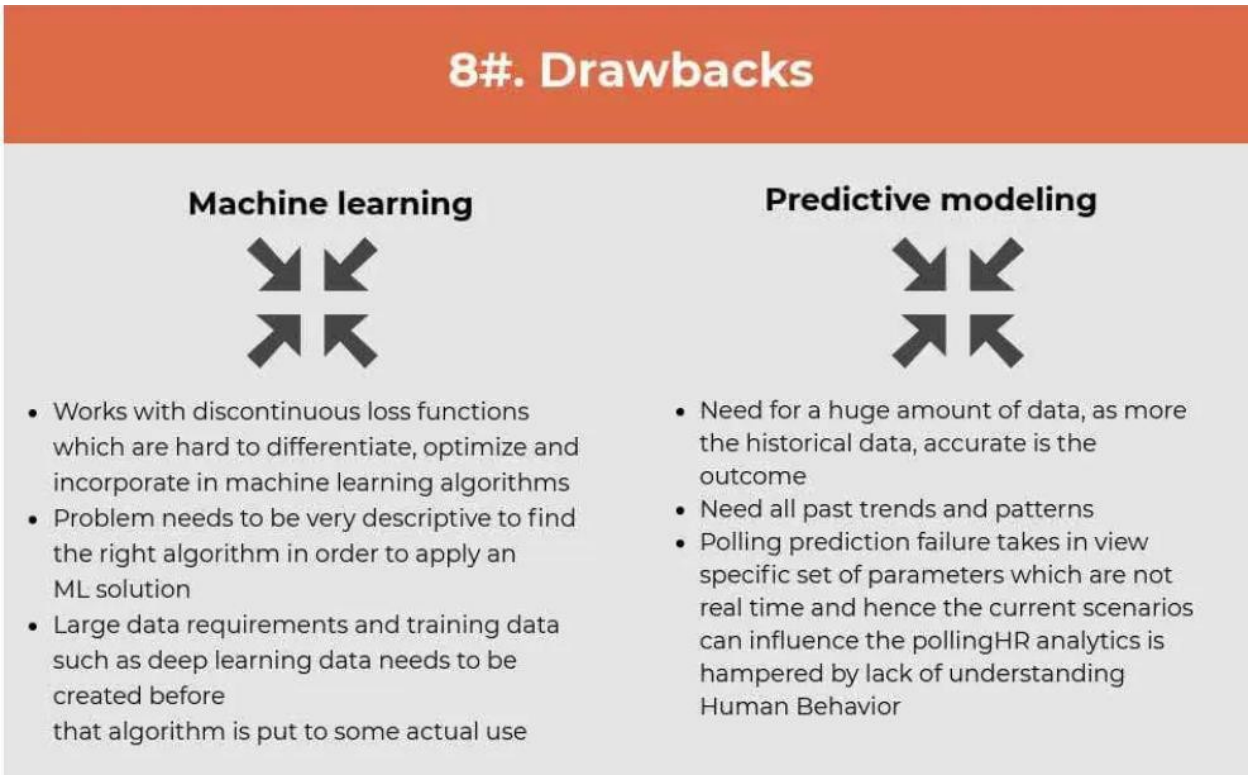
7#. Driving Technology

Machine learning

Machine learning is data driven.

Predictive modeling

Predictive modeling is use case driven.



Machine learning is an area of computer science which uses cognitive learning methods to program their systems without the need of being explicitly programmed. In other words, those machines are well known to grow better with experience.

Machine learning is related to other mathematical techniques and also with data mining which encompasses terms such as supervised and unsupervised learning.

Predictive modeling, on the other hand, is a mathematical technique which uses statistics for prediction. It aims to work upon the provided information to reach an end conclusion after an event has been triggered.

Key Differences between Machine Learning and Predictive Modelling

Below are the lists of points, describe the key differences between Machine Learning and Predictive Modelling

1. Machine learning is an AI technique where the algorithms are given data and are asked to process without a predetermined set of rules and regulations whereas Predictive analysis is the analysis of historical data as well as existing external data to find patterns and behaviors.
2. Machine learning algorithms are trained to learn from their past mistakes to improve future performance whereas predictive makes informed predictions based upon historical data about future events only
3. Machine learning is a new generation technology which works on better algorithms and massive amounts of data whereas predictive analysis are the study and not a particular technology which existed long before Machine learning came into existence. Alan Turing had already made used of this technique to decode the messages during world war II.

4. Related practices and learning techniques for machine learning include Supervised and unsupervised learning while for predictive analysis it is Descriptive analysis, Diagnostic analysis, Predictive analysis, Prescriptive analysis, etc.
5. Once our machine learning model is trained and tested for a relatively smaller dataset, then the same method can be applied to hidden data. The data effectively need not be biased as it would result in bad decision making. In the case of predictive analysis, data is useful when it is complete, accurate and substantial. Data quality needs to be taken care of when data is ingested initially. Organizations use this to predict forecasts, consumer behaviors and make rational decisions based on their findings. A success case will surely result in boosting business and firm's revenues.

Conclusion

In a nutshell, when it comes to data analytics, machine learning is a methodology which is used to devise and generate complex algorithms and models which lend themselves to a prediction. This is popularly known as predictive analysis in commercial use which is used by researchers, engineers, data scientists and other analysts to make decisions and provide results and uncover the hidden insights by making use of historical learning.

SUMMARY OF BUSINESS FORECASTING

Business forecasting is imperative for making balanced financial and operational decisions. Its impact across industries has grown in recent years due to the way companies build data-driven strategies and rely on data. But let's find out what is needed for efficient forecasting and why machine learning models have all the prerequisites for enhancing business intelligence.

How AI Improves Business Forecast Accuracy

Thanks to forecasting, companies are able to better serve clients and ship orders, instead of running out of stock. This leads to a huge impact on sales and customer satisfaction. For example, knowing the demand brings an ability to manage logistics and track inventory costs, or even predict ROI for a new product. Therefore, ML forecasting models allow organizations to enhance their AI maturity, and more importantly, to solve business tasks by looking at existing data. Nowadays, the volume of data from markets, industries, and users is skyrocketing. FinancesOnline reveals that the world will produce and consume 94 zettabytes in 2022. Such growth fuels the training of ML models, making them more robust and accurate. According to Market Research Future, the ML market share is projected to reach $106.52B by 2030, with a CAGR of 38.76% during the forecast period of 2020-2030. With increasing market share (caused by evolving cloud -based services and growth in unstructured data) comes new opportunities for building forecasting models. So, let's figure out how these models improve business forecast accuracy and why they are more efficient than traditional approaches.

ML forecasting rests on an enormous amount of information, which can be analyzed to achieve accurate predictions and high performance rates. Unlike traditional forecasting approaches, machine learning allows companies to consider numerous business drivers and factors, and for building nonlinear algorithms to minimize loss functions (a crucial ingredient in all optimization problems).

Training of any ML forecasting model requires the assessment stage. This stage foresees comparison of predicted and actual results. It brings an understanding of how well the model performs. After that, it would be possible to compare different forecasting algorithms and choose the one which produces a minimal amount of

errors. With this approach, businesses can replace traditional techniques with ML, getting the following benefits for their business forecast:

- Acquiring insights and detecting hidden patterns that are difficult to trace with traditional approaches. Training ML forecasting models on BigData, and moving computation to Cloud is becoming de-facto an industry standard.
- Reduced number of errors in forecasting. For instance, McKinsey claims that AI -driven forecasting models applied to delivery chain management can reduce the number of errors by 20–50%.
- Ability to infuse more data in a model. External data may be valuable here and change the outcomes in terms of predictions.
- Flexibility and rapid adaptability to changes. Compared to traditional non -AI approaches, ML forecasting algorithms can be quickly adapted in case of any significant changes.

Please note that we're considering forecasting, not predictive modeling. We'll explain the difference between these two models in simple terms.

Difference Between Forecasting & PredictiveModeling

Both forecasting and predictive algorithms are applied to address cumbersome challenges related to business planning, customer behavior, and decision -making. But, nevertheless, these techniques differ.

Forecasting modeling implies analysis of past and present data to find patterns, or trends, which allow us to estimate the probability of future events. In contrast to predicting, forecasting modeling should have traceable logics. Typical use cases include a forecast for energy consumption in the following 6–12 months, an evaluation of how many customers will reach support in the next 7 days, or how many agreements for the supply are expected to be signed. All this could be forecasted based on previous (historical) data.

Predictive modeling is the process of applying AI and data mining to assess more detailed, specific outcomes and use much more diverse data types. The difference between predictive and forecasting modeling is blurred, still, we can consider an example to understand it better. Just imagine that a credit institution plans to launch a new premium card. At this point, two questions may arise.

The first will probably be, how many cards will be issued in the next 6 months? Forecasting modeling will help us find an answer to this question thanks to analysis of similar products launched in the past.But we still don't know whom we can recommend this card to. Here predictive modeling comes into play. It enables us to analyze a customer information database with such fields as age, salary, preferences, consumer habits, etc. With this approach, we will eventually understand which clients are more likely to use this card.

Use Cases For Machine Learning Forecasting For Business

FINANCIAL FORECASTING

Without a financial forecast, companies face disruption in processes and performance, while C-level managers tend to make incorrect decisions. That's why companies leverage ML forecasting which instead of dealing with mundane tasks,

concentrates attention on understanding business drivers. Moreover, ML financial forecasting reduces the amount of ineffective strategies in play and human errors and helps predict supply, demand, inventory, future revenues, expenses, and cash flow.

For example, stakeholders of the business are aiming to know the company's turnover and key factors for growth during the next financial period to understand and analyze areas of improvement. Based on historical key company business indicators and existing turnover information during the past periods, we can develop an ML forecasting model using deep learning or regression models. It will predict future required metrics, based also on seasonal information and other influencing factors. In this case, business owners will be able to plan the next period of time accordingly.

SUPPLY CHAIN FORECASTING

ML can fully transform management in the area of supply chains, which are becoming more globalized and sophisticated. ML-based forecasting solutions enable companies to efficiently respond to issues and threats as well as avoid under and overstocking. Machine learning algorithms for forecasting can learn relationships from a training dataset and then apply these relationships to new data. Thus, ML improves selecting and segmenting suppliers, predicting supply chain risks, inventory management, and transportation and distribution processes. Let's look at an example of using machine learning for supply chain forecasting. The chain of hypermarkets operates around 100 stores in different locations and has an average of 50000 SKUs per store. For such a big chain, it's definitely required that the process of replenishment of warehouses be automated. There are two main benefits in this case:

1. No need to store a lot of hard-to-sell products
2. Frequently sold products should be delivered on time

Based on the previous information on replenishment of warehouses, as well as data that shows how fast certain products are selling, we can develop an ML model for predicting the number of products per SKU. The prediction could be shown with different time horizons (e.g. daily, weekly, monthly, etc.). This can help managers properly organize the system of storing products and minimize the case of product absence.

PRICE PREDICTION

Price prediction algorithms determine how much the product must cost to be appealing to consumers, meet the company's expectations, and assure the highest level of sales. The construction of price forecasts should take into account such factors as product features, demand, and existing trends. This approach may be perceived skeptically, yet it's beneficial when companies enter a new mark et or release a new product and want to easily cope with a myriad of fluctuating factors.

Often business owners want to have an understanding of price changes for a specific product for a future period of time. Having taken into consideration client

data with related price changes for a past period of time for all of the existing products, we can catch general patterns from the previous data and extrapolate them for the next periods. The positive impact could also be applied by adding external third-party data that could influence prices as well, for instance: inflation rate, holidays, seasonal patterns, etc. Wrapping up all of this data, we can develop an ML forecasting model that will be able to predict price trends for specific products.

DEMAND & SALES FORECASTING

A fluctuation in demand is a cumbersome challenge that concerns the whole e - commerce industry. That's why companies, including manufacturers, apply ML demand forecasting to predict buyers' behavior and find out how many products to produce or order. With ML models, it's possible to avoid excess inventory or stockout. Moreover, such an approach to demand forecasting enables understanding the target audience and competition.

Let's say a restaurant chain business wants to plan demand in advance . It will help the business in several ways:

- to know the number of dishes that will be sold in the restaurant in order to plan food stock in advance,
- to understand and define an appropriate number of employees that are required to provide quality customer service
- to come up with the proper and timely marketing campaign

In order to develop a demand forecasting model and help businesses to fulfill their goals, it will be great to start by analyzing historical data of the previous periods. One of the ways to improve the model performance could be an integration of NLP algorithms as well. For example, we can consider reviews on Google for our restaurant chain, as well as the main competitors to identify the main dishes/quality of service that customers like or do not like.

FRAUD DETECTION

According to a TransUnion report, there is a 52.2% increase in the rate of suspected digital fraud globally between 2019 and 2021. It indicates that companies should make greater efforts in the development of anti-fraud tactics. ML algorithms can detect suspicious financial transactions by learning from past data. They are already successfully applied in e-commerce, banking, healthcare, fintech, and other areas.

For instance, a cafe chain owner wants to analyze the productivity of employees. One of the main goals is to detect hidden patterns that allow employees to cheat. Different frauds like this could lead to losing money. Based on historical data, we can develop a fraud detection model that will detect anomaly patterns and notify about them. In this case, managers can precisely analyze detected anomalies and identify the root cause of such deviations in the data. In the future, such cases could be prevented by the manager to keep the business safe.

Key Machine Learning Forecasting Algorithms:

Let's look at some key machine learning forecasting algorithms to better understand how ML forecasting can be applied.

REGRESSION ALGORITHMS

ML regression models are applied to predict trends and outcomes, being capable of comprehending how variables impact each other along with the results. The dependency between variables can be both linear and nonlinear, while labeled data is required for training. After understanding the relationship of variables, regression models can predict what results will be in unseen data.

Simple and multiple linear regression and logistic regression, where a target variable has only two values, are one of the most common baseline models to predict sales, stock prices, and customer behavior.

DEEP LEARNING ALGORITHMS

Time series forecasting implementation is gradually replenishing with new deep learning algorithms. The more versatile and explainable a model is, the higher the chances for its production use. Let's take a look at a few deep learning models for time series forecasting.

The first one is DeepAR. It's a supervised ML algorithm created by Amazon and based on recurrent neural networks. It has proven its efficiency with datasets consisting of hundreds of interrelated time series. The advantages of the method are the possibility to use a rich set of inputs, scaling capabilities, and suitability for probabilistic forecasting.

The second one is the Temporal Fusion Transformer (TFT). It overcomes other deep learning models in terms of versatility and can be built on multiple time series. TFT performs well even if trained on a small dataset, thus being suitable for demand forecasting as just one example.

The third algorithm is long short-term memory (LSTM) based upon an artificial RNN, in which the output from one step is transformed into the input of the next step. As for the architecture of LSTM, it consists of neural networks and memory cells for maintaining data, while any manipulation within the memory is performed by gates. There are three gates here: Forget, Input, and Output. However, LSTM requires plenty of resources and a long time for training.

TREE-BASED ALGORITHMS

Tree-based algorithms refer to supervised learning approaches. Their advantages include accuracy, sustainability, and suitability for mapping non -linear patterns. The idea here is to define homogeneous sets in the sample taking into account the key differentiator in input. The classification of tree-based algorithms depends on the target variable. As for advantages, tree-based algorithms can be easily grasped, require minimal data cleaning, and handle different types of variables. The tendency toward overfitting and irreconcilability with continuous variables may be seen as disadvantages in this case.

GAUSSIAN PROCESSES

Gaussian processes (GP) are inferior in popularity to other models, yet they are powerful enough for industrial application, including automatic forecasting.

Gaussian processes enable us to incorporate expert opinion via kernel, though their application in forecasting depends on the number of parameters and may be expensive.

AUTO-REGRESSIVE ALGORITHMS

The group of auto-regression algorithms foresees predicting future values using the output from the previous step as an input. Forecasting algorithms of this group include ARIMA, SARIMA, and others. In ARIMA, forecasting is carried out with the application of moving and autoregressive averages. For instance, the ARIMA model can predict fuel costs or forecast a company's revenue based on past periods. SARIMA uses the same basic idea, but it includes a seasonal component that may affect the outcomes.

EXPONENTIAL SMOOTHING

Exponential smoothing is an alternative to ARIMA models. It can be applied as a forecasting model for univariate data that can be extended to support data with a systematic trend or seasonal component. In this model, forecasting is a weighted sum of past observations, yet the importance (weight) of past observations is exponentially decreased. The accuracy of prediction depends on the type of the exponential smoothing model which can be single, double, or triple. The most sophisticated exponential smoothing models take into account trends and seasonality.

How to Apply Machine Learning Forecasting

Regardless of the chosen model, the whole adoption of ML practices looks as the following:

1. Define business goals and available internal data
2. Search for external data, namely market reports, trends, GDPs, product reviews, etc.
3. Structure, clean, and label data (if needed)
4. Identify the batch of problems to be solved with the help of forecasting
5. Select a baseline model (usually simple regression or tree-based models) to be used as a first reference point to start with
6. Improve models' performance by implementing more sophisticated ML models or adjusting the data
7. After achieving comfortable results, the model is implemented into production (added to existing software and used on more data)

Challenges of ML Forecasting

Nothing good comes without challenges, ML forecasting is no exception. Key business forecasting with machine learning challenges include the following:

- Insufficient amount of data to train a model
- An incorrectly chosen metric to evaluate results in alignment with business needs
- Imputation of missing data
- Dealing with outliers/anomalies

While infusing the data at the scale of AI, businesses encounter difficulties and limitations, that's why it's crucial to involve experienced data science professionals and AI engineers when implementing machine learning.

UNIT IV HR & SUPPLY CHAIN ANALYTICS

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain

HUMAN RESOURCES

WHAT IS HRM?

Human resource management (HRM) is the process of employing people, training them, compensating them, developing policies relating to them, and developing strategies to retain them. As a field, HRM has undergone many changes over the last twenty years, giving it an even more important role in today's organizations. In the past, HRM meant processing payroll, sending birthday gifts to employees, arranging company outings, and making sure forms were filled out correctly—in other words, more of an administrative role rather than a strategic role crucial to the success of the organization. Jack Welch, former CEO of General Electric and management guru, sums up the new role of HRM: "Get out of the parties and birthdays and enrollment forms.… Remember, HR is important in good times, HR is defined in hard times"

It's necessary to point out here, at the very beginning of this text, that every manager has some role relating to human resource management. Just because we do not have the title of HR manager doesn't mean we won't perform all or at least some of the HRM tasks. For example, most managers deal with compensation, motivation, and retention of employees—making these aspects not only part of HRM but also part of management. As a result, this book is equally important to someone who wants to be an HR manager and to someone who will manage a business.

Human Resource Recall

Have you ever had to work with a human resource department at your job? What was the interaction like? What was the department's role in that specific organization?

The Role of HRM

Keep in mind that many functions of HRM are also tasks other department managers perform, which is what makes this information important, despite the career path taken. Most experts agree on seven main roles that HRM plays in organizations. These are described in the following sections.

Staffing

You need people to perform tasks and get work done in the organization. Even with the most sophisticated machines, humans are still needed. Because of this, one of the major tasks in HRM

is staffing. Staffing involves the entire hiring process from posting a job to negotiating a salary package. Within the staffing function, there are four main steps:

1. **Development of a staffing plan.** This plan allows HRM to see how many people they should hire based on revenue expectations.
2. **Development of policies to encourage multiculturalism at work.** Multiculturalism in the workplace is becoming more and more important, as we have many more people from a variety of backgrounds in the workforce.
3. **Recruitment.** This involves finding people to fill the open positions.
4. **Selection.** In this stage, people will be interviewed and selected, and a proper compensation package will be negotiated. This step is followed by training, retention, and motivation.

Development of Workplace Policies

Every organization has policies to ensure fairness and continuity within the organization. One of the jobs of HRM is to develop the verbiage surrounding these policies. In the development of policies, HRM, management, and executives are involved in the process. For example, the HRM professional will likely recognize the need for a policy or a change of policy, seek opinions on the policy, write the policy, and then communicate that policy to employees. It is key to note here that HR departments do not and cannot work alone. Everything they do needs to involve all other departments in the organization. Some examples of workplace policies might be the following:

- Discipline process policy
- Vacation time policy
- Dress code
- Ethics policy
- Internet usage policy

Compensation and Benefits Administration

HRM professionals need to determine that compensation is fair, meets industry standards, and is high enough to entice people to work for the organization. Compensation includes anything the employee receives for his or her work. In addition, HRM professionals need to make sure the pay is comparable to what other people performing similar jobs are being paid. This involves setting up pay systems that take into consideration the number of years with the organization, years of experience, education, and similar aspects. Examples of employee compensation include the following:

- Pay
- Health benefits

- 401(k) (retirement plans)
- Stock purchase plans
- Vacation time
- Sick leave
- Bonuses
- Tuition reimbursement

Retention

Retention involves keeping and motivating employees to stay with the organization. Compensation is a major factor in employee retention, but there are other factors as well. Ninety percent of employees leave a company for the following reasons:

1. Issues around the job they are performing
2. Challenges with their manager
3. Poor fit with organizational culture
4. Poor workplace environment

Despite this, 90 percent of managers think employees leave as a result of pay.As a result, managers often try to change their compensation packages to keep people from leaving, when compensation isn't the reason they are leaving at all.

Training and Development

Once we have spent the time to hire new employees, we want to make sure they not only are trained to do the job but also continue to grow and develop new skills in their job. This results in higher productivity for the organization. Training is also a key component in employee motivation. Employees who feel they are developing their skills tend to be happier in their jobs, which results in increased employee retention. Examples of training programs might include the following:

- Job skills training, such as how to run a particular computer program
- Training on communication
- Team-building activities
- Policy and legal training, such as sexual harassment training and ethics training

Dealing with Laws Affecting Employment

Human resource people must be aware of all the laws that affect the workplace. An HRM professional might work with some of these laws:

- Discrimination laws
- Health-care requirements
- Compensation requirements such as the minimum wage
- Worker safety laws
- Labor laws

The legal environment of HRM is always changing, so HRM must always be aware of changes taking place and then communicate those changes to the entire management organization.

Worker Protection

Safety is a major consideration in all organizations. Oftentimes new laws are created with the goal of setting federal or state standards to ensure worker safety. Unions and union contracts can also impact the requirements for worker safety in a workplace. It is up to the human resource manager to be aware of worker protection requirements and ensure the workplace is meeting both federal and union standards. Worker protection issues might include the following:

- Chemical hazards
- Heating and ventilation requirements
- Use of “no fragrance” zones
- Protection of private employee information

Communication

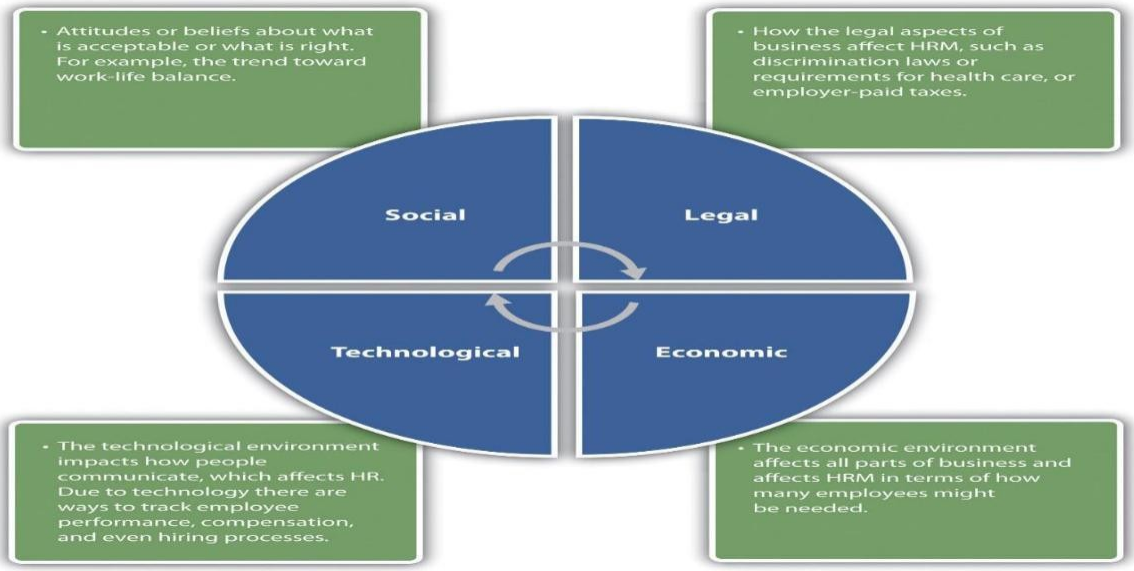
Besides these major roles, good communication skills and excellent management skills are key to successful human resource management as well as general management.

Awareness of External Factors

In addition to managing internal factors, the HR manager needs to consider the outside forces at play that may affect the organization. Outside forces, or external factors, are those things the company has no direct control over; however, they may be things that could positively or negatively impact human resources. External factors might include the following:

1. Globalization and offshoring
2. Changes to employment law
3. Health-care costs
4. Employee expectations
5. Diversity of the workforce
6. Changing demographics of the workforce
7. A more highly educated workforce
8. Layoffs and downsizing
9. Technology used, such as HR databases
10. Increased use of social networking to distribute information to employees

For example, the recent trend in flexible work schedules (allowing employees to set their own schedules) and telecommuting (allowing employees to work from home or a remote location for a specified period of time, such as one day per week) are external factors that have affected HR. HRM has to be aware of these outside issues, so they can develop policies that meet not only the needs of the company but also the needs of the individuals. Another example is the Patient Protection and Affordable Care Act, signed into law in 2010. Compliance with this bill has huge implications for HR. For example, a company with more than fifty employees must provide health-care coverage or pay a penalty. Currently, it is estimated that 60 percent of employers offer health-care insurance to their employees. Because health-care insurance will be mandatory, cost concerns as well as using health benefits as a recruitment strategy are big external challenges. Any manager operating without considering outside forces will likely alienate employees, resulting in unmotivated, unhappy workers. Not understanding the external factors can also mean breaking the law, which has a concerning set of implications as well.



An understanding of key external factors is important to the successful HR professional. This allows him or her to be able to make strategic decisions based on changes in the external environment. To develop this understanding, reading various publications is necessary.

