

Chapter 3

Sales forecasting

Nature and purpose of sales forecasting

It would not be hard to be a successful business person if you had a crystal ball and could look into the future. If you knew which products were going to sell well and which were going to sell badly it would be easy to make a lot of money. Unfortunately, things are never that simple. One can never be one hundred percent sure about the future. However, wise business people will do their best to find out what is likely to happen so that they can position their business in the best way possible to take advantage of any opportunities that may arise. For most businesses the best way to anticipate the future is to use sales forecasting techniques.

Sales forecasting is the art or science of predicting future demand by anticipating what consumers are likely to do in a given set of circumstances. Businesses might ask 'what will demand be if real incomes increase by 10%?' or 'how much is demand likely to fall if a competitor launches a copycat product?' Above all, sales forecasting techniques allow businesses to predict sales, and once a business has what it believes is an accurate estimate of future sales it can then predict HRM needs, finance needs, estimate the quantity and cost of purchases of raw materials as well as determining production levels.

Using past experience or past business data to forecast future sales is called **extrapolation**.

Methods of sales forecasting

Sales forecasting methods can be categorised into quantitative and qualitative techniques.

Quantitative

- Time series analysis
- Use of market research data

Qualitative

- Delphi technique
- Brainstorming
- Intuition
- Expert opinion

Quantitative methods of sales forecasting

Quantitative forecasting methods are used when there is historical data available. A number of different models can be used to forecast future events. Quantitative methods rely heavily on data and are objective.

Time series analysis

Time series analysis uses evidence from past sales records to predict future sales patterns. A business can look at its sales over the last few years and try to work out what is happening. The figures may reveal an upward trend, which is encouraging, or a downward trend, which is worrying. In reality past sales are likely to have fluctuated both up and down over a period of time.

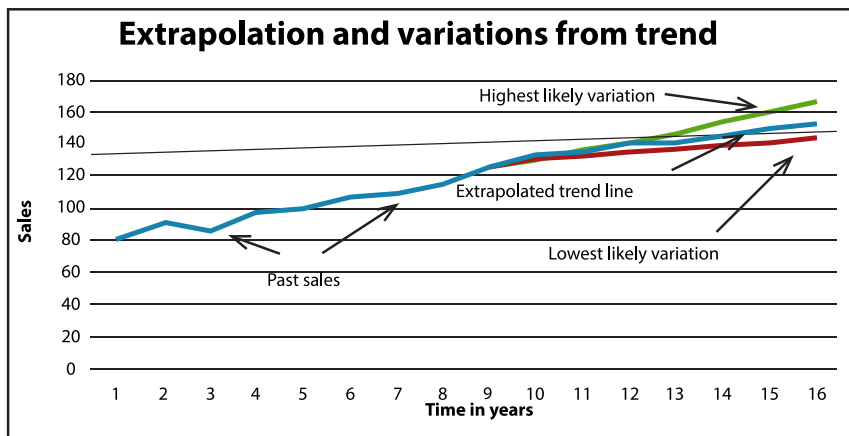
There are several methods of time-series analysis that can be used:

- Seasonal analysis – sales are measured on a monthly or weekly basis to examine the seasonality of demand. For example, the sales of ice cream will be higher in the warmer seasons and lower in the colder seasons or according to daily weather changes.

- Trend analysis – this focuses on long-term data, which has been collected over a number of years. The objective is to determine the general trend of sales - rising, falling or stagnant.
- Cycle analysis – as with trend analysis, long term figures are used but now the objective is to examine the relationship between demand levels and economic activity. For example, by asking the question ‘what is the relationship between demand for the product or products and the stage in the economic or business cycle?’
- Random factor analysis – this method of analysis attempts to explain how unusual or extreme sales figures occur. For example, if sales of ice creams double for a two-week period, then could this be explained by weather conditions, rather than an effective advertising campaign? Random factor analysis therefore attempts to provide explanations for unusual or abnormal sales activity.