One way managers can be aware of the outside forces is to attend conferences and read various articles on the web. For example, the website of the Society for Human Resource Management, SHRM Online[1], not only has job postings in the field but discusses many contemporary human resource issues that may help the manager make better decisions when it comes to people management.

Most professionals agree that there are seven main tasks HRM professionals perform. All these need to be considered in relation to external and outside forces.

SKILLS NEEDED FOR HRM

One of the major factors of a successful manager or human resource (HR) manager is an array of skills to deal with a variety of situations. It simply isn't enough to have knowledge of HR, such as knowing which forms need to be filled out. It takes multiple skills to create and manage people, as well as a cutting-edge human resource department.

The first skill needed is organization. The need for this skill makes sense, given that you are managing people's pay, benefits, and careers. Having organized files on your computer and good time-management skills are crucial for success in any job, but especially if you take on a role in human resources.

Like most jobs, being able to **multitask**—that is, work on more than one task at a time—is important in managing human resources. A typical person managing human resources may have to deal with an employee issue one minute, then switch and deal with recruiting. Unlike many management positions, which only focus on one task or one part of the business, human resources focuses on all areas of the business, where multitasking is a must.

As trite as it may sound, people skills are necessary in any type of management and perhaps might be the most important skills for achieving success at any job. Being able to manage a variety of personalities, deal with conflict, and coach others are all in the realm of people management. The ability to communicate goes along with people skills. The ability to communicate good news (hiring a new employee), bad news (layoffs), and everything in between, such as changes to policy, makes for an excellent manager and human resource management (HRM) professional.

Keys to a successful career in HRM or management include understanding specific job areas, such as managing the employee database, understanding employment laws, and knowing how to write and develop a strategic plan that aligns with the business. All these skills will be discussed in this book.

A strategic mind-set as an HR professional is a key skill as well. A person with a strategic mind-set can plan far in advance and look at trends that could affect the environment in which the business is operating. Too often, managers focus on their own area and not enough on the business as a whole. The strategic HR professional is able to not only work within his or her area but also understand how HR fits into the bigger picture of the business.

Ethics and a sense of fairness are also necessary in human resources. Ethics is a concept that examines the moral rights and wrongs of a certain situation. Consider the fact that many HR managers negotiate salary and union contracts and manage conflict. In addition, HR managers have the task of ensuring compliance with ethics standards within the organization. Many HR managers are required to work with highly confidential information, such as salary information, so a sense of ethics when managing this information is essential.

Ethics is perhaps one of the most important aspects to being a great HR professional. This humorous video shows how unethical behavior can undermine motivation at work.

Having said that, for those of you wanting a career in HRM, there are three exams you can take to show your mastery of HRM material:

1. **Professional in Human Resources (PHR).** To take this exam, an HR professional must have at least two years' experience. The exam is four hours long and consists of 225 multiple-choice questions in a variety of areas. Twelve percent of the test focuses on strategic management, 26 percent on workforce planning, 17 percent on human resource development, 16 percent on rewards, 22 percent on employee and labor relations, and 7 percent on risk management. The application process for taking the exam is given on the Human Resource Certification Institute website at http://www.hrci.org.
2. **Senior Professional in Human Resources (SPHR).** This exam is designed for HR professionals who focus on designing and planning, rather than actual implementation. It is recommended that

the person taking this exam has six to eight years of experience and oversees and manages an HR department. In this test, the greater focus is on the strategic aspect of HRM.

3. **Global Professional in Human Resources (GPHR).** This exam is for HR professionals who perform many of their tasks on a global level and whose companies often work across borders. This exam is three hours long, with 165 multiple-choice questions. A person with two years of professional experience can take the certification test. However, because the test has the international aspect, someone who designs HR-related programs and processes to achieve business goals would be best suited to earn this certification.

The benefits of achieving certifications are great. In addition to demonstrating the abilities of the HR professional, certification allows the professional to be more marketable in a very competitive field.

Most companies need a human resource department or a manager with HR skills. The industries and job titles are so varied that it is possible only to list general job titles in human resources:

1. Recruiter
2. Compensation analyst
3. Human resources assistant
4. Employee relations manager
5. Benefits manager
6. Work-life coordinator
7. Training and development manager
8. Human resources manager
9. Vice president for human resources

This is not an exhaustive list, but it can be a starting point for research on this career path.

TODAY'S HRM CHALLENGES

- One of the most important aspects to productive HRM is to ensure the department adds value to the rest of the organization, based on the organization's strategic plan.
- One of the major challenges of HRM is containment of costs. This can be done in several ways, for example, in the way health care and benefits are offered. Many companies are developing *cafeteria plans* that satisfy the employee and help contain costs.
- HRM can also contain costs by developing and managing training programs and ensuring employees are well trained to be productive in the job.

- Hiring is a very expensive part of human resources, and therefore HRM should take steps to ensure they are hiring the right people for the job the first time. *Turnover* is a term used to describe the departure of an employee.
- Poor communication results in wasting time and resources. We can communicate better by understanding communication channels, personalities, and styles.
- Technology is also a challenge to be met by human resources. For example, employees may request alternative work schedules because they can use technology at home to get their work done.
- Because technology is part of our work life, *cyberloafing*, or employees spending too much time on the Internet, creates new challenges for managers. Technology can also create challenges such as workplace stress and lack of work-life balance.
- The economy is a major factor in human resource management. HR managers, no matter what the state of the economy, must plan effectively to make sure they have the right number of workers at the right time. When we deal with a down economy, the legal and union implications of layoffs must be considered, and in an up economy, hiring of workers to meet the internal demand is necessary.
- The retirement of *baby boomers* is creating a gap in the workplace, related to not only the number of people available but also the skills people have. *Multigenerational* companies, or companies with workers of a variety of ages, must find ways to motivate employees, even though those employees may have different needs. HR must be aware of this and continually plan for the challenge of a changing workforce. Diversity in the workplace is an important challenge in human resource management.
- Ethics and monitoring of ethical behavior are also challenges in HRM. Setting ethical standards and monitoring ethical behavior, including developing a *code of conduct*, is a must for any successful business.

If you were to ask most business owners what their biggest challenges are, they will likely tell you that cost management is a major factor to the success or failure of their business. In most businesses today, the people part of the business is the most likely place for cuts when the economy isn't doing well.

Consider the expenses that involve the people part of any business:

1. Health-care benefits
2. Training costs
3. Hiring process costs
4. And many more…

These costs cut into the bottom line of any business. The trick is to figure out how much, how many, or how often benefits should be offered, without sacrificing employee motivation. A company can cut costs by not offering benefits or 401(k) plans, but if its goal is to hire the best

people, a hiring package without these items will most certainly not get the best people. Containment of costs, therefore, is a balancing act. An HR manager must offer as much as he or she can to attract and retain employees, but not offer too much, as this can put pressure on the company's bottom line. We will discuss ways to alleviate this concern throughout this book.

For example, there are three ways to cut costs associated with health care:

1. Shift more of the cost of health care to employees
2. Reduce the benefits offered to cut costs
3. Change or better negotiate the plan to reduce health-care cost

PLANNING AND RECRUITMENT

PLANNING

The strategic plan may include long-term goals, while the HR plan may include short-term objectives that are tied to the overall strategic plan. More recently, however, the personnel department has divided into human resource management and human resource development, as these functions have evolved over the century. HRM is not only crucial to an organization's success, but it should be part of the overall company's strategic plan, because so many businesses today depend on people to earn profits. Strategic planning plays an important role in how productive the organization is.

Table 2.1 Examples of Differences between Personnel Management and HRM

Personnel Management Focus	HRM Focus
Administering of policies	Helping to achieve strategic goals through people
Stand-alone programs, such as training	HRM training programs that are integrated with company's mission and values

Personnel Management Focus	HRM Focus
Personnel department responsible for managing people	Line managers share joint responsibility in all areas of people hiring and management
Creates a cost within an organization	Contributes to the profit objectives of the organization

Most people agree that the following duties normally fall under HRM. Each of these aspects has its own part within the overall strategic plan of the organization:

1. **Staffing.** Staffing includes the development of a strategic plan to determine how many people you might need to hire. Based on the strategic plan, HRM then performs the hiring process to recruit and select the right people for the right jobs.
2. **Basic workplace policies.** Development of policies to help reach the strategic plan's goals is the job of HRM. After the policies have been developed, communication of these policies on safety, security, scheduling, vacation times, and flextime schedules should be developed by the HR department. Of course, the HR managers work closely with supervisors in organizations to develop these policies. Workplace policies will be addressed throughout the book.
3. **Compensation and benefits.** In addition to paychecks, 401(k) plans, health benefits, and other perks are usually the responsibility of an HR manager.
4. **Retention.** Assessment of employees and strategizing on how to retain the best employees is a task that HR managers oversee, but other managers in the organization will also provide input.
5. **Training and development.** Helping new employees develop skills needed for their jobs and helping current employees grow their skills are also tasks for which the HRM department is responsible. Determination of training needs and development and implementation of training programs are important tasks in any organization. Succession planning includes handling the departure of managers and making current employees ready to take on managerial roles when a manager does leave.
6. **Regulatory issues and worker safety.** Keeping up to date on new regulations relating to employment, health care, and other issues is generally a responsibility that falls on the HRM department.

In smaller organizations, the manager or owner is likely performing the HRM. They hire people, train them, and determine how much they should be paid. Larger companies ultimately perform the same tasks, but because they have more employees, they can afford to employ specialists, or human resource managers, to handle these areas of the business. As a result, it is highly likely that you, as a manager or entrepreneur, will be performing HRM tasks, hence the value in understanding the strategic components of HRM.

HRM vs. Personnel Management

Human resource strategy is an elaborate and systematic plan of action developed by a human resource department. This definition tells us that an HR strategy includes detailed pathways to implement HRM strategic plans and HR plans. Think of the HRM strategic plan as the major objectives the organization wants to achieve, and the HR plan as the specific activities carried out to achieve the strategic plan.

As mentioned at the beginning of this chapter, human resource departments in the past were called personnel departments. This term implies that the department provided "support" for the rest of the organization. Companies now understand that the human side of the business is the most important asset in any business (especially in this global economy), and therefore HR has much more importance than it did twenty years ago. While personnel management mostly involved activities surrounding the hiring process and legal compliance, human resources involves much more, including strategic planning, which is the focus of this chapter. The Ulrich HR model, a common way to look at HRM strategic planning, provides an overall view of the role of HRM in the organization. His model is said to have started the movement that changed the view of HR; no longer merely a functional area, HR became more of a partnership within the organization. While his model has changed over the years, the current model looks at alignment of HR activities with the overall global business strategy to form a strategic partnership. His newly revised model looks at five main areas of HR:

1. **Strategic partner.** Partnership with the entire organization to ensure alignment of the HR function with the needs of the organization.
2. **Change agent.** The skill to anticipate and respond to change within the HR function, but as a company as a whole.
3. **Administrative expert and functional expert.** The ability to understand and implement policies, procedures, and processes that relate to the HR strategic plan.
4. **Human capital developer.** Means to develop talent that is projected to be needed in the future.
5. **Employee advocate**. Works for employees currently within the organization.

According to Ulrich (Ulrich, 2011), implementation of this model must happen with an understanding of the overall company objectives, problems, challenges, and opportunities. For example, the HR professional must understand the dynamic nature of the HRM environment, such as changes in labor markets, company culture and values, customers, shareholders, and the economy. Once this occurs, HR can determine how best to meet the needs of the organization within these five main areas.

To be successful in writing an HRM strategic plan, one must understand the dynamic external environment.

HRM as a Strategic Component of the Business

David Ulrich discusses the importance of bringing HR to the table in strategic planning.Keeping the Ulrich model in mind, consider these four aspects when creating a good HRM strategic plan:

1. **Make it applicable.** Often people spend an inordinate amount of time developing plans, but the plans sit in a file somewhere and are never actually used. A good strategic plan should be the guiding principles for the HRM function. It should be reviewed and changed as aspects of the business change. Involvement of all members in the HR department if it's a larger department) and communication among everyone within the department will make the plan better.
2. **Be a strategic partner.** Alignment of corporate values in the HRM strategic plan should be a major objective of the plan. In addition, the HRM strategic plan should be aligned with the mission and objectives of the organization as a whole. For example, if the mission of the organization is to promote social responsibility, then the HRM strategic plan should address this in the hiring criteria.
3. **Involve people.** An HRM strategic plan cannot be written alone. The plan should involve everyone in the organization. For example, as the plan develops, the HR manager should meet with various people in departments and find out what skills the best employees have. Then the HR manager can make sure the people recruited and interviewed have similar qualities as the best people already doing the job. In addition, the HR manager will likely want to meet with the financial department and executives who do the budgeting, so they can determine human resource needs and recruit the right number of people at the right times. In addition, once the HR department determines what is needed, communicating a plan can gain positive feedback that ensures the plan is aligned with the business objectives.

4. **Understand how technology can be used.** Organizations oftentimes do not have the money or the inclination to research software and find budget-friendly options for implementation. People are sometimes nervous about new technology. However, the best organizations are those that embrace technology and find the right technology uses for their businesses. There are thousands of HRM software options that can make the HRM processes faster, easier, and more effective. Good strategic plans address this aspect.

HR managers know the business and therefore know the needs of the business and can develop a plan to meet those needs. They also stay on top of current events, so they know what is happening globally that could affect their strategic plan. If they find out, for example, that an economic downturn is looming, they will adjust their strategic plan. In other words, the strategic plan needs to be a living document, one that changes as the business and the world changes.

The Steps to Strategic Plan Creation

HRM strategic plans must have several elements to be successful. There should be a distinction made here: the HRM strategic plan is different from the HR plan. Think of the HRM strategic plan as the major objectives the organization wants to achieve, while the HR plan consists of the detailed plans to ensure the strategic plan is achieved. Oftentimes the strategic plan is viewed as just another report that must be written. Rather than jumping in and writing it without much thought, it is best to give the plan careful consideration.

The goal of "Conduct a Strategic Analysis" is to provide you with some basic elements to consider and research before writing any HRM plans.

Conduct a Strategic Analysis

A strategic analysis looks at three aspects of the individual HRM department:

1. **Understanding of the company mission and values.** It is impossible to plan for HRM if one does not know the values and missions of the organization. As we have already addressed in this chapter, it is imperative for the HR manager to align department objectives with organizational objectives. It is worthwhile to sit down with company executives, management, and supervisors to make sure you have a good understanding of the company mission and values.

Another important aspect is the understanding of the organizational life cycle. You may have learned about the life cycle in marketing or other business classes, and this applies to HRM, too. An organizational life cycle refers to the introduction, growth, maturity, and decline of the organization, which can vary over time. For example, when the organization first begins, it is in the introduction phase, and a different staffing, compensation, training, and labor/employee relations strategy may be necessary to align HRM with the organization's goals. This might be opposed to an organization that is struggling to stay in business and is in the decline phase. That same organization, however, can create a new product, for example, which might again put the organization in the growth phase. Table 2.2 "Lifecycle Stages and HRM Strategy" explains some of the strategies that may be different depending on the organizational life cycle.

2. **Understanding of the HRM department mission and values.** HRM departments must develop their own departmental mission and values. These guiding principles for the department will change as the company's overall mission and values change. Often the mission statement is a list of what the department does, which is less of a strategic approach. Brainstorming about HR goals, values, and priorities is a good way to start. The mission statement should express how an organization's human resources help that organization meet the business goals. A poor mission statement might read as follows: "The human resource department at Techno, Inc. provides resources to hiring managers and develops compensation plans and other services to assist the employees of our company."

   A strategic statement that expresses how human resources help the organization might read as follows: "HR's responsibility is to ensure that our human resources are more talented and motivated than our competitors', giving us a competitive advantage. This will be achieved by monitoring our turnover rates, compensation, and company sales data and comparing that data to our competitors" (Kaufman, 2011). When the mission statement is written in this way, it is easier to take a strategic approach with the HR planning process.

3. **Understanding of the challenges facing the department.** HRM managers cannot deal with change quickly if they are not able to predict changes. As a result, the HRM manager should know what upcoming challenges may be faced to make plans to deal with those challenges better when they come. This makes the strategic plan and HRM plan much more usable.

Table 2.2 Lifecycle Stages and HRM Strategy

Life Cycle Stage	Staffing	Compensation	Training and Development	Labor / Employee Relations
Introduction	Attract best technical and professional talent.	Meet or exceed labor market rates to attract needed talent.	Define future skill requirements and begin establishing career ladders.	Set basic employee-relations philosophy of organization.
Growth	Recruit adequate numbers and mix of qualifying workers. Plan management succession. Manage rapid internal labor market movements.	Meet external market but consider internal equity effects. Establish formal compensation structures.	Mold effective management team through management development and organizational development.	Maintain labor peace, employee motivation, and morale.

Life Cycle Stage	Staffing	Compensation	Training and Development	Labor / Employee Relations
Maturity	Encourage sufficient turnover to minimize layoffs and provide new openings. Encourage mobility as reorganizations shift jobs around.	Control compensation costs.	Maintain flexibility and skills of an aging workforce.	Control labor costs and maintain labor peace. Improve productivity.
Decline	Plan and implement workforce reductions and reallocations; downsizing and outplacement may occur during this stage.	Implement tighter cost control.	Implement retraining and career consulting services.	Improve productivity and achieve flexibility in work rules. Negotiate job security and employment-adjustment policies

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Identify Strategic HR Issues

In this step, the HRM professionals will analyze the challenges addressed in the first step. For example, the department may see that it is not strategically aligned with the company's mission and values and opt to make changes to its departmental mission and values as a result of this information.

Many organizations and departments will use a strategic planning tool that identifies strengths, weaknesses, opportunities, and threats (SWOT analysis) to determine some of the issues they are facing. Once this analysis is performed for the business, HR can align itself with the needs of the business by understanding the business strategy. See Table 2.3 "Sample HR Department SWOT Analysis for Techno, Inc." for an example of how a company's SWOT analysis can be used to develop a SWOT analysis for the HR department.

Once the alignment of the company SWOT is completed, HR can develop its own SWOT analysis to determine the gaps between HR's strategic plan and the company's strategic plan. For example,

if the HR manager finds that a department's strength is its numerous training programs, this is something the organization should continue doing. If a weakness is the organization's lack of consistent compensation throughout all job titles, then the opportunity to review and revise the compensation policies presents itself. In other words, the company's SWOT analysis provides a basis to address some of the issues in the organization, but it can be whittled down to also address issues within the department.

Table 2.3 Sample HR Department SWOT Analysis for Techno, Inc.

Strengths	Hiring talented people
	Company growth
	Technology implementation for business processes
	Excellent relationship between HRM and management/executives
Weaknesses	No strategic plan for HRM
	No planning for up/down cycles
	No formal training processes
	Lacking of software needed to manage business processes, including go-to-market staffing strategies

Opportunities	Development of HRM staffing plan to meet industry growth
	HRM software purchase to manage training, staffing, assessment needs for an unpredictable business cycle
	Continue development of HRM and executive relationship by attendance and participation in key meetings and decision-making processes
	Develop training programs and outside development opportunities to continue development of in-house marketing expertise
Threats	Economy
	Changing technology

Prioritize Issues and Actions

Based on the data gathered in the last step, the HRM manager should prioritize the goals and then put action plans together to deal with these challenges. For example, if an organization identifies that they lack a comprehensive training program, plans should be developed that address this need.

An important aspect of this step is the involvement of the management and executives in the organization. Once you have a list of issues you will address, discuss them with the management and executives, as they may see other issues or other priorities differently than you. Remember, to be effective, HRM must work with the organization and assist the organization in meeting goals. This should be considered in every aspect of HRM planning.

Draw Up an HRM Plan

Once the HRM manager has met with executives and management, and priorities have been agreed upon, the plans are ready to be developed. Sometimes companies have great strategic plans, but when the development of the details occurs, it can be difficult to align the strategic plan with the more detailed plans. An HRM manager should always refer to the overall strategic plan before developing the HRM strategic plan and HR plans.

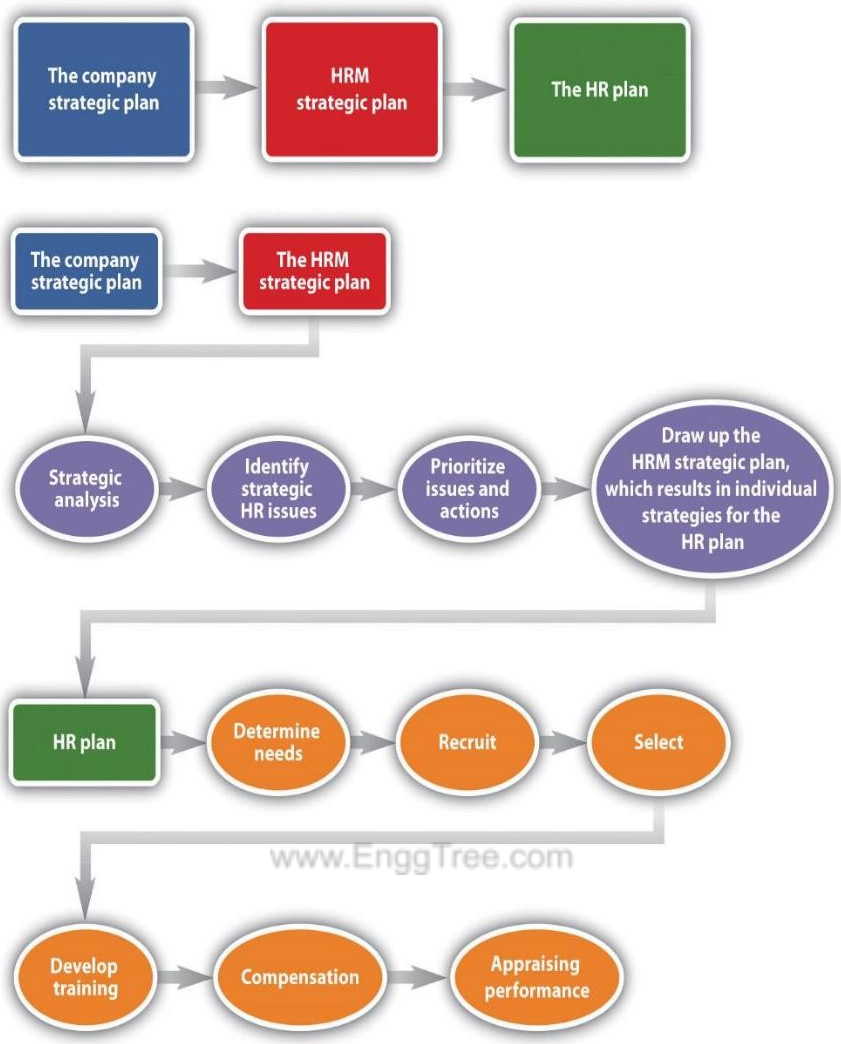
Even if a company does not have an HR department, HRM strategic plans and HR plans should still be developed by management. By developing and monitoring these plans, the organization can ensure the right processes are implemented to meet the ever-changing needs of the organization. The strategic plan looks at the organization as a whole, the HRM strategic plan looks at the department as a whole, and the HR plan addresses specific issues in the human resource department.

Writing the HRM Plan

As the HR manager, you have access to sensitive data, such as pay information. As you are looking at pay for each employee in the marketing department, you notice that two employees with the same job title and performing the same job are earning different amounts of money. As you dig deeper, you notice the employee who has been with the company for the least amount of time is actually getting paid more than the person with longer tenure. A brief look at the performance evaluations shows they are both star performers. You determine that two different managers hired the employees, and one manager is no longer with the organization. How would you handle this?

The six parts of the HRM plan include the following:

1. **Determine human resource needs.** This part is heavily involved with the strategic plan. What growth or decline is expected in the organization? How will this impact your workforce? What is the economic situation? What are your forecasted sales for next year?
2. **Determine recruiting strategy.** Once you have a plan in place, it's necessary to write down a strategy addressing how you will recruit the right people at the right time.
3. **Select employees.** The selection process consists of the interviewing and hiring process.
4. **Develop training.** Based on the strategic plan, what training needs are arising? Is there new software that everyone must learn? Are there problems in handling conflict? Whatever the training topics are, the HR manager should address plans to offer training in the HRM plan.
5. **Determine compensation.** In this aspect of the HRM plan, the manager must determine pay scales and other compensation such as health care, bonuses, and other perks.
6. **Appraise performance.** Sets of standards need to be developed so you know how to rate the performance of your employees and continue with their development.



As you can see from this figure, the company strategic plan ties into the HRM strategic plan, and from the HRM strategic plan, the HR plan can be developed.

Determine Human Resource Needs

The first part of an HR plan will consist of determining how many people are needed. This step involves looking at company operations over the last year and asking a lot of questions:

1. Were enough people hired?
2. Did you have to scramble to hire people at the last minute?
3. What are the skills your current employees possess?
4. What skills do your employees need to gain to keep up with technology?
5. Who is retiring soon? Do you have someone to replace them?
6. What are the sales forecasts? How might this affect your hiring?

These are the questions to answer in this first step of the HR plan process. As you can imagine, this cannot be done alone. Involvement of other departments, managers, and executives should take place to obtain an accurate estimate of staffing needs for now and in the future.

Many HR managers will prepare an inventory of all current employees, which includes their educational level and abilities. This gives the HR manager the big picture on what current employees can do. It can serve as a tool to develop employees' skills and abilities, if you know where they are currently in their development. For example, by taking an inventory, you may find out that Richard is going to retire next year, but no one in his department has been identified or trained to take over his role. Keeping the inventory helps you know where gaps might exist and allows you to plan for these gaps.

Recruit

Recruitment is an important job of the HR manager. Knowing how many people to hire, what skills they should possess, and hiring them when the time is right are major challenges in the area of recruiting. Hiring individuals who have not only the skills to do the job but also the attitude, personality, and fit can be the biggest challenge in recruiting. Depending on the type of job you are hiring for, you might place traditional advertisements on the web or use social networking sites as an avenue. Some companies offer bonuses to employees who refer friends. No matter where you decide to recruit, it is important to keep in mind that the recruiting process should be fair and equitable and diversity should be considered.

Depending on availability and time, some companies may choose to outsource their recruiting processes. For some types of high-level positions, a head hunter will be used to recruit people nationally and internationally. A head hunter is a person who specializes in matching jobs with people, and they usually work only with high-level positions. Another option is to use an agency that specializes in hiring people for a variety of positions, including temporary and permanent positions. Some companies decide to hire temporary employees because they anticipate only a short-term need, and it can be less expensive to hire someone for only a specified period of time.

No matter how it is done, recruitment is the process of obtaining résumés of people interested in the job. In our next step, we review those résumés, interview, and select the best person for the job.

Select

After you have reviewed résumés for a position, now is the time to work toward selecting the right person for the job. Numerous studies have been done, and while they have various results, the majority of studies say it costs an average of $45,000 to hire a new manager (Herman, 1993). While this may seem exaggerated, consider the following items that contribute to the cost:

1. Time to review résumés
2. Time to interview candidates

3. Interview expenses for candidates
4. Possible travel expenses for new hire or recruiter
5. Possible relocation expenses for new hire
6. Additional bookkeeping, payroll, 401(k), and so forth
7. Additional record keeping for government agencies
8. Increased unemployment insurance costs
9. Costs related to lack of productivity while new employee gets up to speed

Because it is so expensive to hire, it is important to do it right. First, résumés are reviewed and people who closely match the right skills are selected for interviews. Many organizations perform phone interviews first so they can further narrow the field. The HR manager is generally responsible for setting up the interviews and determining the interview schedule for a particular candidate. Usually, the more senior the position is, the longer the interview process takes, even up to eight weeks . After the interviews are conducted, there may be reference checks, background checks, or testing that will need to be performed before an offer is made to the new employee. HR managers are generally responsible for this aspect. Once the applicant has met all criteria, the HR manager will offer the selected person the position. At this point, salary, benefits, and vacation time may be negotiated. Compensation is the next step in HR management.

Develop Training

Once we have planned our staffing, recruited people, selected employees, and then compensated them, we want to make sure our new employees are successful. One way we can ensure success is by training our employees in three main areas:

1. **Company culture.** A company culture is the organization's way of doing things. Every company does things a bit differently, and by understanding the corporate culture, the employee will be set up for success. Usually this type of training is performed at an orientation, when an employee is first hired. Topics might include how to request time off, dress codes, and processes.
2. **Skills needed for the job.** If you work for a retail store, your employees need to know how to use the register. If you have sales staff, they need to have product knowledge to do the job. If your company uses particular software, training is needed in this area.
3. **Human relations skills.** These are non-job-specific skills your employees need not only to do their jobs but also to make them all-around successful employees. Skills needed include communication skills and interviewing potential employees.

Perform a Performance Appraisal

The last thing an HR manager should plan is the performance appraisal. It is definitely worth a mention here, since it is part of the strategic plan. A performance appraisal is a method by which

job performance is measured. The performance appraisal can be called many different things, such as the following:

1. Employee appraisal
2. Performance review
3. 360 review
4. Career development review

No matter what the name, these appraisals can be very beneficial in motivating and rewarding employees. The performance evaluation includes metrics on which the employee is measured. These metrics should be based on the job description, both of which the HR manager develops. Various types of rating systems can be used, and it's usually up to the HR manager to develop these as well as employee evaluation forms. The HR manager also usually ensures that every manager in the organization is trained on how to fill out the evaluation forms, but more importantly, how to discuss job performance with the employee. Then the HR manager tracks the due dates of performance appraisals and sends out e-mails to those managers letting them know it is almost time to write an evaluation.

RECRUITMENT

The *recruitment process* is an important part of human resource management (HRM). It isn't done without proper strategic planning. Recruitment is defined as a process that provides the organization with a pool of qualified job candidates from which to choose. Before company's recruit, they must implement proper staffing plans and forecasting to determine how many people they will need. The basis of the forecast will be the annual budget of the organization and the short-to long-term plans of the organization—for example, the possibility of expansion. In addition to this, the organizational life cycle will be a factor. Forecasting is based on both internal and external factors. Internal factors include the following:

1. Budget constraints
2. Expected or trend of employee separations
3. Production levels
4. Sales increases or decreases
5. Global expansion plans

External factors might include the following:

1. Changes in technology
2. Changes in laws

3. Unemployment rates
4. Shifts in population
5. Shifts in urban, suburban, and rural areas
6. Competition

Once the forecasting data are gathered and analyzed, the HR professional can see where gaps exist and then begin to recruit individuals with the right skills, education, and backgrounds. This section will discuss this step in HR planning.

Recruitment Strategy

Although it might seem easy, recruitment of the right talent, at the right place and at the right time, takes skill and practice, but more importantly, it takes strategic planning. An understanding of the labor market and the factors determining the relevant aspects of the labor market is key to being strategic about your recruiting processes.

Based on this information, when a job opening occurs, the HRM professional should be ready to fill that position. Here are the aspects of developing a recruitment strategy:

1. Refer to a staffing plan.
2. Confirm the job analysis is correct through questionnaires.
3. Write the job description and job specifications.
4. Have a bidding system to recruit and review internal candidate qualifications for possible promotions.
5. Determine the best recruitment strategies for the position.
6. Implement a recruiting strategy.

The first step in the recruitment process is acknowledgment of a job opening. At this time, the manager and/or the HRM look at the job description for the job opening (assuming it isn't a new job). We discuss how to write a job analysis and job description.

Assuming the job analysis and job description are ready, an organization may decide to look at internal candidates' qualifications first. Internal candidates are people who are already working for the company.

If an internal candidate meets the qualifications, this person might be encouraged to apply for the job, and the job opening may not be published. Many organizations have formal job posting procedures and bidding systems in place for internal candidates. For example, job postings may be sent to a listserv or other avenue so all employees have access to them. However, the advantage of publishing open positions to everyone in and outside the company is to ensure the organization is diverse.

Then the best recruiting strategies for the type of position are determined. For example, for a high-level executive position, it may be decided to hire an outside head-hunting firm. For an entry-level position, advertising on social networking websites might be the best strategy. Most organizations will use a variety of methods to obtain the best results.

Another consideration is how the recruiting process will be managed under constraining circumstances such as a short deadline or a low number of applications. In addition, establishing a protocol for how applications and résumés will be processed will save time later. For example, some HRM professionals may use software such as Microsoft Excel to communicate the time line of the hiring process to key managers.

Once these tasks are accomplished, the hope is that you will have a diverse group of people to interview (called the selection process). Before this is done, though, it is important to have information to ensure the right people are recruited. This is where the job analysis and job description come in.

Job Analysis and Job Descriptions

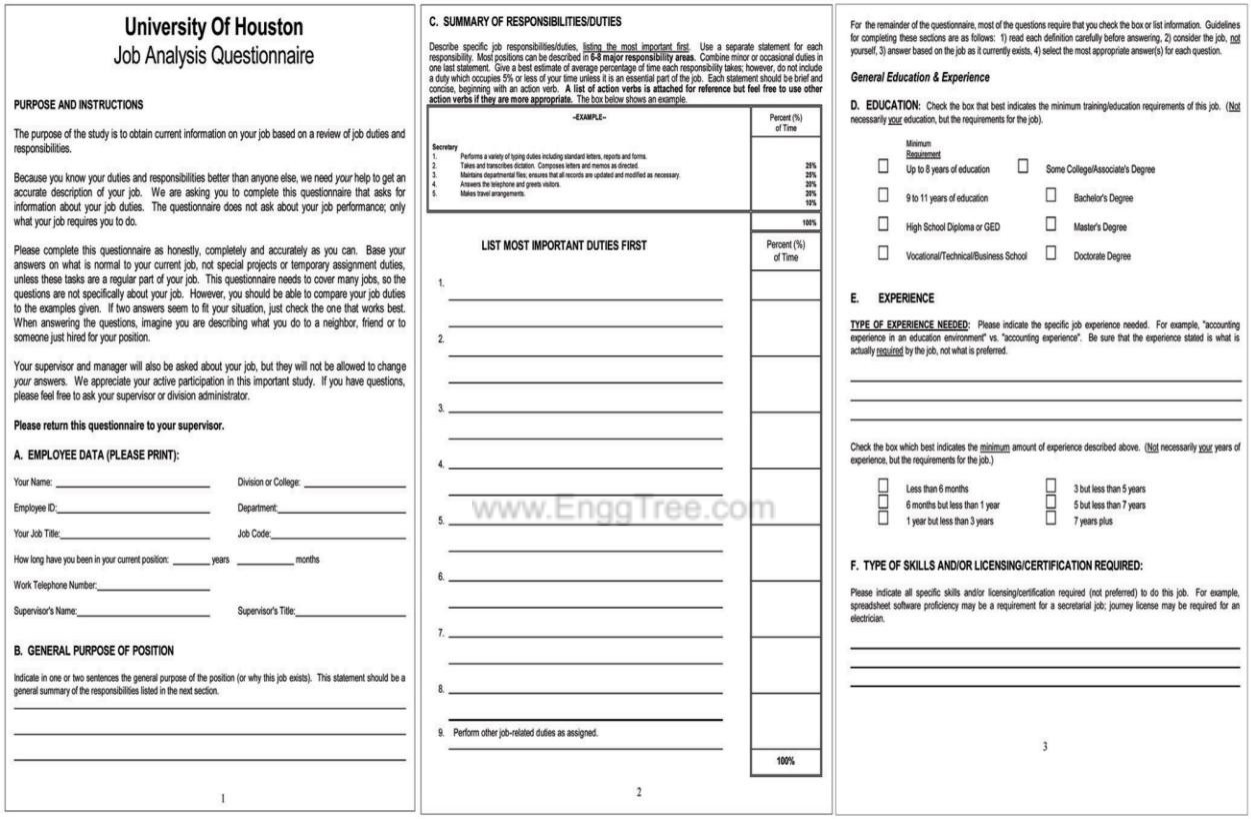
The job analysis is a formal system developed to determine what tasks people actually perform in their jobs. The purpose of a job analysis is to ensure creation of the right fit between the job and the employee and to determine how employee performance will be assessed. A major part of the job analysis includes research, which may mean reviewing job responsibilities of current employees, researching job descriptions for similar jobs with competitors, and analyzing any new responsibilities that need to be accomplished by the person with the position. According to research by Hackman and Oldham (Hackman & Oldham, 1976), a job diagnostic survey should be used to diagnose job characteristics prior to any redesign of a job.

To start writing a job analysis, data need to be gathered and analyzed, keeping in mind Hackman and Oldham's model. Figure 4.1 "Process for Writing the Job Analysis" shows the process of writing a job analysis. Please note, though, that a job analysis is different from a job design. Job design refers to how a job can be modified or changed to be more effective—for example, changing tasks as new technology becomes available.

Figure 4.1 Process for Writing the Job Analysis

The information gathered from the job analysis is used to develop both the job description and the job specifications. A job description is a list of tasks, duties, and responsibilities of a job. Job specifications, on the other hand, discuss the skills and abilities the person must have to perform the job. The two are tied together, as job descriptions are usually written to include job specifications. A job analysis must be performed first, and then based on that data, we can successfully write the job description and job specifications. Think of the analysis as "everything an employee is required and expected to do."

Figure 4.2 Sample Job Analysis Questionnaire



University Of Houston
Job Analysis Questionnaire

PURPOSE AND INSTRUCTIONS

The purpose of the study is to obtain current information on your job based on a review of job duties and responsibilities.

Because you know your duties and responsibilities better than anyone else, we need your help to get an accurate description of your job. We are asking you to complete this questionnaire that asks for information about your job duties. The questionnaire does not ask about your job performance; only what your job requires you to do.

Please complete this questionnaire as honestly, completely and accurately as you can. Base your answers on what is normal to your current job, not special projects or temporary assignment duties, unless these tasks are a regular part of your job. This questionnaire needs to cover many jobs, so the questions are not specifically about your job. However, you should be able to compare your job duties to the examples given. If two answers seem to fit your situation, just check the one that works best. When answering the questions, imagine you are describing what you do to a neighbor, friend or to someone just hired for your position.

Your supervisor and manager will also be asked about your job, but they will not be allowed to change *your* answers. We appreciate your active participation in this important study. If you have questions, please feel free to ask your supervisor or division administrator.

Please return this questionnaire to your supervisor.

A. EMPLOYEE DATA (PLEASE PRINT):

Your Name: _____ Division or College: _____

Employee ID: _____ Department: _____

Your Job Title: _____ Job Code: _____

How long have you been in your current position: _____ years _____ months

Work Telephone Number: _____

Supervisor's Name: _____ Supervisor's Title: _____

B. GENERAL PURPOSE OF POSITION

Indicate in one or two sentences the general purpose of the position (or why this job exists). This statement should be a general summary of the responsibilities listed in the next section.

1

C. SUMMARY OF RESPONSIBILITIES/DUTIES

Describe specific job responsibilities/duties, listing the most important first. Use a separate statement for each responsibility. Most positions can be described in **6-8 major responsibility areas**. Combine minor or occasional duties in one last statement. Give a best estimate of average percentage of time each responsibility takes; however, do not include a duty which occupies 5% or less of your time unless it is an essential part of the job. Each statement should be brief and concise, beginning with an action verb. **A list of action verbs is attached for reference but feel free to use other action verbs if they are more appropriate.** The box below shows an example.

–EXAMPLE–	Percent (%) of Time
Secretary	
1. Performs a variety of typing duties including standard letters, reports and forms.	
2. Takes and transcribes dictation. Composes letters and memos as directed.	25%
3. Maintains departmental files; ensures that all records are updated and modified as necessary.	25%
4. Answers the telephone and greets visitors.	20%
5. Makes travel arrangements.	20%
	10%
	100%

LIST MOST IMPORTANT DUTIES FIRST	Percent (%) of Time
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9. Perform other job-related duties as assigned.	
	100%

2

For the remainder of the questionnaire, most of the questions require that you check the box or list information. Guidelines for completing these sections are as follows: 1) read each definition carefully before answering, 2) consider the job, not yourself, 3) answer based on the job as it currently exists, 4) select the most appropriate answer(s) for each question.

General Education & Experience

D. EDUCATION: Check the box that best indicates the minimum training/education requirements of this job. (Not necessarily your education, but the requirements for the job).

Minimum Requirement			
☐	Up to 8 years of education	☐	Some College/Associate's Degree
☐	9 to 11 years of education	☐	Bachelor's Degree
☐	High School Diploma or GED	☐	Master's Degree
☐	Vocational/Technical/Business School	☐	Doctorate Degree

E. EXPERIENCE

TYPE OF EXPERIENCE NEEDED: Please indicate the specific job experience needed. For example, "accounting experience in an education environment" vs. "accounting experience". Be sure that the experience stated is what is actually required by the job, not what is preferred.

Check the box which best indicates the minimum amount of experience described above. (Not necessarily your years of experience, but the requirements for the job.)

☐	Less than 6 months	☐	3 but less than 5 years
☐	6 months but less than 1 year	☐	5 but less than 7 years
☐	1 year but less than 3 years	☐	7 years plus

F. TYPE OF SKILLS AND/OR LICENSING/CERTIFICATION REQUIRED:

Please indicate all specific skills and/or licensing/certification required (not preferred) to do this job. For example, spreadsheet software proficiency may be a requirement for a secretarial job; journey license may be required for an electrician.

3

This questionnaire shows how an HR professional might gather data for a job analysis. Questionnaires can be completed on paper or online.

G. SUPERVISORY RESPONSIBILITIES

SUPERVISORY NATURE: What is the nature of the direct supervisory responsibility your job has? Check **one** answer.

- ☐ No supervisory responsibility.
- ☐ Work leadership of one or more employees.
- ☐ Supervisor over a section of a department.
- ☐ Assistant Manager over supervisors or a small department.
- ☐ Manager of one department.
- ☐ Manager of more than one department.
- ☐ Director, through managers, of a single department.
- ☐ Director, through managers, of multiple departments.

How many positions report directly to you?

☐ None ☐ 1 ☐ 2-3 ☐ 4-6 ☐ 7 or more

List the title(s) of employee(s) whom you directly supervise:

Title	Grade/Level	Number of Positions

Indicate the total number of employees you indirectly supervise **through supervisors or managers:**

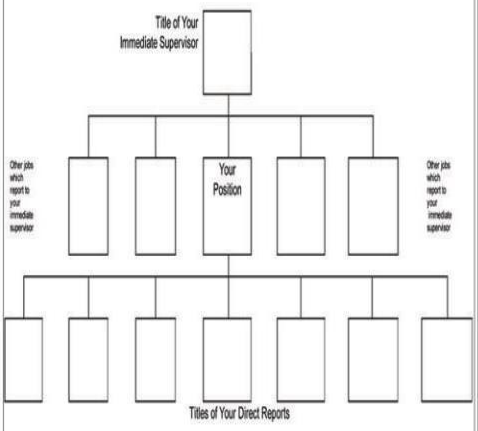
☐ None ☐ 1-5 ☐ 6-10 ☐ 11-20 ☐ 21-50 ☐ 51-100 ☐ 100 +

Does this position require functional supervision of positions that do not report directly to you?

☐ Yes ☐ No

4

Please complete organization chart below:



H. PHYSICAL DEMANDS AND WORKING CONDITIONS

Indicate how often the following physical demands are required to perform the Essential Job Responsibilities.

C=Constantly (5-8 hrs./shift) F=Frequently (2-5 hrs./shift) O=Occasionally (Up to 2 hrs./shift) R=Rarely (Does not exist as regular part of job)

Physical Demands		Environmental Conditions	
Standing		Extreme Cold	
Walking		Extreme Heat	
Sitting		Temperature Changes	
Lifting		Wet	
Carrying		Humid	
Pushing		Noise	
Pulling		Vibration	
Climbing		Hazards	
Balancing		Atmospheric Conditions	
Stooping		Other (define):	
Kneeling			
Crouching			
Crawling			
Reaching		**Physical Strength**	
Handling		Little Physical Effort	
Grasping		Light Work	
Feeling		Medium Work	
Talking		Heavy Work	
Hearing		Very Heavy Work	
Repetitive Motions			
Eye/Hand/Foot Coordination			

5

I. GENERAL EMPLOYEE COMMENTS

Because no single questionnaire can cover every part of a job, can you think of any other information that would be important in understanding your job? If so, please give us your comments below.

Employee's Signature: _____

Date: _____

6

J. SUPERVISOR'S REVIEW SECTION

Based on your understanding of the job as it currently exists, please review the employee's response and provide your own comments in the space provided below. **Please do not change the employee's responses.**

The questionnaire is intended to analyze the job as it is currently being done and not how it might be done in the future. **The employee's level of performance in the job is not part of this review and is not to be considered.**

Section	Remarks

Supervisor's Name:_____ Title:_____

Supervisor's Signature:_____ Date:_____

Telephone Number:_____

K. REVIEWING OFFICIAL'S REVIEW SECTION

Based on your understanding of the job as it currently exists, please review the employee's response and provide your own comments in the space provided below. **Please do not change the employee's or supervisor's responses.**

The questionnaire is intended to analyze the job as it is currently being done and not how it might be done in the future. **The employee's level of performance in the job is not part of this review and is not to be considered.**

Section	Remarks

Reviewing Official's Name:_____ Title:_____

Reviewing Official's Signature:_____ Date:_____

Telephone Number:_____

This questionnaire is to be forwarded next to your division administrator.

Division administrator, please initial to indicate review _____.
(Attach additional page(s) for clarifying comments, as necessary.)

7

ACTION VERBS
ATTACHMENT

This list of action verbs should be used to assist you in completing the Summary of Responsibilities section. These verbs are useful in identifying and defining job functions. Although many of the terms may seem obvious, definitions are provided in the interest of consistency.

Administer—Manage or direct the execution of affairs.
Adopt—Take up and practice as one's own.
Advise—Recommend a course of action; offer an informed opinion based on specialized knowledge
Analyze—Separate into elements and critically examine.
Anticipate—Foresee and deal with in advance.
Appraise—Give an expert judgement of worth or merit.
Approve—Accept as satisfactory; exercise final authority with regard to commitment of resources.
Arrange—Make preparation for an event; put in proper order.
Assemble—Collect or gather together in a predetermined order from various sources.
Assign—Specify or designate tasks or duties to be performed by others.
Assume—Undertake; take for granted.
Assure—Give confidence; make certain of.
Authorize—Approve; empower through vested authority.
Calculate—Make a mathematical computation.
Circulate—Pass from person to person or place to place.
Clean—To remove dirt or make tidy.
Clear—Gain approval of others.
Collaborate—Work jointly with; cooperate with others.
Collect—Gather.
Compile—Put together information; collect from other documents.
Concur—Agree with a position, statement, action, or opinion.
Conduct—Carry on; direct the execution of.
Confer—Consult with others to compare views.
Consolidate—Bring together.
Construct—Build, make or modify.
Consult—Seek the advice of others.
Control—Measure, interpret, and evaluate actions for conformance with plans or desired results.
Coordinate—Regulate, adjust, or combine the actions of others to attain harmony.
Correlate—Establish a reciprocal relationship.
Correspond—Communicate with.
Debug—To detect, locate and remove mistakes from a routine of malfunctions from a computer.
Delegate—Commission another to perform tasks or duties that may carry specific degrees of accountability.
Deliver—Carry to intended destination.
Design—Conceive, create, and execute according to plan.
Determine—Resolve; fix conclusively.
Develop—Disclose, discover, perfect, or unfold a plan or idea.
Devise—Come up with something new; perhaps by combining or applying known ideas or principles.
Direct—Guide work operations through the establishment of objectives, policies, rules, practices, methods, and standards.
Discuss—Exchange views for the purpose of arriving at a conclusion.
Dispose—Get rid of.
Disseminate—Spread or disperse information.
Distribute—Deliver to proper destinations.
Draft—Prepare papers or documents in preliminary form.
Endorse—Support or recommend.
Establish—Bring into existence.
Estimate—Forecast future requirements.
Evaluate—Determine or fix the value of.
Execute—Put into effect or carry out.
Exercise—Exert.

8

Expedite—Accelerate the process or progress of.
Formulate—Develop or devise.
Furnish—Provide with what is needed; supply.
Implement—Carry out; execute a plan or program.
Improve—Make something better.
Initiate—Start or introduce.
Inspect—Critically examine for suitability.
Install—To set up for use.
Interpret—Explain something to others.
Investigate—Study through close examination and systematic inquiry.
Issue—Put forth or to distribute officially.
Maintain—Keep in an existing state.
Monitor—Watch, observe, or check with an eye to reaching agreement.
Notify—Make known to.
Operate—Perform an activity or series of activities.
Participate—Take part in.
Perform—Fulfill or carry out some action.
Place—Locate and choose position for.
Plan—Devise or project the realization of a course of action.
Practice—Perform work repeatedly in order to gain proficiency.
Prepare—Make ready for a particular purpose.
Proceed—Begin to carry out an action.
Process—Subject something to special treatment; handle in accordance with prescribed procedure.
Promote—Advance to a higher level or position.
Propose—Declare a plan or intention.
Provide—Supply what is needed; furnish.
Recommend—Advise or counsel a course of action; offer or suggest for adoption.
Repair—Fix or make usable.
Represent—Act in the place of or for.
Report—Give an account of; furnish information or data.
Research—Inquire into a specific matter from several sources.
Review—Examine or re-examine.
Revise—Rework in order to correct or improve.
Schedule—Plan a timetable.
Secure—Gain possession of; make safe.
Select—Choose the best suited.
Sign—Formally approve a document by affixing a signature.
Sort—To separate or arrange according to a plan.
Specify—State precisely in detail or name explicitly.
Stimulate—Excite to activity; urge.
Submit—Yield or present for the discretion or judgement of others.
Supervise—Personally oversee, direct, inspect, or guide the work of others with responsibility for meeting standards of performance.
Train—Teach or guide others in order to bring up to a predetermined standard.
Transcribe—Transfer data from one form of record to another or from one method of preparation to another, without changing the nature of the data.
Verify—Confirm or establish authenticity; substantiate.
Write—To compose or draft.

9

Two types of job analyses can be performed: a task-based analysis and a competency- or skills-based analysis. A task-based analysis focuses on the duties of the job, as opposed to a competency-based analysis, which focuses on the specific knowledge and abilities an employee must have to perform the job. An example of a task-based analysis might include information on the following:

1. Write performance evaluations for employees.
2. Prepare reports.
3. Answer incoming phone calls.
4. Assist customers with product questions.
5. Cold-call three customers a day.

With task job analysis, the specific tasks are listed and it is clear. With competency based, it is less clear and more objective. However, competency-based analysis might be more appropriate for specific, high-level positions. For example, a competency-based analysis might include the following:

1. Able to utilize data analysis tools
2. Able to work within teams
3. Adaptable
4. Innovative

You can clearly see the difference between the two. The focus of task-based analyses is the job duties required, while the focus of competency-based analyses is on how a person can apply their skills to perform the job. One is not better than the other but is simply used for different purposes and different types of jobs. For example, a task-based analysis might be used for a receptionist, while a competency-based analysis might be used for a vice president of sales position. Consider the legal implications, however, of which job analysis is used. Because a competency-based job analysis is more subjective, it might be more difficult to tell whether someone has met the criteria.