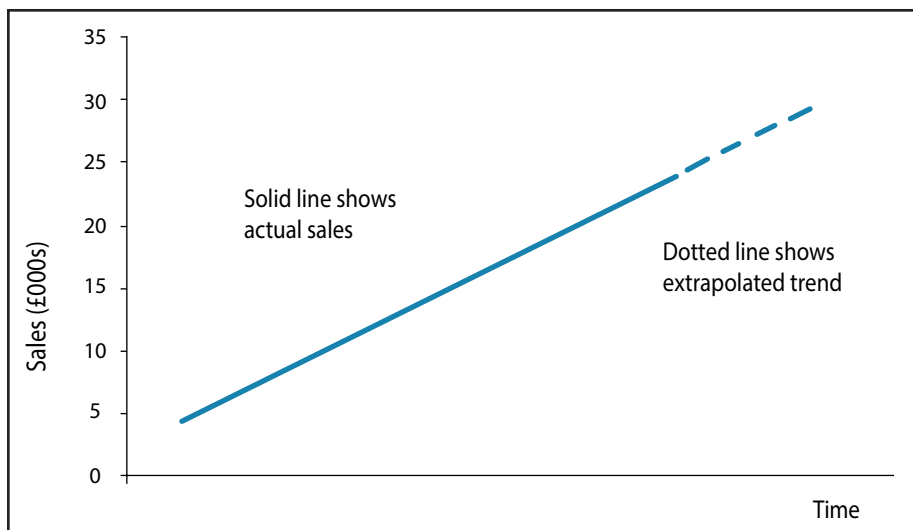
Trend analysis and extrapolation

Once evidence has been gathered, the future can be predicted i.e. sales can be forecasted. Extrapolation involves taking the past and extending it into the future. So, as shown in the diagram below, if sales have grown steadily in the past at around 4 -5% a year then it might be reasonable to extrapolate from this that sales will continue to grow by 5% per year.



We can also add the idea of probability to this prediction of the future. If sales, although showing a general trend of increase, have fluctuated, we can allow for this. The outer lines show possible variations from the simple trend extrapolation. The green line shows what is forecast to be best case scenario and the red lower line shows the forecast worst case scenario. Based on past evidence we can build in factors such as the economic cycle and possible marketing campaigns of competitors.

Extrapolated sales graphs will usually have the future sales displayed as a dotted line, as shown in the graph below.



Moving averages

In order to identify a trend from past sales figures it is customary to make use of a moving average which will even out any major fluctuations in the data. The examples below illustrate how this works.

Below are monthly sales figures for Happy Valley Ice Cream for 2015 and 2016. Sales are in £000s.

Jan 15	Feb 15	Mar 15	Apr 15	May 15	June 15	July 15	Aug 15	Sept 15	Oct 15
130	135	147	250	290	360	428	410	300	260
Nov 15	Dec 15	Jan 16	Feb 16	Mar 16	Apr 16	May 16	June 16	July 16	Aug 16
150	120	125	130	135	230	260	350	400	390

These figures show that there is much variation in the number of ice cream sales depending on the time of year. To establish a trend in the number of ice cream sales, we can calculate a three-point moving average (in this case a three-month moving average).

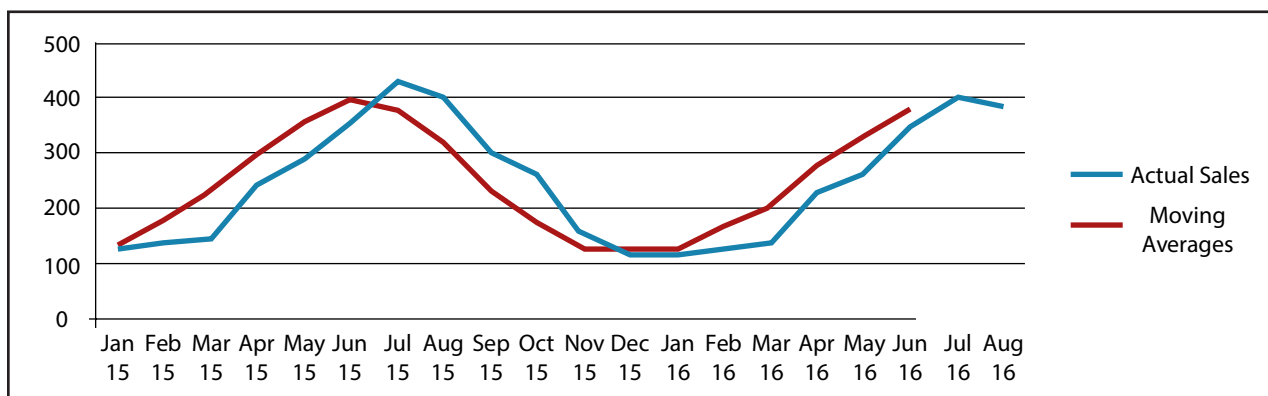
To calculate the three-month moving average, just take three adjacent figures for each month and divide by three. So for Feb 15:

Jan 15	Feb 15	Mar 15
130	135	147

The total for the three months is 412, which is divided by 3 to give 137.3. This becomes the moving average figure for February 2015 (which is the mid-point of the three months).