Once you have decided if a competency-based or task-based analysis is more appropriate for the job, you can prepare to write the job analysis. Of course, this isn't something that should be done alone. Feedback from managers should be taken into consideration to make this task useful in all levels of the organization. Organization is a key component to preparing for your job analysis. For example, will you perform an analysis on all jobs in the organization or just focus on one department? Once you have determined how you will conduct the analysis, a tool to conduct the analysis should be chosen. Most organizations use questionnaires (online or hard copy) to determine the duties of each job title. Some organizations will use face-to-face interviews to perform this task, depending on time constraints and the size of the organization. A job analysis questionnaire usually includes the following types of questions, obviously depending on the type of industry:

1. Employee information such as job title, how long in position, education level, how many years of experience in the industry
2. Key tasks and responsibilities
3. Decision making and problem solving: this section asks employees to list situations in which problems needed to be solved and the types of decisions made or solutions provided.
4. Level of contact with colleagues, managers, outside vendors, and customers
5. Physical demands of the job, such as the amount of heavy lifting or ability to see, hear, or walk
6. Personal abilities required to do the job—that is, personal characteristics needed to perform well in this position
7. Specific skills required to do the job—for example, the ability to run a particular computer program
8. Certifications to perform the job

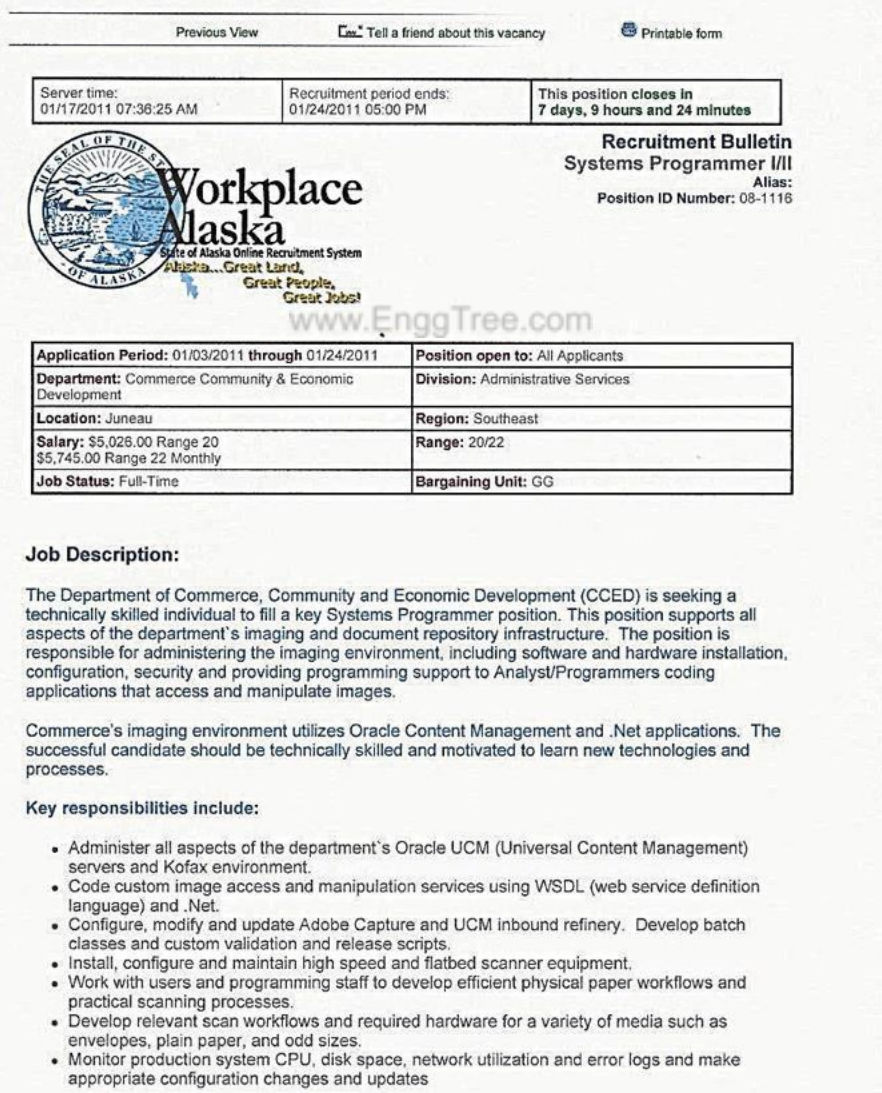
Once all employees (or the ones you have identified) have completed the questionnaire, you can organize the data, which is helpful in creating job descriptions. If there is more than one person completing a questionnaire for one job title, the data should be combined to create one job analysis

for one job title. There are a number of software packages available to help human resources perform this task, such as AutoGOJA.

Once the job analysis has been completed, it is time to write the job description and specifications, using the data you collected. Job descriptions should always include the following components:

1. Job functions (the tasks the employee performs)
2. Knowledge, skills, and abilities (what an employee is expected to know and be able to do, as well as personal attributes)
3. Education and experience required
4. Physical requirements of the job (ability to lift, see, or hear, for example)

Figure 4.3 Sample Job Description



Previous View | Tell a friend about this vacancy | Printable form

Server time: 01/17/2011 07:36:25 AM	Recruitment period ends: 01/24/2011 05:00 PM	This position closes in 7 days, 9 hours and 24 minutes

Workplace Alaska
State of Alaska Online Recruitment System
Alaska...Great Land, Great People, Great Jobs!

Recruitment Bulletin
Systems Programmer I/II
Alias:
Position ID Number: 08-1116

Application Period: 01/03/2011 **through** 01/24/2011	**Position open to:** All Applicants
Department: Commerce Community & Economic Development	**Division:** Administrative Services
Location: Juneau	**Region:** Southeast
Salary: $5,026.00 Range 20 $5,745.00 Range 22 Monthly	**Range:** 20/22
Job Status: Full-Time	**Bargaining Unit:** GG

Job Description:

The Department of Commerce, Community and Economic Development (CCED) is seeking a technically skilled individual to fill a key Systems Programmer position. This position supports all aspects of the department's imaging and document repository infrastructure. The position is responsible for administering the imaging environment, including software and hardware installation, configuration, security and providing programming support to Analyst/Programmers coding applications that access and manipulate images.

Commerce's imaging environment utilizes Oracle Content Management and .Net applications. The successful candidate should be technically skilled and motivated to learn new technologies and processes.

Key responsibilities include:

- Administer all aspects of the department's Oracle UCM (Universal Content Management) servers and Kofax environment.
- Code custom image access and manipulation services using WSDL (web service definition language) and .Net.
- Configure, modify and update Adobe Capture and UCM inbound refinery. Develop batch classes and custom validation and release scripts.
- Install, configure and maintain high speed and flatbed scanner equipment.
- Work with users and programming staff to develop efficient physical paper workflows and practical scanning processes.
- Develop relevant scan workflows and required hardware for a variety of media such as envelopes, plain paper, and odd sizes.
- Monitor production system CPU, disk space, network utilization and error logs and make appropriate configuration changes and updates

Notice how the job description includes the job function; knowledge, skills, and abilities required to do the job; education and experience required; and the physical requirements of the job.

Once the job description has been written, obtaining approval from the hiring manager is the next step. Then the HR professional can begin to recruit for the position.

Tips to Writing a Good Job Description

- Be sure to include the pertinent information:
  - Title
  - Department
  - Reports to
  - Duties and responsibilities
  - terms of employment
  - qualifications needed
- Think of the job description as a snapshot of the job.
- Communicate clearly and concisely.
- Make sure the job description is interesting to the right candidate applying for the job.
- Avoid acronyms.
- Don't try to fit all job aspects into the job description.
- Proofread the job description.

The Law and Recruitment

- *IRCA* stands for *Immigration and Reform Act*. This law requires all employers to determine eligibility of an employee to work in the United States. The reporting form is called an I-9 and must be completed and kept on file (paper or electronic) for at least three years, but some states require this documentation to be kept on file for the duration of the employee's period of employment.
- The *Patriot Act* allows the government access to data that would normally be considered private—for example, an employee's records and work voice mails and e-mails (without the

company's consent). The HR professional might consider letting employees know of the compliance with this law.

- The *EEOC* is a federal agency charged with ensuring discrimination does not occur in the workplace. They oversee the equal employment opportunity (EEO) set of laws. Organizations must post EEO laws in a visible location at their workplace and also include them on job announcements.
- Related to the EEOC, the *bona fide occupational qualification (BFOQ)* makes it legal to discriminate in hiring based on special circumstances—for example, requiring the retirement of airline pilots at a certain age due to safety concerns.
- *Disparate impact* refers to a policy that may limit a protected EEO group from receiving fair treatment. Disparate impact might include a test or requirement that negatively impacts someone based on protected group status. An example is requiring a high school diploma, which may not directly impact the job. *Disparate treatment* refers to discrimination against an individual, such as the hiring of one person over another based on race or gender.

RECRUITMENT STRATEGIES

Now that we have discussed development of the job analysis, job description, and job specifications, and you are aware of the laws relating to recruitment, it is time to start recruiting. It is important to mention, though, that a recruitment plan should be in place.

Recruiters

Some organizations choose to have specific individuals working for them who focus solely on the recruiting function of HR. Recruiters use similar sources to recruit individuals, such as professional organizations, websites, and other methods discussed in this chapter. Recruiters are excellent at networking and usually attend many events where possible candidates will be present. Recruiters keep a constant pipeline of possible candidates in case a position should arise that would be a good match. There are three main types of recruiters:

1. **Executive search firm.** These companies are focused on high-level positions, such as management and CEO roles. They typically charge 10–20 percent of the first year salary, so they can be quite expensive. However, they do much of the upfront work, sending candidates who meet the qualifications.
2. **Temporary recruitment or staffing firm.** Suppose your receptionist is going on medical leave and you need to hire somebody to replace him, but you don't want a long-term hire. You can utilize the services of a temporary recruitment firm to send you qualified candidates who are willing to work shorter contracts. Usually, the firm pays the salary of the employee and the company pays the recruitment firm, so you don't have to add this person to your payroll. If the person does a good job, there may be opportunities for you to offer him or her a full-time, permanent position. Kelly Services, Manpower, and Snelling Staffing Services are examples of staffing firms.

3. **Corporate recruiter.** A corporate recruiter is an employee within a company who focuses entirely on recruiting for his or her company. Corporate recruiters are employed by the company for which they are recruiting. This type of recruiter may be focused on a specific area, such as technical recruiting.

A contingent recruiter is paid only when the recruiter starts working, which is often the case with temporary recruitment or staffing firms. A retained recruiter gets paid up front (in full or a portion of the fee) to perform a specific search for a company.

While the HR professional, when using recruiters, may not be responsible for the details of managing the search process, he or she is still responsible for managing the process and the recruiters. The job analysis, job description, and job specifications still need to be developed and candidates will still need to be interviewed.

Campus Recruiting

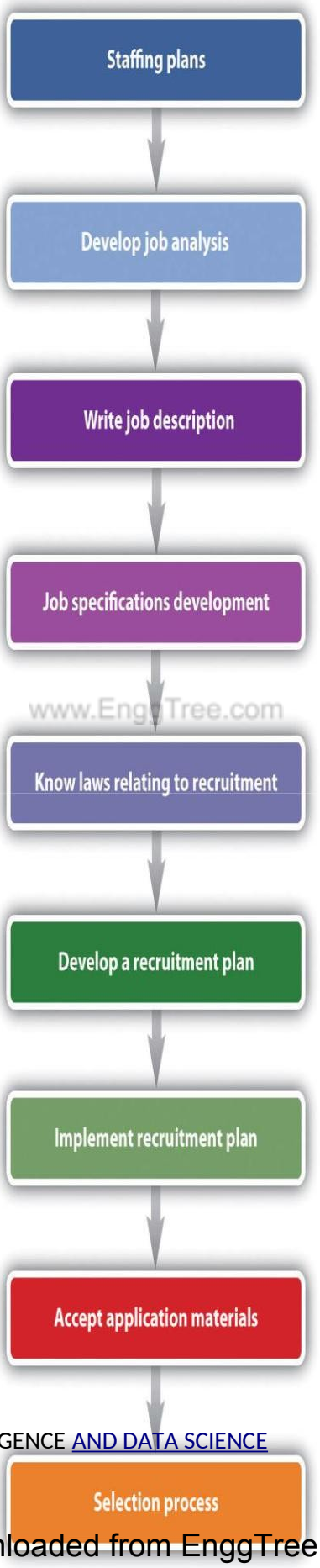
Colleges and universities can be excellent sources of new candidates, usually at entry-level positions. Consider technical colleges that teach cooking, automotive technology, or cosmetology. These can be great sources of people with specialized training in a specific area. Universities can provide people that may lack actual experience but have formal training in a specific field. Many organizations use their campus recruiting programs to develop new talent, who will eventually develop into managers.

For this type of program to work, it requires the establishment of relationships with campus communities, such as campus career services departments. It can also require time to attend campus events, such as job fairs. IBM, for example, has an excellent campus recruiting program. For IBM, recruiting out of college ensures a large number of people to grow with the organization.

Setting up a formal internship program might also be a way to utilize college and university contacts. Walgreens, for example, partners with Apollo College to recruit interns; this can result in full-time employment for the motivated intern and money saved for Walgreens by having a constant flow of talent.

Overview of the Steps to the Recruitment Process:

- HR professionals must have a recruiting plan before posting any job description. The plan should outline where the job announcements will be posted and how the management of candidate materials, such as résumés, will occur. Part of the plan should also include the expected cost of recruitment.
- Many organizations use recruiters. Recruiters can be executive recruiters, which means an outside firm performs the search. For temporary positions, a temporary or staffing firm such as Kelly Services might be used. Corporate recruiters work for the organization and function as a part of the HR team.



Websites

If you have ever had to look for a job, you know there are numerous websites to help you do that. Some examples of websites might include the following:

- Your own company website
- Yahoo HotJobs
- Monster
- CareerBuilder
- JobCentral

Social Media

Facebook, Twitter, LinkedIn, YouTube, and MySpace are excellent places to obtain a media presence to attract a variety of workers. The goal of using social media as a recruiting tool is to create a buzz about your organization, share stories of successful employees, and tout an interesting culture. Even smaller companies can utilize this technology by posting job openings as their status updates. This technique is relatively inexpensive, but there are some things to consider. For example, tweeting about a job opening might spark interest in some candidates, but the trick is to show your personality as an employer early on.

Facebook allows free job postings in Facebook Marketplace, and the company Facebook page can also be used as a recruiting tool. Some organizations decide to use Facebook ads, which are paid on a “per click” or per impression (how many people potentially see the ad) basis. Facebook ad technology allows specific regions and Facebook keywords to be targeted.

Events

Many organizations, such as Microsoft, hold events annually to allow people to network and learn about new technologies. Microsoft’s Professional Developer Conference (PDC), usually held in July, hosts thousands of web developers and other professionals looking to update their skills and meet new people.

Special/Specific Interest Groups (SIGs)

Special/specific interest groups (SIGs), which may require membership of individuals, focus on specific topics for members. Often SIGs will have areas for job posting, or a variety of discussion boards where jobs can be posted. For example, the Women in Project Management SIG provides news on project management and also has a place for job advertisements. Other examples of SIGs might include the following:

- Oracle Developer SIG
- African American Medical Librarians Alliance SIG
- American Marketing Association Global Marketing SIG
- Special Interest Group for Accounting Information Systems (SIG-ASYS)
- Junior Lawyer SIG

Recruiting using SIGs can be a great way to target a specific group of people who are trained in a specific area or who have a certain specialty.

Referrals

- Employee referrals can be a great way to get interest for a posted position. Usually, incentives are offered to the employee for referring people they know. However, diversity can be an issue, as can *nepotism*.

Costs of Recruitment

Our last consideration in the recruitment process is recruitment costs. We can determine this by looking at the total amount we have spent on all recruiting efforts compared to the number of hires. A *yield ratio* is used to determine how effective recruiting efforts are in one area. For example, we can look at the number of total applicants received from a particular form of media, and divide that by the number of those applicants who make it to the next step in the process (e.g., they receive an interview

ADVANTAGES AND DISADVANTAGES OF RECRUITING METHODS

Recruitment Method	Advantages	Disadvantages
Outside recruiters, executive search firms, and temporary employment agencies	Can be time saving	Expensive
		Less control over final candidates to be interviewed
Campus recruiting/educational institutions	Can hire people to grow with the organization	Time consuming
	Plentiful source of talent	Only appropriate for certain types of experience levels
Professional organizations and associations	Industry specific	May be a fee to place an ad
	Networking	May be time-consuming to network
Websites/Internet recruiting	Diversity friendly	Could be too broad
	Low cost	Be prepared to deal with hundreds of résumés
	Quick	
Social media	Inexpensive	Time consuming
		Overwhelming response
Events	Access to specific target markets of candidates	Can be expensive
		May not be the right target market
SIG	Industry specific	Research required for specific SIGS tied to jobs
Referrals	Higher quality people	Concern for lack of diversity
	Retention	Nepotism
Unsolicited résumés and applications	Inexpensive, especially with time-saving keyword résumé search software	Time consuming
Internet and/or traditional advertisements	Can target a specific audience	Can be expensive

Employee leasing	For smaller organizations, it means someone does not have to administer compensation and benefits, as this is handled by leasing company	Possible costs
	Can be a good alternative to temporary employment if the job is permanent	Less control of who interviews for the position
Public employment agencies	The potential ability to recruit a more diverse workforce	May receive many résumés, which can be time-consuming
	No cost, since it's a government agency	
	2,300 points of service nationwide	
Labor unions	Access to specialized skills	May not apply to some jobs or industries
		Builds relationship with the union

The Selection Process

Once you have developed your recruitment plan, recruited people, and now have plenty of people to choose from, you can begin the selection process. The selection process refers to the steps involved in choosing people who have the right qualifications to fill a current or future job opening. Usually, managers and supervisors will be ultimately responsible for the hiring of individuals, but the role of human resource management (HRM) is to define and guide managers in this process. The selection process is expensive. The time for all involved in the hiring process to review résumés, weight the applications, and interview the best candidates takes away time (and costs money) that those individuals could spend on other activities.

The selection process consists of five distinct aspects:

1. **Criteria development.** All individuals involved in the hiring process should be properly trained on the steps for interviewing, including developing criteria, reviewing résumés, developing interview questions, and weighting the candidates.

   The first aspect to selection is planning the interview process, which includes criteria development. Criteria development means determining which sources of information will be used and how those sources will be scored during the interview. The criteria should be related directly to the job analysis and the job specifications.

   In fact, some aspects of the job analysis and job specifications may be the actual criteria. In addition to this, include things like personality or cultural fit, which would also be part of criteria development. This process usually involves discussing which skills, abilities, and personal characteristics are required to be successful at any given job. By developing the criteria before reviewing any résumés, the HR manager or manager can be sure he or she is being fair in selecting

people to interview. Some organizations may need to develop an application or a biographical information sheet. Most of these are completed online and should include information about the candidate, education, and previous job experience.

2. **Application and résumé review.** Once the criteria have been developed (step one), applications can be reviewed. People have different methods of going through this process, but there are also computer programs that can search for keywords in résumés and narrow down the number of résumés that must be looked at and reviewed.
3. **Interviewing.** After the HR manager and/or manager have determined which applications meet the minimum criteria, he or she must select those people to be interviewed. Most people do not have time to review twenty or thirty candidates, so the field is sometimes narrowed even further with a phone interview.
4. **Test administration.** Any number of tests may be administered before a hiring decision is made. These include drug tests, physical tests, personality tests, and cognitive tests. Some organizations also perform reference checks, credit report checks, and background checks. Once the field of candidates has been narrowed down, tests can be administered.
5. **Making the offer.** The last step in the selection process is to offer a position to the chosen candidate. Development of an offer via e-mail or letter is sometimes a more formal part of this process. Compensation and benefits will be defined in an offer.

The Selection Process at a Glance

Criteria Development	• Understand KSAOs • Determine sources of KSAO information such as testing, interviews • Develop scoring system for each of the sources of information • Create an interview plan
Application and Resume Review	• Should be based on criteria developed in step one • Consider internal versus external candidates
Interview	• Determine types of interview(s) • Write interview questions • Be aware of interview bias
Test Administration	 • Perform testing as outlined in criteria development; could include reviewing work samples, drug testing or written cognitive and personality tests
Selection	• Determine which selection method will be used • Compare selection method criteria
Making the Offer	• Use negotiation techniques • Write the offer letter or employment agreement

TRAINING AND DEVELOPMENT

TRAINING

Any effective company has training in place to make sure employees can perform his or her job. During the recruitment and selection process, the right person should be hired to begin with. But even the right person may need training in how your company does things. Lack of training can result in lost productivity, lost customers, and poor relationships between employees and managers. It can also result in dissatisfaction, which means retention problems and high turnover. All these end up being direct costs to the organization. In fact, a study performed by the American Society for Training and Development (ASTD) found that 41 percent of employees at companies with poor training planned to leave within the year, but in companies with excellent training, only 12 percent planned to leave. To reduce some costs associated with not training or undertraining, development of training programs can help with some of the risk. This is what this chapter will address.

For effective employee training, there are four steps that generally occur. First, the new employee goes through an orientation, and then he or she will receive in-house training on job-specific areas. Next, the employee should be assigned a mentor, and then, as comfort with the job duties grows, he or she may engage in external training. **Employee training and development is the process of helping employees develop their personal and organization skills, knowledge, and abilities.**

Steps to Take in Training an Employee

(1)Employee Orientation

The first step in training is an employee orientation. Employee orientation is the process used for welcoming a new employee into the organization. The importance of employee orientation is two-fold. First, the goal is for employees to gain an understanding of the company policies and learn how their specific job fits into the big picture.

The goals of an orientation are as follows:

1. **To reduce start-up costs.** If an orientation is done right, it can help get the employee up to speed on various policies and procedures, so the employee can start working right away. It can also be a way to ensure all hiring paperwork is filled out correctly, so the employee is paid on time.
2. **To reduce anxiety.** Starting a new job can be stressful. One goal of an orientation is to reduce the stress and anxiety people feel when going into an unknown situation.
3. **To reduce employee turnover.** Employee turnover tends to be higher when employees don't feel valued or are not given the tools to perform. An employee orientation can show that the organization values the employee and provides tools necessary for a successful entry.

4. **To save time for the supervisor and coworkers.** A well-done orientation makes for a better prepared employee, which means less time having to teach the employee.
5. **To set expectations and attitudes.** If employees know from the start what the expectations are, they tend to perform better. Likewise, if employees learn the values and attitudes of the organization from the beginning, there is a higher chance of a successful tenure at the company.

(2) In-House Training

In-house training programs are learning opportunities developed by the organization in which they are used. This is usually the second step in the training process and often is ongoing. In-house training programs can be training related to a specific job, such as how to use a particular kind of software. In a manufacturing setting, in-house training might include an employee learning how to use a particular kind of machinery.

Many companies provide in-house training on various HR topics as well, meaning it doesn't always have to relate to a specific job. Some examples of in-house training include the following:

- Ethics training
- Sexual harassment training
- Multicultural training
- Communication training
- Management training
- Customer service training
- Operation of special equipment
- Training to do the job itself
- Basic skills training

As you can tell by the list of topics, HR might sometimes create and deliver this training, but often a supervisor or manager delivers the training.

(3) Mentoring

After the employee has completed orientation and in-house training, companies see the value in offering mentoring opportunities as the next step in training. Sometimes a mentor may be assigned during in-house training. A mentor is a trusted, experienced advisor who has direct investment in the development of an employee. A mentor may be a supervisor, but often a mentor is a colleague who has the experience and personality to help guide someone through processes. While mentoring may occur informally, a mentorship program can help ensure the new employee not only feels welcomed but is paired up with someone who already knows the ropes and can help guide the new employee through any on-the-job challenges.

To work effectively, a mentoring program should become part of the company culture; in other words, new mentors should receive in-house training to be a mentor. Mentors are selected based on experience, willingness, and personality.

However, potential mentors are trained and put into a database where new employees can search attributes and strengths of mentors and choose the person who closely meets their needs. Then the mentor and mentee work together in development of the new employee. “We view this as a best practice,” says Patricia Lewis-Burton, vice president of human resources, Integrated Supply Chain Division. “We view it as something that is not left to human resources alone.

Some companies use short-term mentorship programs because they find employees training other employees to be valuable for all involved. Starbucks, for example, utilizes this approach. When it opens a new store in a new market, a team of experienced store managers and baristas are sent from existing stores to the new stores to lead the store-opening efforts, including training of new employees.

(4) External Training

External training includes any type of training that is not performed in-house. This is usually the last step in training, and it can be ongoing. It can include sending an employee to a seminar to help further develop leadership skills or helping pay tuition for an employee who wants to take a marketing class. To be a Ford automotive technician, for example, you must attend the Ford ASSET Program, which is a partnership between Ford Motor Company, Ford dealers, and select technical schools.

TYPES OF TRAINING

There are a number of different types of training we can use to engage an employee. These types are usually used in all steps in a training process (orientation, in-house, mentorship, and external training). The training utilized depends on the amount of resources available for training, the type of company, and the priority the company places on training. Companies such as The Cheesecake Factory, a family restaurant, make training a high priority. The company spends an average of $2,000 per hourly employee. This includes everyone from the dishwasher and managers to the servers.

For The Cheesecake Factory, this expenditure has paid off. They measure the effectiveness of its training by looking at turnover, which is 15 percent below the industry average (Ruiz, 2006). Servers make up 40 percent of the workforce and spend two weeks training to obtain certification. Thirty days later, they receive follow-up classes, and when the menu changes, they receive additional training (Ruiz, 2006). Let’s take a look at some of the training we can offer our employees. As you will see from the types of training below, no one type would be enough for the

jobs we do. Most HR managers use a variety of these types of training to develop a holistic employee.

(1) Technical or Technology Training

Depending on the type of job, technical training will be required. Technical training is a type of training meant to teach the new employee the technological aspects of the job. In a retail environment, technical training might include teaching someone how to use the computer system to ring up customers. In a sales position, it might include showing someone how to use the customer relationship management (CRM) system to find new prospects. In a consulting business, technical training might be used so the consultant knows how to use the system to input the number of hours that should be charged to a client. In a restaurant, the server needs to be trained on how to use the system to process orders. Let's assume your company has decided to switch to the newest version of Microsoft Office. This might require some technical training of the entire company to ensure everyone uses the technology effectively. Technical training is often performed in-house, but it can also be administered externally.

(2) Quality Training

In a production-focused business, quality training is extremely important. Quality training refers to familiarizing employees with the means of preventing, detecting, and eliminating no quality items, usually in an organization that produces a product. In a world where quality can set your business apart from competitors, this type of training provides employees with the knowledge to recognize products that are not up to quality standards and teaches them what to do in this scenario. Numerous organizations, such as the International Organization for Standardization (ISO), measure quality based on a number of metrics. This organization provides the stamp of quality approval for companies producing tangible products. ISO has developed quality standards for almost every field imaginable, not only considering product quality but also certifying companies in environmental management quality. ISO9000 is the set of standards for quality management, while ISO14000 is the set of standards for environmental management. ISO has developed 18,000 standards over the last 60 years[1]. With the increase in globalization, these international quality standards are more important than ever for business development. Some companies, like 3M (QAI, 2011), choose to offer ISO training as external online training, employing companies such as QAI to deliver the training both online and in classrooms to employees.

Training employees on quality standards, including ISO standards, can give them a competitive advantage. It can result in cost savings in production as well as provide an edge in marketing of the quality-controlled products. Some quality training can happen in-house, but organizations such as ISO also perform external training.

(3) Skills Training

Skills training, the third type of training, includes proficiencies needed to actually perform the job. For example, an administrative assistant might be trained in how to answer the phone, while a salesperson at Best Buy might be trained in assessment of customer needs and on how to offer the customer information to make a buying decision. Think of skills training as the things you actually need to know to perform your job. A cashier needs to know not only the technology to ring someone up but what to do if something is priced wrong. Most of the time, skills training is given in-house and can include the use of a mentor. An example of a type of skills training is from AT&T and Apple (Whitney, 2011), who in summer 2011 asked their managers to accelerate retail employee training on the iPhone 5, which was released to market in the fall.

(4) Soft Skills Training

Our fourth type of training is called soft skills training. Soft skills refer to personality traits, social graces, communication, and personal habits that are used to characterize relationships with other people. Soft skills might include how to answer the phone or how to be friendly and welcoming to customers. It could include sexual harassment training and ethics training. In some jobs, necessary soft skills might include how to motivate others, maintain small talk, and establish rapport.

In a retail or restaurant environment, soft skills are used in every interaction with customers and are a key component of the customer experience. In fact, according to a *Computerworld* magazine survey, executives say there is an increasing need for people who have not only the skills and technical skills to do a job but also the necessary soft skills, such as strong listening and communication abilities. Many problems in organizations are due to a lack of soft skills, or interpersonal skills, not by problems with the business itself. As a result, HR and managers should work together to strengthen these employee skills. Soft skills training can be administered either in-house or externally.

(5) Professional Training and Legal Training

In some jobs, professional training must be done on an ongoing basis. Professional training is a type of training required to be up to date in one's own professional field. For example, tax laws change often, and as a result, an accountant for H&R Block must receive yearly professional training on new tax codes). Lawyers need professional training as laws change. A personal fitness trainer will undergo yearly certifications to stay up to date in new fitness and nutrition information.

Some organizations have paid a high cost for not properly training their employees on the laws relating to their industry. In 2011, Massachusetts General Hospital paid over $1 million in fines related to privacy policies that were not followed (Donnelly, 2011). As a result, the organization has agreed to develop training for workers on medical privacy. The fines could have been prevented if the organization had provided the proper training to begin with. Other types of legal training might include sexual harassment law training and discrimination law training.

(6) Team Training

Do you know the exercise in which a person is asked to close his or her eyes and fall back, and then supposedly the team members will catch that person? As a team-building exercise (and a scary one at that), this is an example of team training. The goal of team training is to develop cohesiveness among team members, allowing them to get to know each other and facilitate relationship building. We can define team training as a process that empowers teams to improve decision making, problem solving, and team-development skills to achieve business results. Often this type of training can occur after an organization has been restructured and new people are working together or perhaps after a merger or acquisition. Some reasons for team training include the following:

- Improving communication
- Making the workplace more enjoyable
- Motivating a team
- Getting to know each other
- Getting everyone "onto the same page," including goal setting
- Teaching the team self-regulation strategies
- Helping participants to learn more about themselves (strengths and weaknesses)
- Identifying and utilizing the strengths of team members
- Improving team productivity
- Practicing effective collaboration with team members

Team training can be administered either in-house or externally. Ironically, through the use of technology, team training no longer requires people to even be in the same room.

(7) Managerial Training

After someone has spent time with an organization, they might be identified as a candidate for promotion. When this occurs, managerial training would occur. Topics might include those from our soft skills section, such as how to motivate and delegate, while others may be technical in nature. For example, if management uses a particular computer system for scheduling, the manager candidate might be technically trained. Some managerial training might be performed in-house while other training, such as leadership skills, might be performed externally.

(8) Safety Training

Safety training is a type of training that occurs to ensure employees are protected from injuries caused by work-related accidents. Safety training is especially important for organizations that use

chemicals or other types of hazardous materials in their production. Safety training can also include evacuation plans, fire drills, and workplace violence procedures. Safety training can also include the following:

- Eye safety
- First aid
- Food service safety
- Hearing protection
- Asbestos
- Construction safety
- Hazmat safety

The Occupational Safety and Health Administration, or OSHA, is the main federal agency charged with enforcement of safety and health regulation in the United States. OSHA provides external training to companies on OSHA standards. Sometimes in-house training will also cover safety training.

TRAINING DELIVERY METHODS

- Training delivery methods are important to consider, depending on the type of training that needs to be performed.

- Most organizations do not use only one type of training delivery method; a combination of many methods will be used.
- *On-the-job coaching delivery method* is a training delivery method in which an employee is assigned to a more experienced employee or manager to learn the skills needed for the job. This is similar to the *mentor training delivery method*, except a mentor training method is less about skills training and more about ongoing employee development.
- *Brown bag lunch training delivery* is normally informal and can involve personal development as well as specific job-related skills.
- *Web-based training* is any type of training that is delivered using technology.
- There are numerous platforms that can be used for web-based training and considerations, such as cost, when selecting a platform for use.
- A *synchronous* training method is used for web-based training and refers to delivery that is led by a facilitator. An *asynchronous* training method is one that is self-directed.
- *Job shadowing* is a delivery method consisting of on-the-job training and the employee's learning skills by watching someone more experienced.

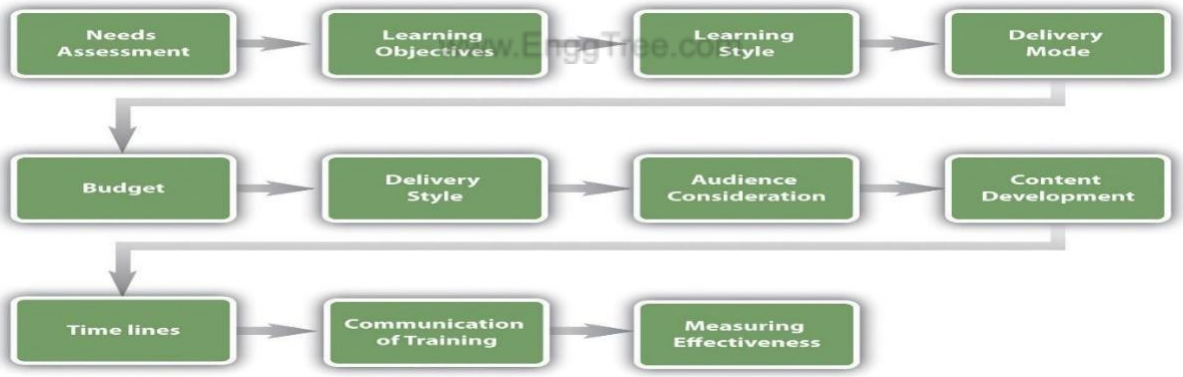
- To motivate employees and allow them to develop new skills, *job swapping* training delivery may be used. This occurs when two people change jobs for a set period of time to learn new skills. With this method, it is likely that other methods will also be used, too.
- *Vestibule training* delivery is also known as "near site" training. It normally happens in a classroom, conference room, or lecture room and works well to deliver orientations and some skills-based training. Many organizations also use vestibule training for technical training, safety training, professional training, and quality training.
- Since many companies operate overseas, providing training to those employees with international assignments can better prepare them for living and working abroad.

DESIGNING A TRAINING PROGRAM

Training Program Framework Development

When developing your training plan, there are a number of considerations. Training is something that should be planned and developed in advance.

Training Program Development Model



The considerations for developing a training program are as follows:

1. **Needs assessment and learning objectives.** This part of the framework development asks you to consider what kind of training is needed in your organization. Once you have determined the training needed, you can set learning objectives to measure at the end of the training.
2. **Consideration of learning styles.** Making sure to teach to a variety of learning styles is important to development of training programs.
3. **Delivery mode.** What is the best way to get your message across? Is web-based training more appropriate, or should mentoring be used?Most training programs will include a variety of delivery methods.

4. **Budget.** How much money do you have to spend on this training?
5. **Delivery style.** Will the training be self-paced or instructor led? What kinds of discussions and interactivity can be developed in conjunction with this training?
6. **Audience.** Who will be part of this training? Do you have a mix of roles, such as accounting people and marketing people? What are the job responsibilities of these individuals, and how can you make the training relevant to their individual jobs?
7. **Content.** What needs to be taught? How will you sequence the information?
8. **Timelines.** How long will it take to develop the training? Is there a deadline for training to be completed?
9. **Communication.** How will employees know the training is available to them?
10. **Measuring effectiveness of training.** How will you know if your training worked? What ways will you use to measure this?

SUPPLY CHAIN NETWORK

What is a supply chain network? And why are they so important for logistics and business managers?

Supply Chain is a connection of all the parties, resources, businesses and activities involved in the marketing or distribution through which a product reaches the end user. It creates a link between the channel partners like suppliers, manufacturers, wholesalers, distributors, retailers, and the customer. To put simply, it encompasses the flow and storage of the raw material; semi-finished goods and the finished goods from point of origin to its final destination i.e. consumption.

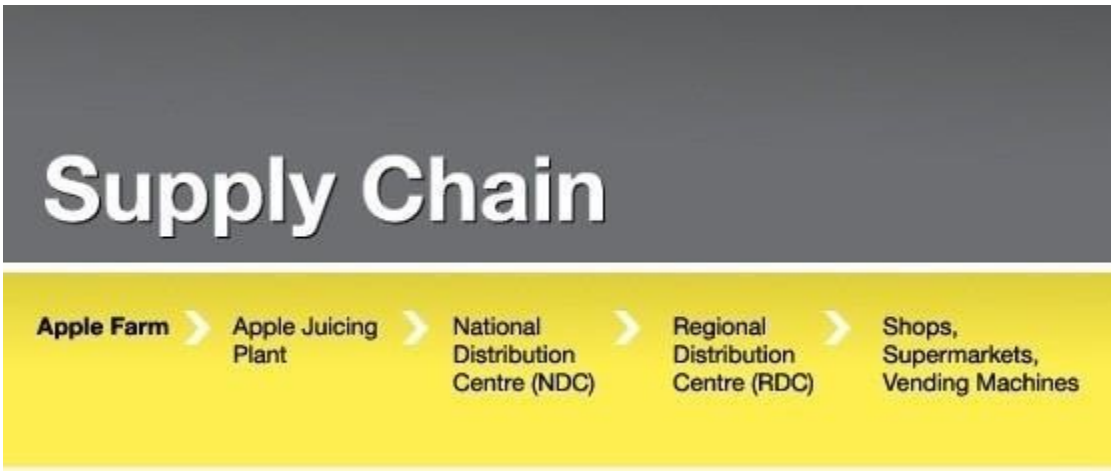
Often organisations focus only on their organisation; what they produce or provide and not what the end customer receives. Looking at a supply chain network enables firms to look at the overall movement of materials/information from start to end, allowing organisations to see the value in creating partnerships; and the value in working together to ensure the best possible value is provided to the end-customer.

Supply chains and supply networks both describe the flow and movement of materials & information, by linking organisations together to serve the end-customer.

'Network' describes a more complex structure, where organisations can be cross-linked and there are two-way exchanges between them; 'chain' describes a simpler, sequential set of links.

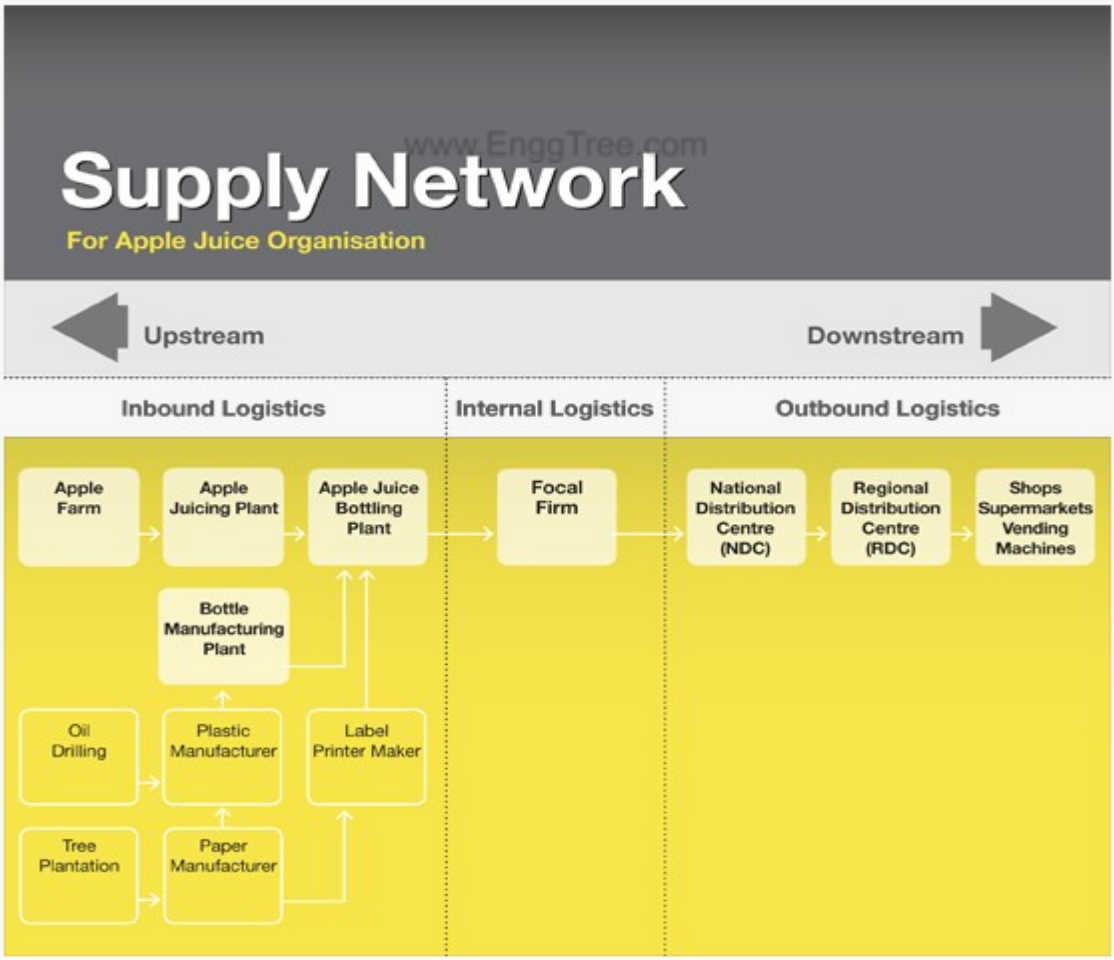
In order to understand a supply chain network; we need to understand what a supply chain is. A supply chain is a series of processes linked together to form a chain.

Supply Chain Example: for apple juice production.



The above diagram is an example of a simplified supply chain; the supply chain shows the movement of material flow from the Apple farm right through the production process to the end users.

Supply Chain Network Example: For Apple Juice Organisation



A supply chain network shows the links between organisations and how information and materials flow between these links. The more detailed the supply chain network the more complex and web like the network becomes.

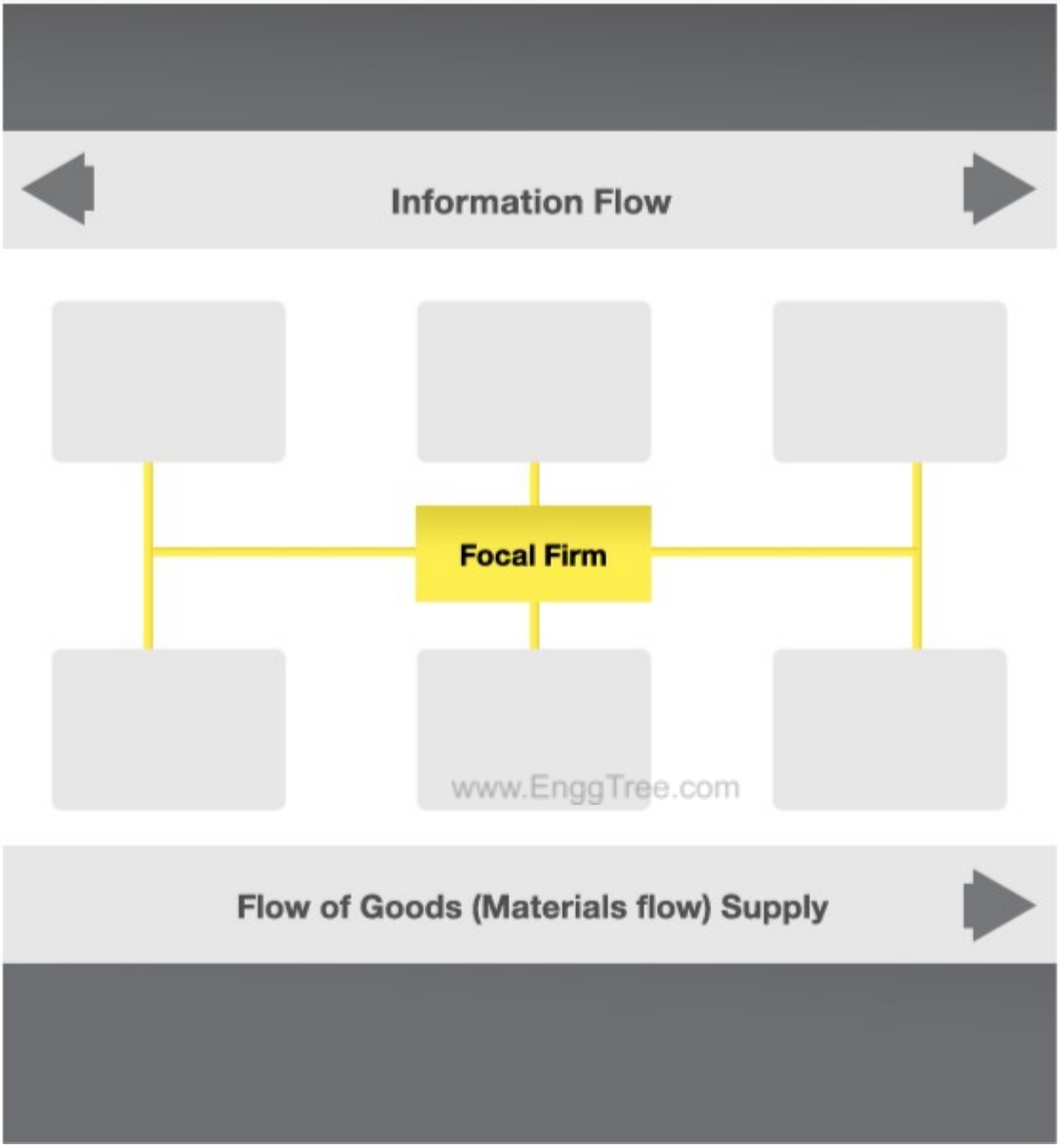
The above example demonstrates a simplified version of a supply chain network of an Apple Juice organisation. The organisation will have an upstream network and a downstream network.

Organisations are linked via two types of flows:

To get a complete picture of an organisations supply chain network; information & material flow should be mapped. Inefficiency can then be located and removed.

- **Material flow:** Is the movement of goods from raw primary goods (such as Wool, Trees and Coal etc.) to complete goods (TV's, Radios and Computers) that are to be delivered to the final customer.
- **Information flow:** Is the demand from the end-customer to preceding organisations in the network.

Supply Chain Network: Information flow, Flow of Materials



If a focal firm provides their suppliers with their sales data/ forecasting demand information; their supplier will be able to reduces costs (such as over production waste) and improve prices.

In order to better serve your end customer, it is important to develop strong partnerships within your supply network which has a flow on effect to your end customers whether you are a manufacturer, distributor or retailer. Better communication will increase efficiency and productivity. Trust is the core ingredient to developing better communication and relationships.

Supply Chain refers to the integration of all activities involved in the process of sourcing, procurement, conversion and logistics.

Supply Chain is the interconnection of all the functions that starts from the manufacturing of raw material into the finished product and ends when the product reaches the final customer. This network helps to provide quality products to the customer at a reasonable price.

Most of the time supply chain is juxtaposed with the value chain. In this, we have compiled all the substantial differences between supply chain and value chain. Have a look.

BASIS FOR COMPARISON	SUPPLY CHAIN	VALUE CHAIN
Meaning	The integration of all the activities involved in the procurement, conversion and logistics of the product is known as Supply Chain.	Value Chain is defined as the series of activities, that adds value to the product.
Originated from	Operation Management	Business Management
Concept	Conveyance	Value Addition
Sequence	Product Request - Supply Chain - Customer	Customer Request - Value Chain - Product
Objective	Customer Satisfaction	Gaining competitive advantage

SUPPLY CHAIN NETWORK DESIGN

The supply chain network design is defined as a working model that delineates the overall framework of a supply chain to assess the time and costs required to bring goods to the market. This model helps a business spot inefficiencies and potential risks in the supply chain. The model also helps analyze "what if" scenarios to optimize operations to reduce costs, improve service and increase responsiveness.

What is the goal of a Global Supply Chain Network Design?

The key objectives of a global supply chain design are to optimize inventory, working capital and logistics costs. It also increases visibility, identifies opportunities for cost savings and reduces potential risks.
Supply network design reinforces the supply chain by mapping and modeling processes and optimizing them to ensure that products or services are delivered on time and in a cost-effective manner.

What is the Importance of Supply Chain Network Design?

Analysts in a GEP white paper on the importance of supply chain network design said that 80% of supply chain costs are determined at the designing phase of the product and supply chain network. Thus, failure to consider network design can cost the enterprise dearly and be counterproductive in the longer term.
Simply mapping a global supply chain network, its flows, timelines, current costs and revenues generated can generate a bunch of troubling yet important questions, such as:

- Why are the enterprises' only suppliers based overseas?
- Why are there so many warehouses, and why in those locations?
- Why is there so much dead stock? Why has more inventory been ordered?
- Why are freight and trucking costs so high?
- Is the current network design efficient?
- Is the supply chain design aligned with the enterprises' sustainability goals?

What Are the Benefits of Supply Network Design?

Supply chain network design or SCM network design helps enterprises simulate and visualize their supply chains to optimize them. Optimization of supply chains reduces overall costs and enhances service, speed-to-market, flexibility and risk mitigation. Here are the key benefits:

- Discerning parts for streamlining and potential cost savings
- Reduction in purchase costs and inventory
- Working capital reduction
- Reduction in freight costs
- Route optimization for reducing transit time and fuel costs
- Reduction in network fixed costs (facilities, equipment) and supply chain variable costs (labor, handling, 3PL costs)

- Optimization of service levels and delivery dates for customer satisfaction
- Process and cost visibility across the supply chain network
- Providing performance visibility of the complete supply chain network by comparing its capabilities/costs against set benchmarks

What Factors Are Considered While Designing a Supply Chain Network Model?

To start with, enterprises must establish a benchmark, and to do so, the following components must be considered:

- Define the objectives as aligned with the enterprises' objectives and the supply chain design model parameters, such as capacity issues, inventory replenishment lead times, customer needs, location of facilities and sources and so on.
- Collate the required data, such as forecasts and future trends.
- Use network optimization tools and necessary data for building a “living” model, incorporating the defined parameters and data collected.
- Validate the model with historical "what if" scenarios and compare the outcome with known results.
- Finalize the supply chain network design and implement it.

How Many Types of Supply Chain Network Design Are There?

Enterprises deciding to assess their supply chain network design must zero in on the type of SCM network design to be adopted.
The three types of supply chain network design are:

Strategic Network Design:

Here, the designing of the network — location of the facilities and sources, production and warehouse capacities, market strategies — must be aligned with the objectives of the business.

Tactical Network Design:

Here, different ways to optimize the existing network are explored for implementing short-term planning decisions.

Identifying Risks and Their Mitigation:

Here, risks are identified by asking “what if” questions. A plan of action (PoA) for managing each identified risk is then made.

Should Supply Network Design Be Considered a Core Process?

A supply network design is a dynamic process due to the ever-changing conditions of the environment, markets, customers, suppliers and raw materials, including weather. Thus, a supply chain model designed earlier will no longer be valid today.
It is an iterative process that continues to refine the model and ensures a more consistent output. Regularly updating the supply chain model with the current realities and parameters will provide accurate results over time.
Many top global companies consider supply chain design a critical function and a core process, regularly rationalizing their models as required.

Ways to Make Supply Chain Design as a Core Business Process

- Ensure a permanent network design center operated by a cross-functional team with the necessary skill sets and experience.
- Plan the frequency and the critical issues that should flag the remodeling of the supply chain design and establish these rules.
- Appoint a trusted consultant having in-depth knowledge and vast experience in supply chain network design.
- Reach out for help when needed — approach other professionals or supply chain design forums for help when needed.

Conclusion

Supply chain review and design have gained traction of late and are acknowledged to effectively cope with the rapid changes and challenges faced by enterprises globally. Unfortunately, many businesses are yet to regard supply chain design as a core process and instead treat it as a one-of-a-kind case or tweak it on a project-to-person basis.
Examples of a supply chain network design model include spotting bottlenecks in a supply chain and looking to enhance the processes across the supply chain, which is vital in today's scenario. Tech-savvy enterprises can thus leverage a dynamic supply chain model to ensure that their supply chains deliver and exceed business expectations long into the future.

DEMAND PLANNING

What is Demand Planning?

Demand planning is a supply chain management process of forecasting, or predicting, the demand for products to ensure they can be delivered and satisfy customers. The goal is to strike a balance between having sufficient inventory levels to meet customer needs without having a surplus. A wide variety of factors can influence demand, including labor force changes, economic shifts, **severe weather**, natural disasters or **global crisis events**.

What are the Aspects of Demand Planning?

Demand planning spans several aspects, with the three primary areas being:

(1) Product Portfolio Management

Product portfolio management oversees the overall product lifecycle, beginning with the introduction of a new product through to its end-of-life planning. In many cases, product lines are interdependent, and understanding how new products may influence demand for other products is important to understanding the overall product mix required to maximize market share.

(2) Statistical Forecasting

Using historical data, statistical forecasting creates supply chain forecasts with advanced statistical algorithms. In this area, it is important to determine the accuracy of each model, identify outliers and exclusions and understand assumptions. Seasonal shifts (think the spurt of holiday shopping that occurs between October and December for retailers, or the boost in yard equipment sales in spring months) can also be assessed with statistical forecasting.

(3) Trade Promotion Management

Trade promotion or marketing events can influence demand, especially in the retail industry. The goal of a trade promotion is to help a brand connect with a customer, often through an in-store giveaway, discount, or promotion, and these events can impact the demand for a product.