Jan 15	Feb 15	Mar 15	Apr 15	May 15	June 15	July 15	Aug 15	Sept 15	Oct 15
130	135	147	250	290	360	428	410	300	260
	137.33	177.33	229.00	300.00	359.33	399.33	379.33	323.33	236.67
Nov 15	Dec 15	Jan 16	Feb 16	Mar 16	Apr 16	May 16	June 16	July 16	Aug 16
150	120	125	130	135	230	260	350	400	390
176.67	131.67	125.00	130.00	165.0	208.33	280.00	336.67	380.00	

If we plot all the data for all of the moving averages using the data in the table above, we can see the figures in blue are actual sales and the figures in red are the moving average.



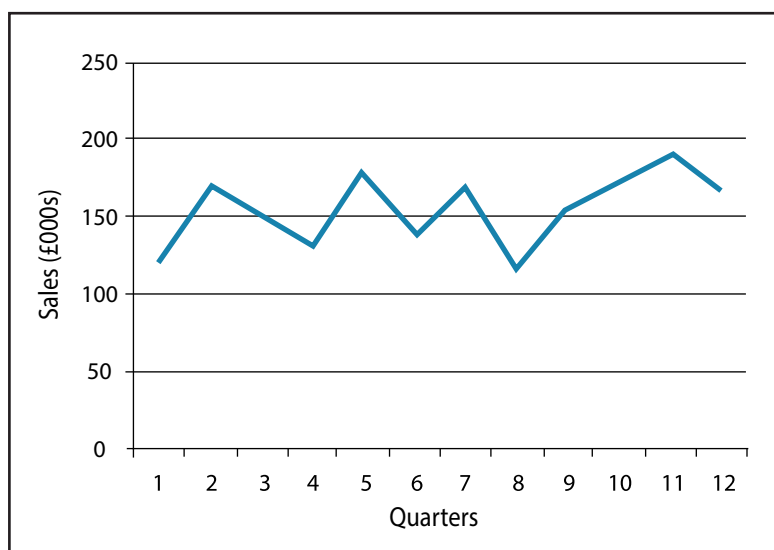
The effect of the calculation of a 3 month moving average is to smooth out seasonal variations. This smoothing will help us plot or predict trends, especially if we have more than one year's figures.

Let us consider another example. The data below shows the quarterly sales figures of an engineering company, W. Peters Ltd. over the last three years. The figures are in £000s.

A quarter is a period of three months. The first quarter of a year is comprised of the months January, February and March whilst the second quarter is comprised of the months April, May and June and so on. In order to make the data easier to understand the quarters for the last three years have been labelled 1 to 12, with 1 being year one, quarter one and 2 being year one quarter 2, etc.

Year 1				Year 2				Year 3			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	2	3	4	5	6	7	8	9	10	11	12
122	170	152	131	179	140	170	119	155	173	191	167

It can be seen from these figures that there are quite large fluctuations in sales from quarter to quarter. The results above are plotted in the following graph. The graph shows quite sharp peaks and troughs in the sales levels.



Now let us calculate the three-point moving average (in this example, per three quarters). To start with we will calculate the average of the first three quarters (1 to 3), then move on to the second quarter and calculate the average of the next three quarters (2 to 4) and so on.