Why is Demand Planning Important?

If product isn't available for customers to purchase because it's out of stock, businesses lose out on revenue, and over time, they could lose the customer to a competitor. On the other hand, sitting on a slew of unused inventory incurs both space and production costs unnecessarily. With demand planning, business leaders can stay in front of market shifts and make more proactive decisions, while being responsive to their customers' needs.

Best Practices for Demand Planning

Demand planning is a multi-step process, dependent on the right tools, information and processes. Often, there can be unique nuances in the process, based on product positioning, inventory needs and organizational goals, but some best practices to keep in mind include:

Implement the Right Software

There is a plethora of options when it comes to enterprise resource planning (ERP) systems, so choosing the right one can be tricky. When considering ERP software, it's important to examine the ability of the tool to handle forecasting nuances as well as the provider's reputation, reporting capabilities, and the transparency and reliability of the forecasts it produces.

Gather and Prepare Data

Data drives demand planning, now more than ever. **Real-time visibility** into inventory movements coupled with metrics reports that paint a clear picture and data mining and aggregation that can identify areas for improvement or reaction can help to create more agile process modelling.

Define Process Models

Lacking a defined process for a demand planning cycle leads to chaos. Confusing process with information that is simply a set of widely known facts around an organization is all too common,

making it difficult to hold anyone accountable, and thus hurting overall performance. For most companies, the steps in the demand planning process go something like this:

- Preparation of data
- Initial forecasting
- Incorporation of market intelligence
- Consideration of sales goals and financial reports to reconcile bottom-up forecasts with top-down financial and sales forecasts
- Refine a final forecast
- Performance monitoring based on real-time analytics

Implement and Monitor

Successful demand planners usually design a pilot version of the plan using historical data, or **descriptive analytics**, as a basis. They also make regular adjustments and have a team of people dedicated solely to devising the plan, implementing it, reducing error and bias, and designing processes for execution.

The Future of Demand Planning in the Supply Chain

Like many business needs, supply chain and demand planning are going digital. Advances in applications of machine learning within the supply chain are making it possible to adapt and update forecasts in real time, allowing inventory to run leaner, without missing the mark on demand.

For supply chain professionals, understanding how to use digital enterprise architectures and implementing artificial intelligence and machine learning programs that can help optimize a lean, agile and data-driven approach will reveal new ways to cut costs in operations, boost revenue and offer a greater competitive edge.

A better-connected supply chain means demand planning can be conducted even more in the moment. When implemented well, demand planning can be a pivotal process in boosting a supply chain's profitability.

INVENTORY AND SUPPLY CHAIN MANAGEMENT

INVENTORY MANAGEMENT

Retail inventory is the stocking of products that you sell to consumers. Use the system to set profitable prices and ensure you have the right amount of stock to meet demand.

Manufacturing Inventory Management

Manufacturing inventory management is the practice of keeping enough stock on hand so production lines can fulfill orders. The process helps managers see stock levels at a glance and tracks raw materials, parts, work-in-progress and finished goods.

What Is Multi-Location Inventory Management?

Multi-location inventory management is the process of managing stock across multiple locations, warehouses, and retail stores or across multiple selling channels. With multi-location management, you can watch stock levels in all locations and optimize your inventory to fulfill orders.

What Is an Inventory Management System?

An inventory management system combines varying software packages to track stock levels and stock movements. The solution can integrate with multichannel sales systems or shipping systems.

An inventory management system optimizes inventory levels and ensures product availability across multiple channels. It provides a single, real-time view of items, inventory and orders across all locations and selling channels. This enables businesses to carry less inventory on hand and frees up cash to be used in other parts of the business. An inventory management system helps keep inventory costs low while delivering on customer expectations.

How to Choose an Inventory Management System?

Choosing an inventory management system is a matter of identifying the features your business needs. Do you need to track stock movements and location within a warehouse, or plan inventory and track trends, or both?

INVENTORY MANAGEMENT FAQS

There are many questions in a broad and complicated topic like inventory management. Here are answers to a few:

What Are the Objectives of Inventory Management?

One objective of inventory management is to keep enough stock to satisfy customers. Another is to invest as little as possible in stock while still earning the most profit.

Why Inventory Management Is Important in the Supply Chain

Inventory management is vital in the supply chain because a company must balance customer demand with storage space and cash limitations. Inventory management provides visibility into the supply chain (procurement, production, fulfillment, etc.) so managers can coordinate lead times for deliveries with production timetables.

How Can Inventory Management Be Improved?

Keeping accurate accounting records and taking regular physical stock counts can improve your inventory management efforts. A system that provides your organization with real-time visibility into inventory can help stakeholders make critical business decisions. You should also be aware of a stock's condition, especially if you're dealing with perishables.

How Inventory Management Affects the Working Capital

Real goods in warehouses tie up working capital until they sell. Making the supply chain more efficient keeps you from holding too much stock. Improving inventory management processes helps you prevent storing, picking and shipping errors that reduce sales.

What Are Inventory Management Policies?

Inventory management policies are plans for how to use inventory to make customers happy and reduce costs. Policies outline such things as the stock management method the company uses.

What Are the Types of Inventory Management Systems?

There are several types of inventory management systems that businesses use depending on how they operate. Three examples are manual inventory, periodic inventory and perpetual inventory. Manual methods are the least sophisticated and least accurate, and perpetual systems are the most sophisticated and most accurate.

- **Manual Inventory System:** This involves physically counting items and recording them on paper or in a spreadsheet. Small businesses may use manual systems.

- **Periodic Inventory System:** Periodic inventory systems include manual and periodic counts. Periodic counts record item details as items move in and out of stock. Barcodes simplify stocktaking. A database contains the records of stock levels and locations.

- **Perpetual Inventory System:** Perpetual inventory systems provide real-time stock data, as they rely on active radio frequency identification (RFID) tags that are always on and sending updates on item movements. Passive RFID tags, meanwhile, use a scanner to send stock information to the database.

What Is Service Level in Inventory Management?

A service level for inventory management is how much a company believes it can successfully store a particular stock. In other words, it's the probability a company will avoid stockouts and support sales.

How Does ERP Help in Inventory Management?

Enterprise resource planning (ERP) is helpful for inventory management because it tracks and provides insights into supply chain operation, accounting and purchasing, consolidating the information and making it visible in one place.

What Is Poor Inventory Management?

Poor inventory management is an imbalance between keeping too much and too little stock. The definition of a perfect balance can change as demand changes: Sales change when trends or seasons change. Poor stock management increases costs and thereby reduces profits.

HOW IS INVENTORY MANAGEMENT DIFFERENT FROM OTHER PROCESSES?

People sometimes confuse inventory management with related practices. Inventory management controls all stock within a company. Supply chain management manages the process from supplier to delivering the product to the customer. Warehouse management is a part of inventory control and focuses on stock in a specific location.

Inventory Management vs. Inventory Control

inventory control is a part of the overall inventory management process. Inventory control manages the movement of items within the warehouse.

Inventory Management vs. Inventory Optimization

Inventory optimization is the process of using inventory in the most efficient way, and as a result minimizing the dollars spent on stock and storing those items.

You can also think about inventory optimization as seeing inventory across all locations and selling channels, being able to use any of it to fulfill customer orders—in doing so, you can hold less stock overall.

Inventory Management vs. Order Management

Inventory management is responsible for ordering and tracking stock as it arrives at the warehouse. Order management is the process of receiving and tracking customer orders. Software often combines both tasks.

Inventory management plays an important role in order management. As orders are received, inventory can be allocated to specific orders, and then the status can be changed in the inventory record to essentially put it "on hold" for that order. Furthermore, when the order management system and inventory system are integrated, the inventory system can recommend which location should fulfill the order, based on where all the items in the order are available—this eliminates multiple shipments for a single order.

Inventory Management vs. Supply Chain Management

Supply chain management is a process of managing supply relationships outside a company and the flow of stock into and through a company. Inventory management may focus on trends and orders for the company or a part of the company.

Inventory management is essential for a properly running supply chain. Inventory management follows the flow of goods to, through and out of the warehouse. The supply chain includes demand planning, procurement, production, quality, fulfillment, warehousing and customer service—all of which require inventory visibility.

Inventory Management vs. Warehouse Management

Warehouse management complements inventory management. Warehouse management organizes stock in a warehouse. Inventory management manages stock and trends for many warehouses or an entire company.

The key to streamlining your warehouse operations is a thoughtfully laid out and meticulously organized facility. When each product has a specific place in the warehouse, it prevents staff from moving about inefficiently and maximizes labor efficiency. But these processes are only as good as the inventory records that drive them.

Inventory Management vs. Logistics

Logistics is the practice of controlling processes in a warehouse and in the replenishment and delivery systems. Inventory management maintains stock levels and manages stock location.

Inventory management is a crucial part of how companies manipulate their logistics. The relationship between inventory management and logistics is interdependent. Logistics need inventory management to perform their activities. Good logistics systems improve warehouse and operational activities.

Inventory Management vs. ERP

An enterprise resource planning (ERP) system is software that manages business activities such as accounting, purchasing, compliance and supply chain operations. By contrast, inventory management is a part of a modern ERP system, providing insight into stock levels, inventory en route and the status of current inventory—this makes it visible across the organization in real time.

Inventory management helps to properly plan a company's replenishment orders. ERP systems give companies accurate inventory data, so they have the most current information for their inventory management plan. ERP systems optimize the data so inventory management is successful.

LOGISTICS

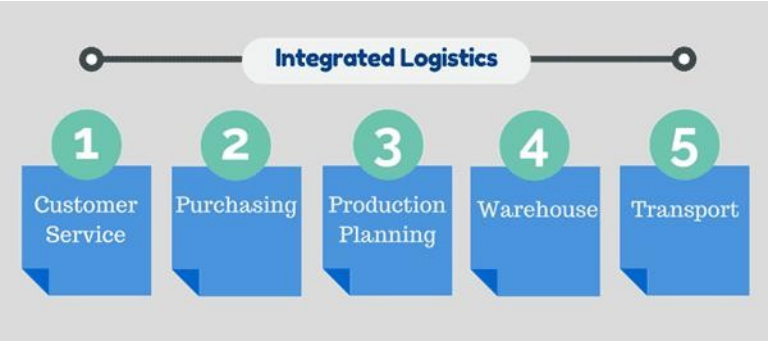
What is Logistics and Supply Chain Management?

"Logistics typically refers to activities that occur within the boundaries of a single organization and Supply Chain refers to networks of companies that work together and coordinate their actions to deliver a product to market. Also, traditional logistics focuses its attention on activities such as procurement, distribution, maintenance, and inventory management. Supply Chain Management (SCM) acknowledges all of traditional logistics and also includes activities such as marketing, new product development, finance, and customer service" - Michael Hugos

What is Logistics?

"Logistics is about getting the right product, to the right customer, in the right quantity, in the right condition, at the right place, at the right time, and at the right cost (the 7 Rs)" - John J. Coyle et al

In the past, various tasks were under different departments, but now they are under the same department and report to the same head as below,



What is Logistics Management?

"Logistics Management deals with the efficient and effective management of day-to-day activity in producing the company's finished goods and services" - Paul Schönsleben

What is Supply Chain?

"Supply Chain is the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer" - Martin Christopher

What is Supply Chain Management?

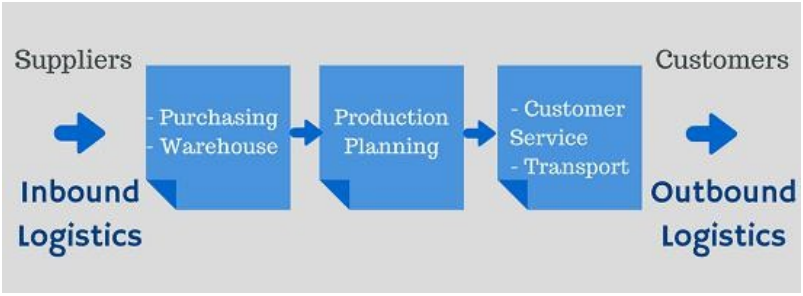
Each researcher defines supply chain management differently. However, we would like to provide the simple definition as below,

"Supply Chain Management (SCM) refers to the coordination of production, inventory, location, and transportation among the participants in a supply chain to achieve the best mix of responsiveness and efficiency for the market being served" -Michael Hugos

What is the Difference Between Inbound and Outbound Logistics?

"Inbound Logistics refers to movement of goods and raw materials from suppliers to your company. In contrast, Outbound Logistics refers to movement of finished goods from your company to customers"

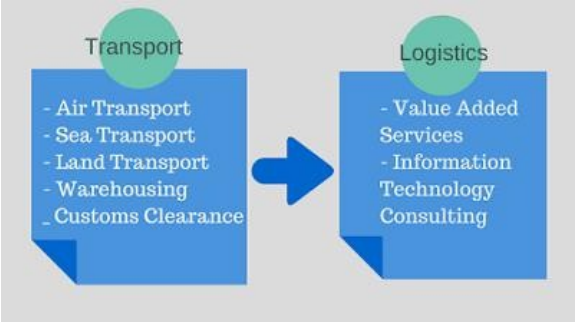
To illustrate this term, we make a small graphic as below,



As you can see, purchasing and warehouse (distribution center) communicate with suppliers and they are sometimes called "supplier facing function". Production planning and inventory control function is the center point of this chart. Customer service and transport functions communicate with customers and they are sometimes called "customer-facing functions.

What is Transport and Logistics?

"Transport and Logistics refers to 2 types of activities, namely, traditional services such as air/sea/land transportation, warehousing, customs clearance and value-added services which including information technology and consulting"



What is International Logistics?

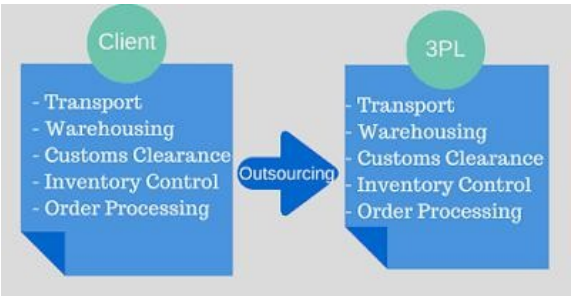
These are one of the most ambiguous groups of terms in international business out there. They are used interchangeably with international supply chains or international production and transportation activities. However, the most concise definition is as below,

"International Logistics focuses on how to manage and control overseas activities effectively as a single business unit. Therefore, companies should try to harness the value of overseas product, services, marketing, R&D and turn them into competitive advantage"

What is Third Party Logistics or 3PL?

The concept of 3PL appeared on the scene in the 1980s as a way to reduce costs and improve services which can be defined as below,

"Third Party Logistics or 3PL refers to the outsourcing of activities, ranging from a specific task, such as trucking or marine cargo transport to broader activities serving the whole supply chain such as inventory management, order processing and consulting."



In the past, many 3PL providers didn't have adequate expertise to operate in complex supply chain structures and processes. The result was the inception of another concept.

What is Fourth Party Logistics or 4PL?

The 4PL is the concept proposed by Accenture Ltd in 1996 and it was defined as below,

"Fourth Party Logistics or 4PL refers to a party who works on behalf of the client to do contract negotiations and management of performance of 3PL providers, including the design of the whole supply chain network and control of day-to-day operations"

You may wonder if a 4PL provider is really needed. According to the research by Nezar Al-Mugren from the University of Wisconsin-Stout, the top 3 reasons why customers would like to use 4PL providers are as below,

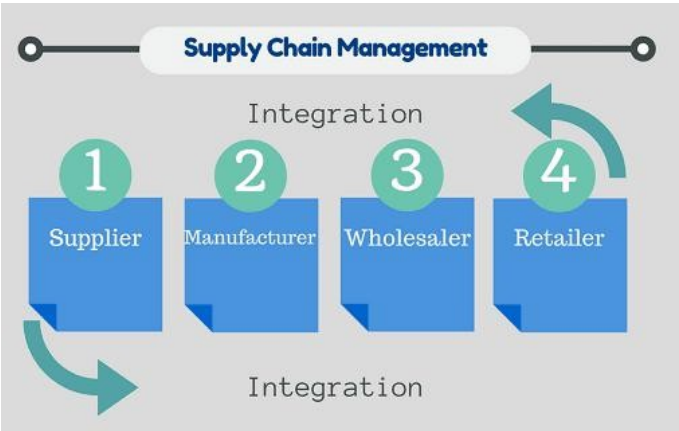
- Lack of technology to integrate supply chain processes

- The increase in operating complexities

- The sharp increase of the operations in the global supply chains

What is Supply Chain Network?

Many companies have a department that controls supply chain activity so they believe that SCM is a "function". Some companies think SCM is a kind of management system under IT (information system or enterprise resource planning.) In fact, SCM is actually a "network" consisting of many players as below,

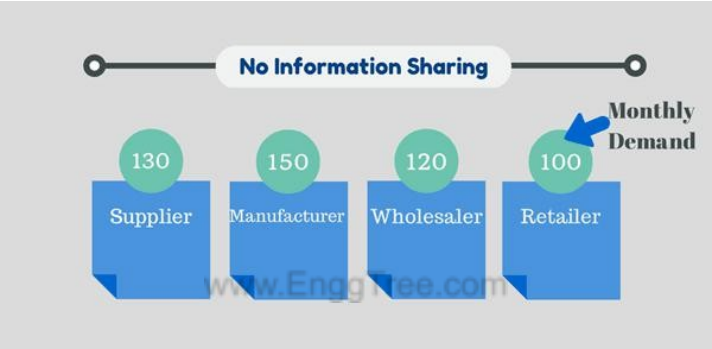


A generic supply chain structure is as simple as Supplier, Manufacturer, Wholesaler, and Retailer (it's more complex in the real world but a simple illustration serves the purpose.)

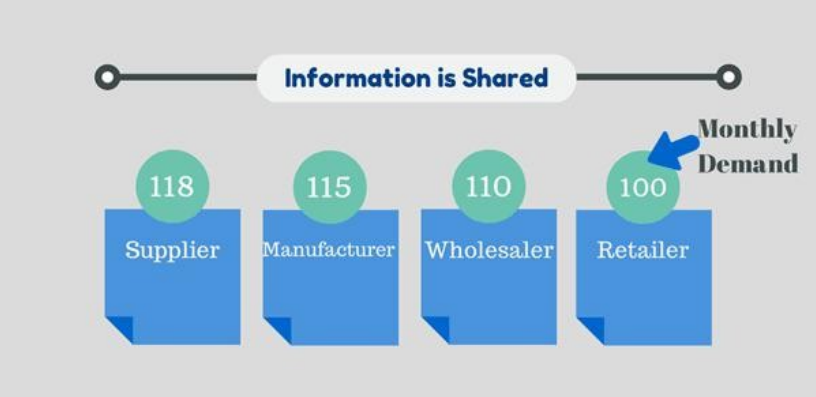
The word "management" can be explained briefly as "planning, implementing, controlling". Supply Chain Management (in the supply chain education context) is then the planning, implementing, and controlling of the networks.

What is Information Sharing?

Another important attribute of supply chain management is the flow of material, information, and finance (these are things that can be found in lean manufacturing and the six sigma project too). Even though there are 3 types of flow, the most important one is information flow aka information sharing. Let's see the example of this through the simplified version of the bullwhip effect as below,



When customer demand data is not shared, each player in the same supply chain must make some sort of speculation and this can become a management issue. According to the above graphic, the retailer has a demand for 100 units, but each player tends to keep stock more and more every step of the way. This results in higher costs for everyone in the same supply chain.



When information is shared via demand management from retailer down to supplier, everyone doesn't have to keep stock that much. The result is a lower cost for everyone. This is sometimes called the extended supply chain or supply chain visibility.

Information sharing will also reduce the need to use digital transformation solutions such as supply chain systems, digital supply chain, predictive analytics, or artificial intelligence.

What is Supply Chain Coordination?

Information sharing requires a certain degree of "coordination" (it's also referred to as collaboration or integration in scholarly articles). Do you wonder when people started working together as a network? In 1984, companies in the apparel business worked together to reduce overall lead time. In 1995, companies in the automotive industry used Electronic Data Interchange to share information. So, working as a "chain" is a real-world practice.

What are Conflicting Objectives?

Working as a network requires the same objective, but this is often not the case (even with someone in the same company). "Conflicting Objectives" is the term used to describe the situation when each function wants something that won't go well together. For example, purchasing people always place the orders with the cheapest vendors (with a very long lead-time) but production people or project managers need material more quickly.

To avoid conflicting objectives, you need to decide if you want to adopt a time-based strategy, low-cost strategy, or differentiation strategy. A clear direction is needed so people can make the decisions accordingly.

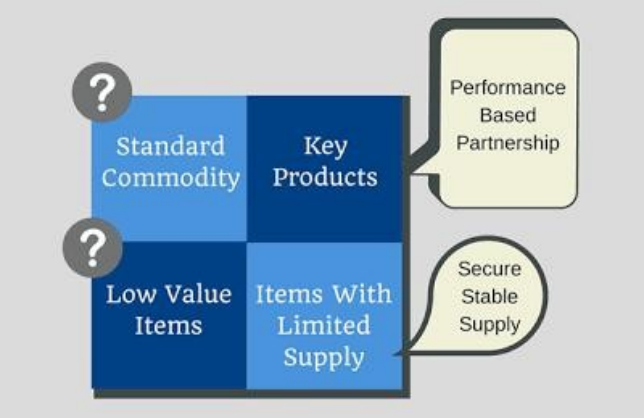
What is the Cost/Service Trade-off?

The concept of the Cost/Service Trade-off appeared as early as 1985 but it seems that people really don't get it.When you want to improve service, the cost goes up. When you want to cut costs, service suffers. It's like a "seesaw", the best way you can do is to try to balance both sides.

A real-world example is that a "new boss" asks you to cut costs by 10%, improve service level by 15%, and double inventory turns so the financial statement looks good. If you really understand the cost/service trade-off concept, you will agree that you can't win them all. The most appropriate way to handle this is to prioritize your KPIs.

What is Supply Chain Relationship?

To work as the same team, a long-term relationship is key. Otherwise, you're just a separate company with a different strategy/agenda. So academia keeps preaching about the importance of relationship-building but is not for everyone.



Since there are too many suppliers to deal with, a portfolio matrix is often used to prioritize relationship-building to create supply chain partners. Focus your time and energy to create a long-term relationship with suppliers of key products and items with limited sources of supply (or items with high supply chain risk.) Because people and human resources are the factors that can make or break your supply chain.

ANALYTICS APPLICATIONS IN HR & SUPPLY CHAIN

Advanced analytics can be leveraged by HR teams to positively impact both talent and business decisions in the organization. HR can evolve from being just a people-management function to playing a more transformational role in human capital management and being a strategic business partner in the company.

8 Applications Of Advanced Analytics In HR

1. Hiring The Right Talent With Competency Acquisition Analytics

Hiring the right talent is instrumental to a company's success with employees amounting to one of the biggest costs and greatest opportunities in most businesses. Hence, in order to study whether or not you are acquiring the right talent for your business, competency acquisition analytics can be used.

The primary step includes identifying the core competencies that are crucial for the success of your business. Then, you can map these competencies against the existing talent, their current capabilities and their potential for growth. Talent gaps, if any, can also be identified at this stage.

The HR team can assess whether the existing resources can be trained to plug the identified competency gaps, or whether new talent with those competencies need to be hired.

2. Recruitment Channel Analytics

Just as important as hiring the right talent, is understanding where the best talent is coming from. Recruitment channel analytics is a process that helps determine where an organization's best employees have been recruited from, and what recruitment channels have been most effective in hiring the right resources for the company.

This analysis includes gaining insights by drilling down into historical employee data, surveys and feedback records and assessing KPIs such as the return per employee and human capital value-added.

3. Classification Analysis To Determine The Success Rate Of Teams

Classification analysis is the process of analyzing historical data to identify patterns that help us predict which category a particular observation or data entity belongs to. In HR, this analytical method can be used to study the composition of a team, and other context variables in order to determine how successful the team will be.

Instead of forming teams merely on the experience, availability of resources, organizations can use insights from classification analytics to understand what other factors such as leadership style, team dynamics and size, the duration of a project, etc, impact the success rate of a team. Being able to determine the success rate of a team beforehand, enables organizations to form the right teams for a project.

4. Attrition Analysis

High attrition is a huge challenge for HR teams and cost intensive for companies. Job postings, recruiting, onboarding and training are some significant expenses of losing employees and replacing them. This is a bigger problem if you're in a customer-facing business as customers prefer to work with a particular set of people they're habituated with. One way to reduce attrition is by using advanced analytics and NLP to harness the employee reviews data from employment websites like Glassdoor, Indeed, Comparably etc. This analysis helps you measure the employee satisfaction towards the brand and understand the common factors that lead to attrition.

5. Personalizing Training Programmes

Instead of applying run-of-the-mill training methods and general programs for all employees, the HR team can instead personalize courses to suit the learner's preference.

In order to do so, 'adaptive' learning technology must be used in which data analytics determines the learning pace of the employee, the mode of training, as well as what questions are best suited for them, in order to personalize the course to suit the learner.

6. Capacity Analytics And Utilization

One of the major business benefits of advanced analytics in HR is in cutting down costs. HR teams can use Capacity Analytics to determine:

- What the team capacity is and how much of it is actually being utilized.
- What activities the team is engaged in when they are working.
- What processes, tools, and applications are being used to complete the work and how much they cost the company.
- How operationally efficient the team is – helps determine if the team is either overworked or underutilized.
- The capacity for growth.

7. Improving Employee Performance

Although traditional methods of determining and managing employee performance such as peer and manager review, monitoring KPIs, etc, are globally used, they have not been very impactful in improving employee performance. In fact, a PwC report on Performance Management highlights that 52 percent of organizations have made or are planning to make changes to employee performance management in the near future.

But with Employee performance analytics, individual employee performance can be measured much more efficiently with the help of both historical and real-time data. Employee performance analytics provides both a retrospective as well as a forward-looking analysis of what employee performance was and how we can improve it. With the resulting insights, we can identify the employees that are performing well and which employees need additional training and motivation in order to perform better.

8. Anomaly Detection Analysis

Anomaly detection analysis is used to recognize unexpected or deviant patterns. In HR management, anomaly detection analysis can help identify relationships between accidents at work and employees who are working longer working hours and possibly fatigued. By identifying resources that work longer than a specified threshold, HR teams could prevent accidents and injuries in the workplace.