For the first three quarters the calculation is $(122+170+152)/3 = 148$

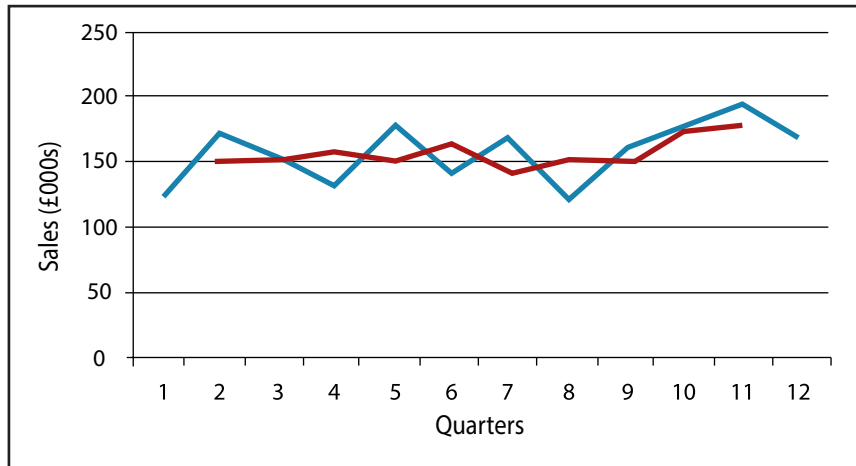
For the next three quarters the calculation is $(170+152+131)/3 = 151$

This process is repeated for all of the quarters up to Year 3, Q4. The results are given in the table below. Notice that the moving average is placed in the middle i.e. the average of quarters 1 to 3 is placed in quarter 2.

Year 1				Year 2				Year 3			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	2	3	4	5	6	7	8	9	10	11	12
122	170	152	131	179	140	170	119	155	173	191	167
	148	151	154	150	163	143	148	149	173	177	

Also notice that there are no results for the first and last quarters, since these periods are not mid-points for the data given.

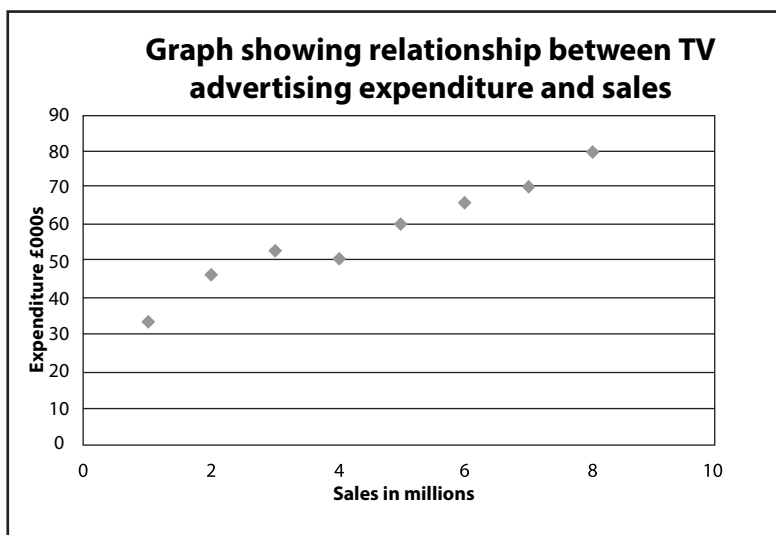
The results of the original data (in blue) and the three-point moving average (in red) are plotted in the following graph below. It can be seen that the moving average is much smoother than the raw data.



Correlation

A correlation measures the relationship between two variables e.g. whether there is a link between a business's advertising expenditure and the amount of sales it achieves. Businesses may seek to establish whether a relationship exists between two variables, and to what extent, in order to generate strategies such as sales and profit maximisation or customer satisfaction.

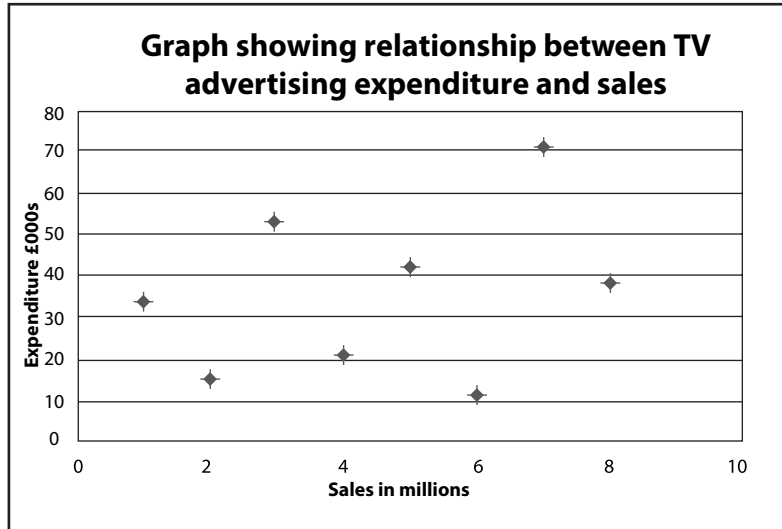
Let us consider the example of the amount spent on TV advertising for a product and the sales for that product. The data can be plotted in a **scatter graph**, as shown below, to study the relationship between these two variables.