Examples Of Companies Using HR Analytics

- **UPS Improves Employee Performance And Productivity**

An example of a company using HR analytics to improve employee performance can be seen in the logistics giant, UPS. UPS has provided its drivers with intelligent handheld computers that help drivers make better decisions, such as determining which order to deliver parcels in for the most efficient route.

Additionally, the company collects crucial data on the behavior of the driver with the help of more than 200 sensors that are fitted onto the trucks. These sensors record data on everything the driver does, such as whether or not they wore a seatbelt or how many times they reversed the vehicle.

This data is then used to provide feedback to the drivers and suggest improvements or training wherever needed. Another major impact the insights have had is on the revenue of the company –

UPS has achieved a reduction of 8.5 million gallons of fuel and 85 million miles per year. Drivers are now making more deliveries per day with an average of 120 stops a day as opposed to less than 100 in the past.

- **Bank Of America Saves $15 Million With Retention Analytics**

Turnover rates in US-based call centres are generally high – about 40%. And Bank of America was experiencing a similar problem with its call centres as well. This in turn led to poor customer experience and customer frustration. After collecting data from all its call centers, the company leveraged analytics to understand the root cause for such high turnover rates. The company found that the call centers which promoted inter-office collaboration have higher retention compared to the ones that did not.

Using this insight, the bank optimized its business policies and allowed everyone to take breaks together. After just a few weeks of this change, Bank of America witnessed that the call handling time was 23% faster and cohesiveness was up by 18%. This led to the company saving $15 million with the increased productivity and decreased employee turnover.

UNIT V MARKETING & SALES ANALYTICS

Marketing Strategy, Marketing Mix, Customer Behavior – selling Process – Sales Planning – Analytics applications in Marketing and Sales

MARKETING STRATEGY

INTRODUCTION

A marketing strategy is a long-term vision outlining a business's value proposition to its customers. Rather than describing the concrete actions required in specific advertising campaigns, marketing strategies are used as a compass to direct overall marketing efforts.
While it may be tempting to jump ahead and hash out a marketing plan right away, marketing strategies have been shown to improve success. Read on to learn more about what marketing strategy is, why it matters, different types of marketing strategy, and what you need to do to make one yourself.

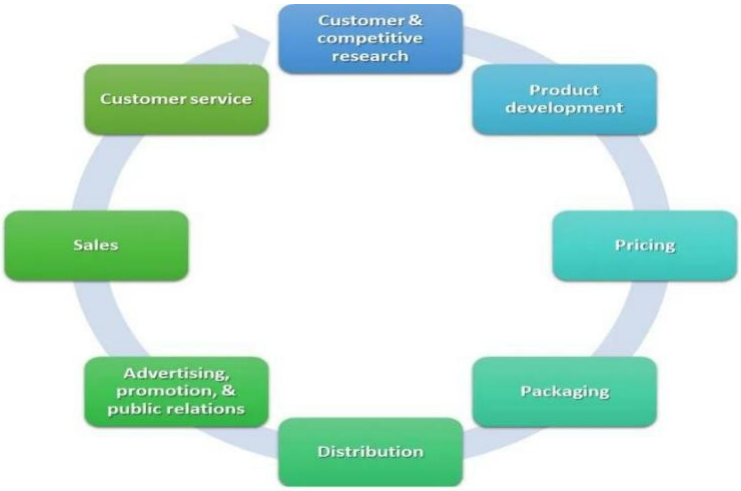
What is a marketing strategy?

A marketing strategy is an overview of how a business or organization will articulate its overall value proposition to its customers. Generally, a marketing strategy outlines the business' goals, its target market, buyer personas, competitors, and value for customers. It provides a long-term vision for overall marketing efforts, often looking many years ahead.

Understanding marketing

Before we dive into the ins and outs of marketing strategy, you need to have a firm grasp of what exactly marketing is – and what it isn't.

What is marketing?
Marketing is about connecting your company with potential customers and connecting those customers with your products. It involves understanding customer needs, translating those needs into products and services, packing and pricing those products and services, and then convincing customers that they need to buy those products and services.
To put it simply, marketing is the entire cycle from identifying potential customers to satisfying those customers' needs with the products you produce.



What marketing isn't

Marketing isn't just advertising, public relations or putting together a website or email campaign. It's also about everything leading up to those activities to support both your customers and your sales team. It, ideally, drives your entire business and determines what products you produce and how you distribute them.

What is included in a marketing strategy?

In essence, a marketing strategy determines the general direction – but not the specific details – for a variety of marketing-related activities. Ideally, your marketing strategy should help you define the following for your company:

- Target audience
- Value proposition
- Product mix
- Brand messaging
- Promotional initiatives
- Content marketing

In the following video, marketing legend Philip Kotler shares his insights about marketing strategy:

Why is having a marketing strategy important?

Creating – and following – a marketing strategy is essential to setting the direction not just for your marketing-related activities but also for your entire business. Your marketing strategy helps you stay in sync with your customer base, develop the right products for them and determine how you communicate information about those products.

Without a defined strategy you won't know who your customers are, you won't develop the right products, and you'll waste money promoting them.

In short, having a defined marketing plan makes you more successful. According to a CoSchedule survey, companies who have a documented marketing strategy are 313% more likely to be successful than those who don't.

How to create a successful marketing strategy?

There are several steps you need to take to create a robust marketing strategy for your business.

Set definable business goals

Your company's vision and objectives are the driving factors behind your marketing strategy. These overall objectives help determine your marketing goals, which your marketing strategy is in service of.

Your marketing goals build on your company's goals. You might set a goal to achieve a specific market share, dominate a particular channel or reach a certain percentage of a certain type of consumer. Your goals should be reachable and measurable.

Identify and research the target market

The goals you set help you define the target market to pursue. This requires you to get familiar with the customers in this market, which requires some degree of market research and analysis. You need to determine the following about the target market and its customers:

- Market size and growth potential
- Market trends
- Competitors
- Geographic and demographic characteristics
- Customer behavior

Focus on the 7 P's

As you develop your marketing strategy, you should focus on the traditional 7 P's of marketing:

- Product – how you satisfy customer needs
- Price – how much customers are willing to pay for your product
- Promotion – which channels you use to tell customers about your product
- Place – where you sell your product
- People – individuals who help sell your product to customers
- Packaging – how you present your product to the customer
- Process – how you deliver your product to customers

Develop product plans

Once you understand your target customers, you can determine what products best serve those customers' needs. When you know what a customer wants, you can build the right product for that customer.

Developing the product falls outside the parameters of the marketing department, of course, as does producing the product. But marketing should have a prominent and vocal role in determining the product's features, pricing and packaging, as determined by customer needs and metrics.

Identify the key benefits

Savvy marketers know that new customers don't make decisions based on a new product's features but rather on how that product benefits them. It's essential to identify the key benefits of the products you develop – how that product best serves the customers' wants or needs.

Unsuccessful products often have attractive features but unless those features translate into benefits, customers simply don't care. It's not a matter of "if you build it, they will come," it's a matter of meeting your customers' needs.

Craft your positioning and messaging

Product positioning should build on a product's benefits and how the product meets the needs of the target audience. You have to deeply understand what your customers value and then position your product accordingly.

This follows through into all messaging surrounding the product. The product position may be that it's the best for meeting a particular need – the messaging communicates that positioning in a clear, concise and attention-getting fashion.

Define your marketing mix

Finally, your marketing strategy should determine how you reach your target audience – what channels and activities you include in your marketing mix. This can include traditional channels like print, radio and television, as well as digital channels, social media and mobile apps.

Significance of Marketing Analytics Strategies

Marketing analytical strategies are critical in addressing and resolving marketing issues. The prime motive behind implementing these strategies is to evaluate the effective marketing programs in terms of return on investments in a business.

- The outcomes of adopting these strategies:
- Comparisons with competitors
- Recommendations for effective allocation of budget and resources
- Data processing analysis
- Collection of data through all the channels of communication and units in the company
- Creating a structured template for reporting the purpose of effective analysis of units
- Thus the marketing analysis strategies help in the given aspects:
- Having a holistic view of business
- Improving the management of the company and finance
- Forecasting and planning marketing initiatives
- Increasing the effectiveness of existing marketing programs through the allocation of resources
- Increase the profitability and return on investments

Thus you should set a proper marketing analytics framework within the organization to have the right processes along with the right technology platforms to capture data-driven strategy and deliver consistent information about this

Marketing strategy vs. marketing plan

People often use the terms “marketing strategy” and “marketing plan” interchangeably, but, in reality, they are two different processes.

A marketing plan describes the concrete actions and marketing tactics undertaken to complete a marketing campaign. A **marketing strategy**, meanwhile, outlines the big picture of a marketing effort, such as the business's target audience and their product's value proposition for customers. As a result, it is common to refer to an existing marketing strategy when developing a marketing plan. While the strategy describes *what* the marketing objectives are, the plan describes *how* those objectives are going to be achieved. Without a well-thought-out marketing strategy, marketing plans are in danger of missing the mark.

For example, imagine an e-commerce business that is trying to grow its customer base. They start using marketing tactics like a referral program to encourage positive word of mouth. But their efforts only have marginal success.

If they had created a marketing strategy, then the company may have realized that they actually needed to grow their customer base by appealing to an untapped target audience. As a result, their marketing plan would have instead outlined a digital marketing strategy focused on content creation through targeted blog posts and search engine optimization. A great strategy can lead to a great plan.

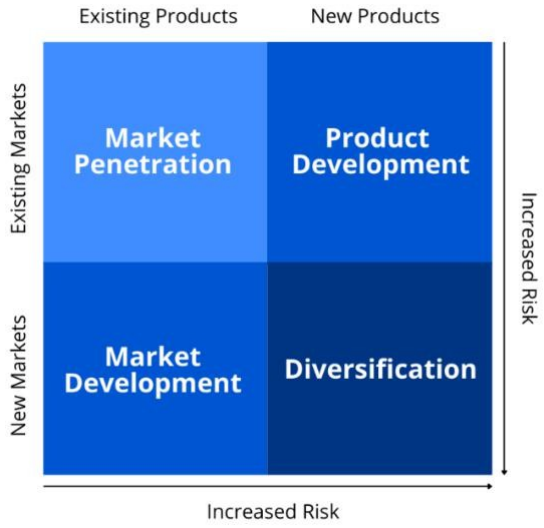
Types of marketing strategy

There are many different approaches to marketing – such as social media marketing or content marketing – but the most elementary strategies for market growth are found in **Ansoff's matrix**. These four strategies are:

- Market penetration
- Product development
- Market development
- Diversification

H. Igor Ansoff created his matrix to help businesses understand the different strategies required for market growth. Ansoff made two basic assumptions about how growth could be achieved: firstly, by varying what product is being sold and, secondly, by varying who the product is being sold to [2]. As a result, each of the quadrants in his matrix feature a mix of these two factors.

FIG: Ansoff's matrix.



In outlining these four growth strategies, Ansoff's matrix also emphasizes the different marketing tactics that business and marketers must consider when undertaking them. Each strategy requires a different consideration of the **the** four Ps, also know as the "marketing mix," which marketers should consider together to ensure an effective marketing strategy. The four Ps are:

- **Product:** What is being sold
- **Place:** Where it is being sold
- **Price:** What the product costs
- **Promotion:** How the product is marketed to the target audience

The exact way that a marketer defines the four Ps for their marketing efforts will depend on the growth strategy they are using and the political and economic outlook of their market. Let's take a closer look at each strategy from Ansoff's matrix.

How to create a marketing strategy?

A marketing strategy can set you up for marketing success. As you are creating your own marketing strategy, consider the following steps to help guide your process.

1. Define your business and marketing goals.

The first step in creating an effective marketing strategy is to clarify what your overall business objectives and marketing goals are.

In other words: what is the end outcome you are trying to achieve with your market growth strategy? The answer to this question will inevitably depend on your particular place in the market and your own comfortability with different risk levels.

Some examples of business and marketing goals include:

- Grow customer base
- Increase sales
- Increase brand awareness

Whatever you ultimately decide are you objectives, though, the purpose is simply to take time out and consider what you want to actually accomplish by expanding your marketing efforts. These overarching goals will guide you as you further develop your marketing strategy.

2. Conduct market research.

Strategic marketing requires a comprehensive understanding of the marketplace, its economic and political context, and your place in it. So, market research is a must.

As you are conducting market research, some of the factors will want to consider include:

- Competitors, particularly their value proposition and market share
- Market size, including the realistic number of customers that would be interested in your products
- Market gaps where you can provide value
- Possible economic and political realities that could impact the market in the long-term

As you gain a better understanding of the market, you will also better understand how you fit into it and where you can grow in it.

3. Create a customer profile.

The purpose of every marketing campaign is to connect with a consumer. To help guide the development of a strong marketing plan, then, your marketing strategy needs to include a comprehensive profile of your target audience.

It is helpful to consider your target audience in relation to the four Ps. So, you might ask yourself the following questions:

- Based on what you know about the market, who is your target audience? What are their key demographics?
- What is your product's value proposition to your customer? (Product)
- How much is your target audience willing to pay for your product or service? (Price)
- Where does your target audience shop? (Place)
- What marketing tactics are most persuasive to your target audience? (Promotion)

As you research and consider these questions, your customer should come more clearly into view. A comprehensive understanding of you target market will help you create a strategy that has impact with those you are trying to reach.

4. Synthesize and strategize.

Finally, you will take the goals you have outlined, research you have conducted, and profiles you have created to construct a marketing strategy. The critical question you will want to answer is: how will you align with your target market to meet your overall objectives? Your answer to this question will be your strategy.

Ultimately, your marketing strategy should cover the following:

- Business and marketing objectives
- Market overview, including key facts and figures
- Competitor research
- Customer profile
- General statement of strategy highlighting the product's value proposition to customers

While you may have collected much information as you were conducting research, your marketing strategy doesn't need to be too long. In fact, a strong marketing strategy can be as short as one to two pages. Remember, the marketing strategy is meant to act as long-term guide for directing specific marketing tactics, not an action plan of how a marketing campaign will be done.

Key takeaways

- Marketing is more than just advertising and promotion – it's all about connecting with the customer.
- A marketing strategy sets the direction for all your product and marketing-related activities.
- Having a marketing strategy helps keep all your activities on track.
- Developing a marketing strategy involves setting goals, researching the market, developing product plans, defining your marketing initiatives, and following the "7 P's."

CONCLUSION:

Optimizely's digital experience platform and cloud-based CMS solutions should be part of your company's marketing strategy. Optimizely's online solutions help you better manage your digital assets, optimize the customer experience, and enhance your company's ecommerce efforts, improving the effectiveness of your evolving marketing strategy.

MARKETING MIX

INTRODUCTION

A marketing mix includes multiple areas of focus as part of a comprehensive marketing plan. The term often refers to a common classification that began as the four Ps: product, price, placement, and promotion.

Effective marketing touches on a broad range of areas as opposed to fixating on one message. Doing so helps reach a wider audience, and by keeping the four Ps in mind, marketing professionals are better able to maintain focus on the things that really matter. Focusing on a marketing mix helps organizations make strategic decisions when launching new products or revising existing products.

Definition of Marketing Mix

The marketing mix is defined by the use of a marketing tool that combines a number of components in order to become harden and solidify a product's brand and to help in selling the product or service. Product based companies have to come up with strategies to sell their products, and coming up with a marketing mix is one of them.

Table of Content

What is Marketing Mix?

Marketing Mix is a set of marketing tool or tactics, used to promote a product or services in the market and sell it. It is about positioning a product and deciding it to sell in the right place, at the right price and right time. The product will then be sold, according to marketing and promotional strategy. The components of the marketing mix consist of 4Ps Product, Price, Place, and Promotion. In the business sector, the marketing managers plan a marketing strategy taking into consideration all the 4Ps. However, nowadays, the marketing mix increasingly includes several other Ps for vital development.

What is 4 P of Marketing

1.Product in Marketing Mix:

A product is a commodity, produced or built to satisfy the need of an individual or a group. The product can be intangible or tangible as it can be in the form of services or goods. It is important to do extensive research before developing a product as it has a fluctuating life cycle, from the growth phase to the maturity phase to the sales decline phase.

A product has a certain life cycle that includes the growth phase, the maturity phase, and the sales decline phase. It is important for marketers to reinvent their products to stimulate more demand once it reaches the sales decline phase. It should create an impact in the mind of the customers, which is exclusive and different from the competitor's product. There is an old saying stating for marketers, "what can I do to offer a better product to this group of people than my competitors". This strategy also helps the company to build brand value.

2.Price in Marketing Mix:

Price is a very important component of the marketing mix definition. The price of the product is basically the amount that a customer pays for to enjoy it. Price is the most critical element of a marketing plan because it dictates a company's survival and profit. Adjusting the price of the product, even a little bit has a big impact on the entire marketing strategy as well as greatly affecting the sales and demand of the product in the market. Things to keep on mind while determining the cost of the product are, the competitor's price, list price, customer location, discount, terms of sale, etc.,

3.Place in Marketing Mix:

Placement or distribution is a very important part of the marketing mix strategy. We should position and distribute our product in a place that is easily accessible to potential buyers/customers.

4.Promotion in Marketing Mix:

It is a marketing communication process that helps the company to publicize the product and its features to the public. It is the most expensive and essential components of the marketing mix, that helps to grab the attention of the customers and influence them to buy the product. Most of the marketers use promotion tactics to promote their product and reach out to the public or the target audience. The promotion might include direct marketing, advertising, personal branding, sales promotion, etc.

What is 7 P of Marketing

The 7Ps model is a marketing model that modifies the 4Ps model. As Marketing mix 4P is becoming an old trend, and nowadays, marketing business needs deep understanding of the rise in new technology and concept. So, 3 more new P's were added in the old 4Ps model to give a deep understanding of the concept of the marketing mix.

1.People in Marketing Mix:

The company's employees are important in marketing because they are the ones who deliver the service to clients. It is important to hire and train the right people to deliver superior service to the clients, whether they run a support desk, customer service, copywriters, programmers…etc. It is very important to find people who genuinely believe in the products or services that the particular business creates, as there is a huge chance of giving their best performance. Adding to it, the organisation should accept the honest feedback from the employees about the business and should input their own thoughts and passions which can scale and grow the business.

2.Process in Marketing Mix:

We should always make sure that the business process is well structured and verified regularly to avoid mistakes and minimize costs. To maximize the profit, It's important to tighten up the enhancement process.

3.Physical Evidence in Marketing Mix:

In the service industries, there should be physical evidence that the service was delivered. A concept of this is branding. For example, when you think of "fast food", you think of KFC. When you think of sports, the names Nike and Adidas come to mind. Marketing Mix Example:

This topic will go through a marketing mix example of a popular cereals company. At first, the company targeted older individuals who need to keep their diet under control, this product was introduced. However, after intense research, they later discovered that even young people need to have a healthy diet. So, this led to the development of a cereals product catered to young people. In accordance with all the elements of the marketing mix strategy, the company identified the product, priced it correctly, did tremendous promotions and availed it to the customers. This marketing mix example belongs to Honeycomb, one of the most renowned companies in the cereal niche.

Following these rules clearly has managed to make the company untouchable by all the other competitors in the market.

This makes Honeycomb, the giant we know and love today to eat as morning breakfast!

Marketing Mix Product

All products can be broadly classified into 3 main categories. These are :

1. **Tangible products:** These are items with an actual physical presence such as a car, an electronic device, and an item of clothing or a consumer good.
2. **Intangible products:** These are items that have no physical presence but can be felt indirectly. An insurance policy is an example of this. Online items such as software, applications or even music and video files are also intangible products.
3. **Services:** Services are also intangible products but they are the result of an economic activity that does not result in ownership. It is a process that creates benefits for customers. Services depend highly on who is performing them and remain difficult to reproduce exactly.

Importance of Marketing Mix

The marketing mix is a remarkable tool for creating the right marketing strategy and its implementation through effective tactics. The assessment of the roles of your product, promotion, price, and place plays a vital part in your overall marketing approach. Whereas the marketing mix strategy goes hand in hand with positioning, targeting, and segmentation. And at last, all the elements, included in the marketing mix and the extended marketing mix, have an interaction with one another.

Questions on Marketing Mix

Q.1 State Any One Advantage of Personal Branding

Ans:

- It is because of branding that customers are able to identify the products.
- Example, a customer who is satisfied with 'Dove' beauty bar need not inspect it every time she buys the product.

Q.2 State the Components of Product Mix.

Ans:

- Branding.
- Packaging.
- Labeling.

Q.3 A Company Has to Decide About Its Price Policy, Credit Policy; Terms of Payment Etc. Name the Concept Which the Company is Trying to Decide. Ans:

Price Mix

CUSTOMER BEHAVIOR

INTRODUCTION

Customer behavior refers to an individual's buying habits, including social trends, frequency patterns, and background factors influencing their decision to buy something. Businesses study customer behavior to understand their target audience and create more-enticing products and service offers.

Customer behavior doesn't describe who is shopping in your stores but how they're shopping in your stores. It reviews factors like shopping frequency, product preferences, and how your marketing, sales, and service offers are perceived. Understanding these details helps businesses communicate with customers in a productive and delightful way.

Factors That Affect Customer Behavior

There are three factors that influence customer behavior: personal, psychological, and social. Let's dive into each type.

Personality Traits

A customer's behavior in your store is heavily influenced by their personality, background, and upbringing. Some will be jovial and outgoing, others quiet and collected, and some will fall in between. Understanding where your target audience lies in this category will be vital to understanding customer behavior.

Psychological Responses

Psychological responses can be challenging to predict, but they play a significant role in customer behavior because someone's response to a situation is based on perception and attitude, which can change daily.

For example, say you got a promotion, you're having a celebratory dinner, and your server accidentally spills a glass of water on your shirt. You might be more forgiving in this instance because you're in a great mood and having a good day. However, if you were just fired from your job, you might be more frustrated with the situation.

Customers can be patient and satisfied one day, but the next, they're pressing your rep on an urgent issue. Understanding that a customer's psychological response doesn't represent who they are as a person can help your team defuse stressful situations and prevent potential churn.

Social Trends

Social trends are external influencers that customers listen to, like peer recommendations, societal norms, or fads. Some of these influences can be temporary, but others can affect customers permanently.

We've just gone over some examples of factors influencing customer behavior; now, let's discuss some data-backed examples of consumer behaviors that directly impact customer service.

What Is a Customer Behavior Analysis?

A customer behavior analysis is a qualitative and quantitative observation of how customers interact with your company. You begin by segmenting customers into buyer personas based on their shared interests. Then, observe each group at their respective stage in the customer journey to see how the different personas interact with your company.

This analysis gives insight into the variables that influence your audiences and the motives, priorities, and decision-making methods customers consider during their journey. It also helps you understand how customers feel about your company and if that perception aligns with their core values.

Why should you conduct a customer behavior analysis?

Content Personalization

A customer behavior analysis is important because now, more than ever, customers expect highly personalized content.

In fact, a Salesforce survey of over 6,000 consumers found that 66% of them expected companies to understand their needs and expectations, and a Redpoint Global survey found that 82% of respondents expect businesses to accommodate their preferences and meet their expectations and 70% say they're highly likely to purchase exclusively from brands that understand them and their needs. So, in brief, you'll be ensuring you speak to customers' needs and desires, contributing to customer loyalty and retention.

Customer Value

Another key business need is the ability to predict a customer's overall value. A customer behavior analysis improves this process by identifying ideal customer characteristics. By targeting these personas, your business can attract brand-loyal customers before your competitors do.

Content Optimization

The data you get from your customer behavior analysis can be used to optimize your marketing campaigns. Not only can you narrow your focus to your most valuable segment of customers, but you can also engage them on their preferred channels. This analysis can also help you deliver content at the most effective time to make an impact.

You'll also get insight into where roadblocks occur for each persona, helping you increase opportunities for upselling and cross-selling.

Customer Retention

While it's important to attract loyal customers, it's just as important to retain them. Accenture reported that 49% of customers expect special recognition when they're a "good customer." Even if they like your company, these people may start to look elsewhere if you don't have a way to

acknowledge them. A behavior analysis can help your team reduce this customer churn by identifying good and bad customer traits.

How to Conduct a Customer Behavior Analysis?

1. Segment your audience.

The first step to a customer behavior analysis is segmenting your audience.

Key segmentation models are demographic segmentation (age, gender, etc.), psychographic segmentation (personality, values, etc.), geographic segmentation (country, town, etc.), or other things like behaviors like frequent actions and product use, preferred media channels, and online shopping habits.

You'll also want to identify the characteristics of customers that are the most valuable to your business. One way to do this is through an RFM analysis, which outlines how recently a customer has purchased from you and how frequently they purchase from you.

2. Identify the key benefit for each group.

Each customer persona will have a unique reason for choosing your business, and it's imperative to identify it. Look beyond the product or service and consider the external factors influencing the customer's buying decision.

For example, was it a purchase of convenience? Or did they make a conscious decision to seek out your brand? How urgent was the purchase, and how much do they want to spend? Thinking about the context of customers' needs is a great way to determine areas to improve the customer experience.

3. Allocate quantitative data.

Some resources may be more accessible than others, and it's important to derive information from both internal and external sources to ensure you get a complete picture of both micro and macro consumer trends.

From within, your company can pull stats such as blog subscription data, social media insights, and product usage reports. Secondary outlets can offer things like consumer reviews and competitor analytics. Third-party data isn't specific to one company but provides general statistics across an entire industry. Through the combination of the three, you'll have a broad scope of information to work with when analyzing customer behaviors.

4. Compare your quantitative and qualitative data.

After you've collected your data, the next step is to compare the qualitative data against the quantitative.

To do this, go through your customer journey map using the data sets as a reference. Look at which persona bought what product, when they bought it, and where. Did they return for another visit? By comparing the two sets of data against the customer experience, you can develop a detailed understanding of your customer's journey.

Comparing data should help you identify recurring trends. Look for common roadblocks that seem to pop up at different lifecycle stages, and note any unique behaviors specific to a customer type. Circle back to your high-value customers, and acknowledge anything that stands out with their buying behaviors.

5. Apply your analysis to a campaign.

As discussed earlier, you can use your findings to optimize your content delivery. Pick the best delivery channel for each persona, and take advantage of opportunities where you can personalize the customer experience. Nurture customers throughout the entire customer journey by responding to roadblocks on time. The insights you've gained from conducting your customer behavior analysis should give you a good idea of where you can make updates to your marketing campaigns.

Before rolling out your new initiatives, use your analysis to determine what your customers will think about these changes. Customers are habitual creatures, and some will push back on change even if it's for the better. These customers tend to be more loyal to your brand, so it's imperative you don't lose them as a result. Consider different ways to introduce change to these customers, and remember to be receptive to their feedback.

6. Analyze the results.

Once you've given ample time for testing, you'll probably want to know if your changes worked. Use metrics like conversion rate, acquisition cost, and customer lifetime value to determine the effect of your updated campaigns. It's important to continuously analyze your results as new tech, politics, and events constantly influence customer needs. Revisiting your analysis frequently ensures you capture new trends in the customer's journey.

SELLING PROCESS

Sales is a key part of any business, helping companies grow while building a strong customer base. Learning about the selling process can help you find potential buyers or prospective clients, increase your overall sales and nurture your relationship with consumers.

Key takeaways:

- The selling process is the interaction between a salesperson and their potential buyer. There are seven common steps to the selling process: prospecting, preparation, approach, presentation, handling objections, closing and follow-up.
- The first three steps of the selling process involve research into prospects' wants and needs, with your presentation midway through the selling process. The final four steps include addressing any questions or concerns, then closing the deal and maintaining your connection.
- Both business-to-business (B2B) and business-to-consumer (B2C) salespeople follow the same general selling process to connect with prospective clients and build a strong customer base.

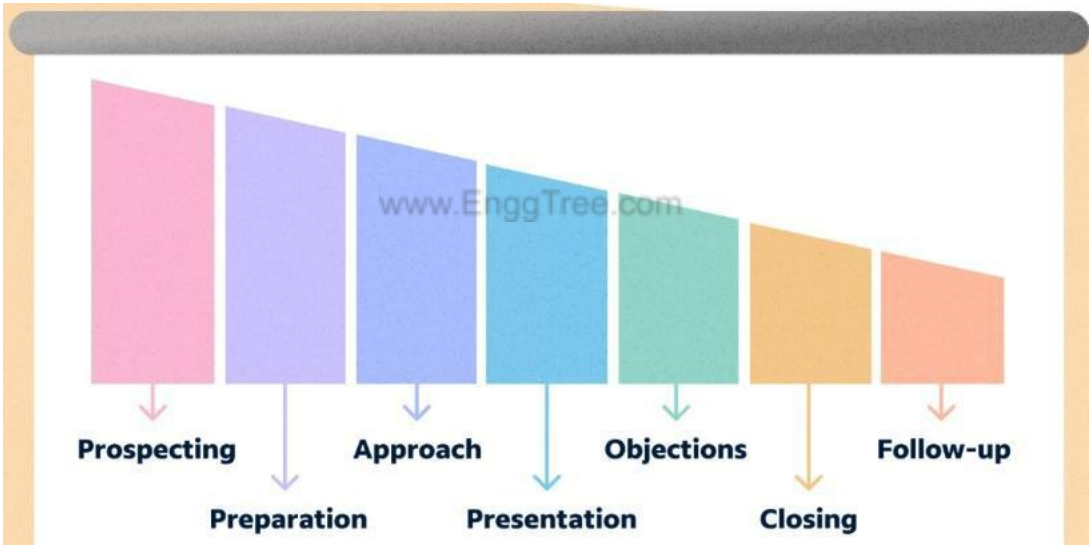
What is the selling process?

The selling process is the interaction between a seller and a potential buyer or client. It's generally a method business can replicate for consistent performance among salespeople. Businesses use the common seven steps of the selling process to complete sales and ensure continued profits.

7-step selling process

Here are seven steps that are typically involved in making a sale:

1. Prospecting
2. Preparation or pre-approach
3. Approach
4. Presentation
5. Handling objections
6. Closing
7. Follow-up



1. Prospecting

Prospecting involves finding and qualifying potential buyers or clients. At this stage, you determine whether your prospective customer has a particular need or want that your business can fulfill. You might also decide on varying factors such as affordability.

This stage of the selling process often involves research to identify your ideal customer. You can start compiling a list of leads or potential clients. You might screen them based on qualifying questions, such as whether they're a business owner or homeowner or if their average monthly profits or income are suitable for the product price. This helps narrow your buyer pool.

You can also use the screening process to determine buyers' current needs. For instance, if you're selling insurance to individuals over age 65, then you probably won't target someone in their 30s.

2. Preparation or pre-approach

Before making initial contact with your prospects, you want to prepare. It's important to have all your information ready, such as product descriptions, prices, payment options, competitor rates and dates for specific sales. You also want to know as much as possible about your prospects so you can better connect with them.

This stage of the selling process might also involve preparing your initial sales presentation. Be ready to answer any questions your prospects could have with supporting data. Practice what you're going to say out loud, and have someone present you with potential questions so you can rehearse your response.

3. Approach

During the approach stage of the selling process, you'll make your first personal connection with your prospect or prospects. This step involves getting the potential buyer or client to interact with you by personalizing your meeting or otherwise establishing rapport. Ask questions to get the client involved in the conversation.

Example: *For instance, if you sell skincare products or services, you might ask:*

- *Do you currently have a daily skincare routine?*
- *Is there anything about your daily skin regimen that you're unhappy with?*
- *What are your top skin complaints?*
- *Have you heard about the skin benefits of our specific product or service?*

You can also offer a gift, such as $10 off the first skin treatment or a sample of the product so your prospect can experience the benefits firsthand before making a greater investment. This also helps to confirm confidence in what you're selling.

4. Presentation

At this point in the selling process, you have established an understanding of your prospect's individual needs and wants. You can then tailor your presentation or demonstration to show how your product or service can best fulfill those needs or wants. To complete this step effectively, focus on personalizing it and frame your product as a solution to their problem.

Your presentation might involve a tour, product demonstration, video presentation or other visual or hands-on experience. This step is when you can apply all your research. For instance, if you're trying to sell a house to a growing family, you likely would show them a larger home with a yard in a family-friendly neighborhood rather than a second-story condo.

5. Handling objections

After you complete your presentation, your prospect might have some questions, concerns or objections. This is a normal and important part of the selling process. View objections as an opportunity to learn more about your prospect. When you research and prepare appropriately, you'll have all the information needed to overcome objections.

This step might involve listening to your prospect's concerns and asking additional questions to better identify and understand their objections. You might want to then reframe your sales pitch to address those concerns.

Example: If a customer says they won't be able to make an investment until next month, you could offer them additional savings or promotions if they follow through with their purchase. While in the handling objections step of the selling process, you might also reiterate the cost or loss of value if the prospect decides to completely forgo the purchase.

6. Closing

Once you've convinced the prospect that your product or service can meet their needs, it's time to close the sale. It's important to actually ask the prospect if they want to make the purchase and ensure they fully understand all the terms of the sale.

Closing the sale might involve drafting a proposal, negotiating terms or pricing, signing contracts, completing a monetary transaction or even overcoming additional concerns or objections. You want to make sure your buyer understands the terms and restrictions included in the contract, such as any refunds, guaranteed customer satisfaction clauses or ongoing purchases or billing for monthly memberships.

At this stage, you can also use upselling techniques, such as offering additional products that complement their original purchase, upgrades or a higher-end version of your product. After completing the transaction, always thank the customer and be sure not to instantly drop the connection.

7. Follow-up

The follow-up, which takes place after the sale, is one of the most important steps in the selling process. It's a continuation of the relationship between the seller and the buyer that ensures customer satisfaction, retains customer loyalty and helps prospect for new customers. The idea is not to continue selling at this stage, but instead to nurture the existing relationship.

The follow-up might involve sending a thank-you note or calling the customer to ask about their experience with their new product or service. You might also ask your customer to rate your service or post a review on one of your social media or business pages. Sometimes, the follow-up includes completing the logistics of a sale, such as signing additional contracts, making deliveries or installing products. When done well, this stage can often lead you back to step one in the selling process with additional sales, referrals or reviews that bring new customers to you.

Types of sales

There are two primary types of sales: business-to-business (B2B) and business-to-consumer (B2C). Understanding the similarities and differences between these types of sales can help you improve your use of the selling process when approaching prospects.

B2B sales

B2B sales involve selling products or services to other businesses. When you work in B2B sales, you often work with a professional buyer who is very familiar with the selling process. Examples of B2B sales include:

- **Wholesale:** A coffee bean manufacturer sells large quantities of coffee beans to a cafe that then sells those coffee beans in smaller quantities to consumers.
- **Supply:** A paper goods company sells paper cups and napkins to restaurants.
- **Service:** A marketing firm works with businesses to increase their presence online.

B2C sales

B2C sales involve selling products or services to consumers. The selling process for B2C sales is usually much shorter, with many customers making a purchase soon after the prospecting stage.

One example of B2C sales is a representative selling a laptop to a customer at a tech store. Another example that usually involves more research and prospecting is an insurance salesperson selling a life insurance policy to an individual.

SALES PLANNING

INTRODUCTION

A sales plan is a document that encompasses goals, target audience, and sales strategy aimed at attaining necessary results. It enables a company's team to predict business-related risks and avoid them.

Contents

In this article, we'll uncover the importance, components, and examples of sales plans. We'll also find out how to write a sales plan and explore 8 tips to follow to create a successful sales plan.

Why is it important to have a sales plan?

Planning is an essential point for any business, especially when talking about sales targets. Before selling your product, you need to outline your main goals and the ways you can achieve them. This includes various sales strategies, tactics, and approaches. Once you have your objectives identified, you need to create a plan where you can mention all the details of your marketing strategy.

A sales plan enables you to predict possible problems and risks related to your product and sales. As a result, you can eliminate these risks before the problem arises and escalates. When you have a clear plan of action, you can be confident about the correctness of your decisions. Besides, you can keep an eye on the product's sales performance and decide what else you can do to get closer to your short-term and long-term goals.

A sales plan will also come in handy if you conquer international markets. This document will serve you as an overview of customers' needs, requirements, and preferences in different countries. Also, it'll contain sales strategies that suit different geographics. As a result, you can successfully reach your goals.

Now that you know the importance, let's discover the components of a sales plan.

What should a sales plan include?

A sales plan is a comprehensive document covering many aspects of your business. You need to create it as detailed as possible to attain your objectives faster. Your plan should contain the following sections:

- mission;
- company goals;
- revenue expectations;
- target market;
- business performance for the previous period;
- market trends;
- industry conditions;
- competitor analysis;
- marketing strategy;
- sales strategies, tactics, techniques;
- software;
- human and financial resources available;
- tasks and responsibilities of different departments;
- metrics.

It's time to reveal how to write a sales plan.

How to write a sales plan?

Creating a sales plan might require you to spend some time defining goals, revenue targets, tasks for departments, but it's worth it. In the end, you'll have a clear roadmap for a certain period your company's team should follow to get great results in sales. If you don't know where to start, we'll help you. Follow our guide to clarify the details of the process.

1. **Determine your major goals.** The first and foremost is to define your main goals. Think of the things you want to achieve related to sales. For example, sell 500 items in one month or earn $20,000 in one year. Make sure that your goals are specific, achievable, and measurable. Besides accurate sales targets, you can also think about more general things like the growth of your brand, new markets, or the production of new products.
2. **Make your targets more specific and accurate.** If you are ready with more general objectives, it's time to proceed to the next stage and identify more specific goals. Be realistic and set goals possible to reach. Let's imagine that you want to enter the Latin America region. In this case, you need to list all countries where you want to present your product. As an option, give tasks to your team members to research which countries will accept your product.
3. **Assess your resources.** At this stage, you need to evaluate your human resources and money opportunities. Analyze whether you have enough employees to bring your plan to life and financial support to purchase all the necessary inventory.
4. **Choose KPIs.** Key performance indicators are necessary to figure out whether your plan works and brings you closer to your main goals. Choose the most appropriate metrics. It's perfect to have 3-5 indicators to control business performance.
5. **Allocate time wisely.** There's no need to rush since this process can be time-consuming. Your company's team will help you manage all the tasks efficiently. Have a week or more to develop an accurate and realistic plan that includes all the details of your sales strategy, tactics, goals, revenue targets, etc.

Now you know the steps necessary to write a sales plan, so let's proceed to the next section to explore tips for creating a successful plan.

8 Tips for Creating a Successful Sales Plan

Sales plans vary in different companies. However, there are some critical points you should consider in your sales plan to be more effective. The following tips will provide you with a clue.

1. Make sure that you have realistic objectives.
2. Set deadlines.
3. Consult with sales representatives.
4. Conduct competitive analysis.

5. Develop a budget proposal that encompasses previous performance data and forecasts for the future.
6. Write specific plans for each department of your company.
7. Analyze issues your sales representatives find challenging.
8. Use special tools to simplify your work.

You need to do profound research and work with your teams to understand what information to include in your sales plan. For sure, it'll require your effort. However, after you do all the work, you'll be able to develop a plan that will lead you towards success and growth.

Now that you know some tips, it's time to grab some inspiration from the examples

below. **Examples of Sales Plans**

We've prepared different examples of sales plans you can consider for your business. The type you choose depends on your business objectives, so take a closer look at each of them to find a perfect option.

1. **Market expansion.** If you decide to reach new markets, you should consider this sales plan. This document outlines your tasks, goals, and metrics to track your progress. With its help, you'll address the needs of a new target audience in a completely new geographic area. Besides, a market expansion plan usually includes distribution costs, logistics, and time zone.
2. **New product.** The main aim of a new product launch is to bring ROI. That's the main focus of the new product sales plan. When you create this type of plan, it's a must to conduct a competitive analysis, identify sales strategy, and take care of your brand positioning.
3. **30-60-90-day plan.** This is the most general sales plan which focuses on a timeframe by which you should reach certain goals. You can set a deadline to do something in 30, 60, and 90 days. For example, you can decide to acquire 10 new customers in 30 days, increase ROI by 10% in 60 days, and reduce churn by 2% in 90 days.

CONCLUSION:

A sales plan is an essential element of your business that helps predict all the possible risks and prevent them. Once you have a roadmap, you know in what direction you should move to attain your targets.

ANALYTICS APPLICATIONS IN MARKETING AND SALES

SALES ANALYTICS

INTRODUCTION:

It's important for sales and marketing teams to review their strategies and performance to make improvements. One way to measure performance is with sales analytics. Sales analytics can also help sales and marketing teams create strategies, so it's useful to learn about sales analytics and how to use them.

In this, we define analytics for sales, explain why they're important and review different sales analytics methods with tips on how to use them to improve your sales process.

What are Sales Analytics?

Sales analytics are a method business can use to predict sales trends and model their sales process. Analytics typically involve technology that can collect and measure sales data, such as reach, purchases and customer interactions with the business. It's helpful for marketing and sales teams to define metrics for sales analytics at the beginning of a marketing campaign to best track their performance and progress.

Benefits of sales Analytics:

Sales analytics offer many benefits to the marketing team, including the ability to:

Optimize the sales funnel

The sales funnel refers to the buyer's activities from the first point of contact with a business to the point of purchase. A close review of each stage can help optimize each part of the process by making minor improvements. Sales analytics can also help automate some processes, such as prospecting, and give sales representatives the opportunity to focus only on closing sales.

Identify strengths and weakness

Sales analytics like team performance can help determine what practices work best in making sales. Marketing teams and sales representatives can review each stage of the process and its success individually. For example, marketers can collect analytics about content that consumers interact with versus content that gets little interaction and use this to create more engaging content.

Increase efficiency in sales

Using sales analytics helps to optimize the sales funnel and make improvements to the sales process, which leads to efficiency. Sales analysis does this by automating workflows and helping team members collaborate and reduce time spent on tasks.

Sales effectiveness is a metric that can recognize patterns in lead generation, such as what type of content consumers are most likely to interact with. This helps the marketing and sales team create more content like this and generate more leads.

Types of Analytics for sale:

Here are nine types of sales analytics and what they're useful for:

1.Market research:

Market research is information on consumer preferences, behaviors and needs. This helps to create content that properly targets a business's audience and helps to produce goods and services that best serve the consumers.

Marketing departments can gather market research through social listening tools that track consumer behavior. Another method is to send surveys to customers and request feedback on how to improve their products and services.

2. Sales trends:

Sales trends are patterns in purchasing behaviors and patterns in key performance indicators, which are metrics marketers used to measure marketing data, such as conversions. Sales trends can help predict revenue and inform marketing departments of which techniques are effective among certain demographics in the business's target audience.

For example, a company that markets products to people below the age of 30 years old can customize its sales and marketing approaches to appeal to the desires of that market, instead of a general market.

3. Predictive sales:

Predictive sales are analytics that uses marketing data from the past and present to forecast sales. This helps to manage the marketing budget and plan for resources, such as labor costs. Forecasting sales is also important for the production of goods, so businesses can meet the demand for a product.

4. The performance of sales:

The performance of a sales team is analytics that helps track sales goals, such as the number of sales or customers a sales representative gains. This is a helpful analytic to provide accountability for sales team members. Gathering information about each sales representative on the team also helps to reach larger sales goals, such as customer acquisition.

The sales pipeline analysis is a review of the sales process, including market research, gaining customers, making sales pitches and closing sales. It's helpful to look at the sales pipeline and each stage of the sales process to optimize strategy.

For example, sales pipeline analytics let marketers look at strategies for prospecting, or finding consumers who are likely to purchase, and by reviewing the prospecting strategy, marketers can determine which practices are most successful in finding customers.

Product sales analysis reviews all the products a business has on the market. It's important to track each product and focus on the products that are performing best. Sometimes, a business may remove a product if it's not selling and others to prevent overcrowding the marketplace. Often, this removes competition and helps the business's other products increase in sales.

Sales effectiveness analyzes sales team performance and helps identify opportunities to make sales to customers. This involves qualifying leads and recognizing patterns. Using this analytic can help automate repetitive processes, such as tracking calls that end with closing a sale, and provide sales representatives with more time to focus on turning consumers into customers.

8.Diagnostics:

Diagnostics can explain trends by identifying causing factors. Diagnostic analysis can compile a list of performance indicators to help explain the effectiveness of the sales department. Examples of aspects diagnostics may provide data on are:

- Revenue goals
- Top competitors
- Sales Process
- Standard pricing

- Customer acquisition

9. Prescriptive marketing

Prescriptive marketing analysis reviews marketing and customer data to inform sales representatives of what to offer to which clients and when. This is an intuitive analytic and can be a great resource for representatives by providing data on prospects and customers to help make and repeat sales.

This is especially helpful for finding which consumers are more likely to become repeat customers and which ones are unlikely to buy the organization's products or services again.

Tips for using sales analytics

Here are some tips for using sales analytics to improve the sales process:

Identify Key sales data metrics: It's important to identify which metrics to use for tracking the performance of the sales team and sales process to provide the best analysis. Consider these key metrics:

conversion rate: In sales, the conversion rate is the percentage of leads that result in sales. Tracking conversions is important to repeat and increase the number of conversions.

sales cycle length: This is how long it takes, on average, for a customer to move from lead generation to the point of purchase. Measuring the sales cycle length can help you learn to shorten and optimize the sales cycle.

Tracking churn rate: This is the number of customers who don't renew subscriptions to your service. Tracking churn rate can help determine patterns and create strategies to improve customer retention.

Sales productivity: All activity that involves engaging with customers and prospects, such as emails, calls and advertisements, is a sales activity that can help measure how productive the sales team is.

Use CRM software:

Using customer relationship management, or CRM, software to combine all the data a business has on customers, including demographics and their individual sales process. Having a software system to track customers helps sales representatives find opportunities to sell, qualify leads and predict consumer behavior from past trends.

This can also help a sales professional determine customers who are unlikely to continue buying products and services, allowing the organization to cease sending marketing and promotional materials to that customer.

CONCLUSION:

An important step in the sales process is to **follow up with customers** after closing a sale. This helps build customer relationships and a loyal customer base, which can ensure customer retention. Following up means answering any concerns, thanking the customer and ensuring customer satisfaction.

MARKETING ANALYTICS

INTRODUCTION:

Modern marketing is a data-driven process fueled by analytics. Without analyzing relevant key performance indicators (KPI), businesses can't tell whether their marketing efforts are providing the expected return on investment (ROI). Marketing analytics is the key to evaluating past performance and determining how to improve it going forward.

What is marketing analytics?

Marketing analytics is a set of technologies and methods used to transform raw data into marketing insights. The goal of marketing analytics is to maximize ROI from an enterprise's marketing initiatives. Marketing analytics encompasses tools for planning, managing, and evaluating these efforts across every channel.

Marketers use established business metrics, and sometimes create new KPIs, to measure the success of their organizations' marketing initiatives. These metrics include:

- Profitability segmented by demographic
- Churn rate
- Customer lifetime value
- Customer satisfaction
- Public perception

Businesses can analyze performance indicators alongside other data, such as customer profiles or demographic trends, to reveal the causal links between marketing decisions and actual sales.

Benefits of marketing analytics

Marketing analytics makes advertising more effective and automates many rote tasks:

- Marketing analytics helps stakeholders achieve a comprehensive view across all marketing channels, such as pay-per-click (PPC) advertising, email marketing, and social media. Analytics can clarify the big picture, as well as dig down into more granular marketing trends.
- Marketing analytics tools improve lead generation by providing the insights needed to optimize advertising efforts and target the most profitable consumers. Better leads generate more sales and improved ROI.
- Marketing analytics provides insights into customer behavior and preferences. Businesses can then tailor their marketing initiatives to meet the needs of individual consumers.
- Marketing analytics enables real-time decision support as well as proactive management. Modern analytics tools make it easy for stakeholders to analyze data as it comes in, so marketing can be adjusted as required by changing trends, and they also allow businesses to use predictive analytics to anticipate those trends rather than react to them.

Challenges of marketing analytics

Enterprises should be aware of the challenges that come with using marketing analytics:

- Many organizations and their marketing teams still struggle to integrate data, which can keep analysts and engineers from being able to access the information they need. Enterprises need to

break down **data silos** that isolate information, as marketing analytics initiatives may flounder if analysts lack access to data from all marketing channels. Organizations should centralize their information in a **data warehouse** so analysts can work with integrated and accessible data.

- Enterprises need to ensure that they have management buy-in and personnel with analytics expertise. Many marketers lack analytics experience, and some executives and marketing decision-makers remain reluctant to make the up-front investments required in employees or infrastructure. Take the time up front to evaluate existing obstacles to using analytics and make the hires or **pitches** necessary to overcome them.
- Businesses need to select the right KPIs. Marketers can easily focus on metrics that are either too granular or too unfocused. To avoid this, enterprises should link performance measurements to concrete business requirements and objectives. For example, a retailer could choose a specific goal, like increasing profits by 10%, and then select a limited number of KPIs related to that goal that are appropriate for its industry, like sales per employee or average transaction value.
- Collecting any customer data involves privacy concerns. Organizations should establish **data governance** and **data security** policies to ensure that their customers' sensitive information stays protected.

How to use marketing analytics

Marketing analytics can benefit organizations' marketing initiatives across all channels. Enterprises should consider the many applications of marketing analytics and determine which may be valuable to them.

Understand search marketing

Many organizations access huge markets through search engines like Google, where consumers often begin their purchasing journeys. Search engine marketing (SEM) promotes businesses and raises online visibility through advertising on search engine results pages (SERP). Revenue from digital advertising in the U.S. breaks new records every year, and search advertising accounts for **almost half of this revenue**. Businesses can use services like Google Ads and Bing Ads to expand their reach.

Organizations need marketing analytics to track and optimize the performance of their SEM efforts. One application of SEM analytics might involve serving different versions of the same ad to a randomized set of browsers and then comparing the performance of these ads in real time.

Search engine optimization (SEO) involves adjusting web content and structure to improve organic search engine rankings. An enterprise can use SEO to reach more consumers and enhance its brand. Tools like **Google Analytics** allow businesses to track relevant KPIs and analyze how their SEO initiatives are progressing and how to improve them.

Analyze social media engagement

More than **a third of the world's population** — including **98% of digital consumers** — spend time on social media, averaging almost two and a half hours per day on these platforms. While SEM drives sales from customers who are searching for specific products, social media marketing can generate interest and demand from new groups of consumers. Social media is now the primary or sole marketing channel for many businesses and organizations, such as crafts sellers on Pinterest, fashion brands on Instagram, and nonprofits on Facebook. Many social media platforms offer their own analytics tools, such as Facebook Insights or Twitter Analytics, and third-party options are available as well.

Analyzing data obtained through social media platforms can provide valuable insights for building business or customer relationships. For example, marketers can set up an account to automatically post information about new products or features as they come out, use an analytics tool to evaluate consumer sentiment through comments or reactions without manually sifting through the data, and then rework their social media marketing as necessary.

Optimize email marketing

Though businesses can use email promotions to reach new audiences, email marketing is more often concerned with existing customers who have opted in to mailing lists or have already purchased products and services. Email provides a more direct gauge of consumer sentiment than other channels, because existing customers are more likely to respond to surveys or interact with advertised material. Popular email marketing tools include Salesforce Marketing Cloud, Mailjet, and Autopilot.

Enterprises can use analytics to optimize and personalize email marketing efforts. Analyzing how customers interact with different email promotions can help businesses target their email marketing and tailor their messages to meet customer expectations and needs. Enterprises can use marketing analytics to determine, for instance, whether customers respond well to certain keywords, emails sent at particular times of day, or links to content on specific topics.

Take advantage of predictive scoring

Predictive lead scoring models leverage marketing data from all channels, as well as internal data, to create a full picture of customer behavior, advertising potential, and marketing opportunities. These models use machine learning to build consumer profiles, which organizations can use to predict how consumers may react to different types of advertising and outreach. Campaigns can then target individual customers to maximize efficiency. For example, a predictive scoring system could rank individuals by likelihood of retention and risk of churning, which could help prioritize outreach to an organization's customer base

CONCLUSION: (Marketing analytics and the data warehouse)

Enterprises should integrate their data before performing analytics, as analyzing data across marketing channels can reveal new, unexpected insights. Centralizing information in a data warehouse allows analysts and engineers to access it for analytics and reporting. Stitch provides a **data pipeline** for replicating information to the data warehouse of your choice, making it easy to integrate a wide variety of data sources.