We can see a definite relationship between the two variables. This is because the scatter graph shows that as the expenditure of TV advertising increases so does the sales of the product they advertise. In this example, there is a **strong positive correlation** between the two variables.

However, the relationship may not always be strong or there could be no relationship at all.

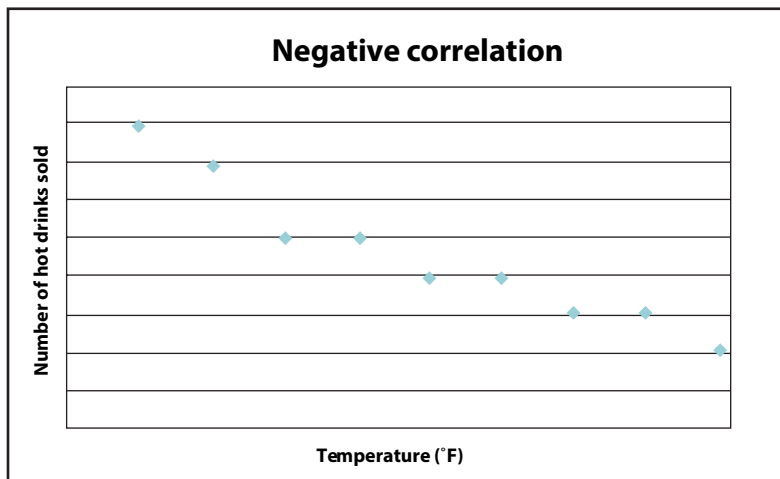
In the scatter graph below, there seems little or no relationship between TV advertising spend and sales (there is little or no correlation between the two variables). Now in this case you would expect a relationship to exist, so questions need to be asked to ascertain why the expected correlation does not occur.



In the two graphs above a positive correlation and a **non-existent correlation** have been considered.

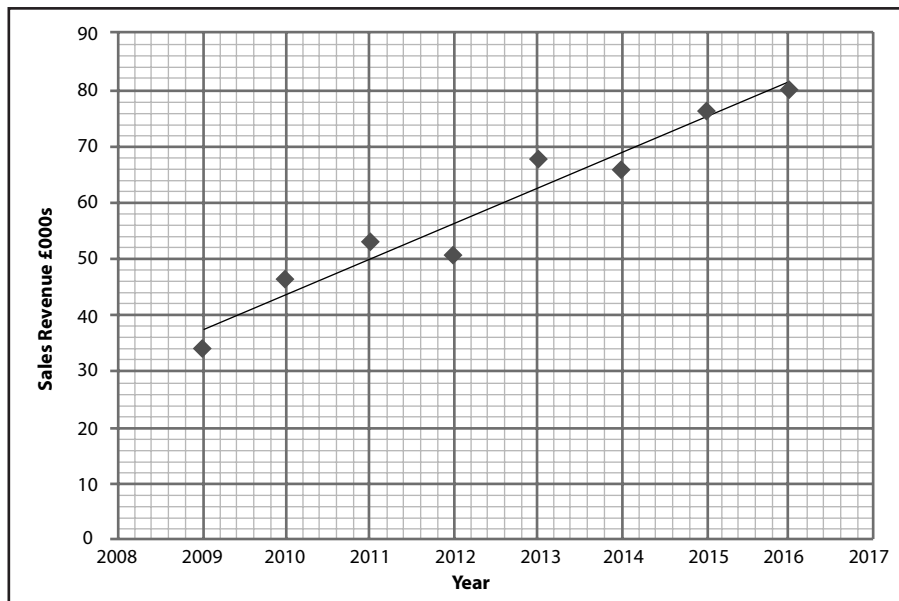
Let us now consider the final type of correlation - a **negative correlation**.

A negative correlation occurs when there is a relationship between two variables, in that as one of the variables **increases**, the other **decreases** (and vice versa). For example, a business might see a negative correlation between temperature and seasonal clothing sales. Another example is with inferior goods; as incomes increase the demand for inferior goods decrease. The graph below shows an example of negative correlation.

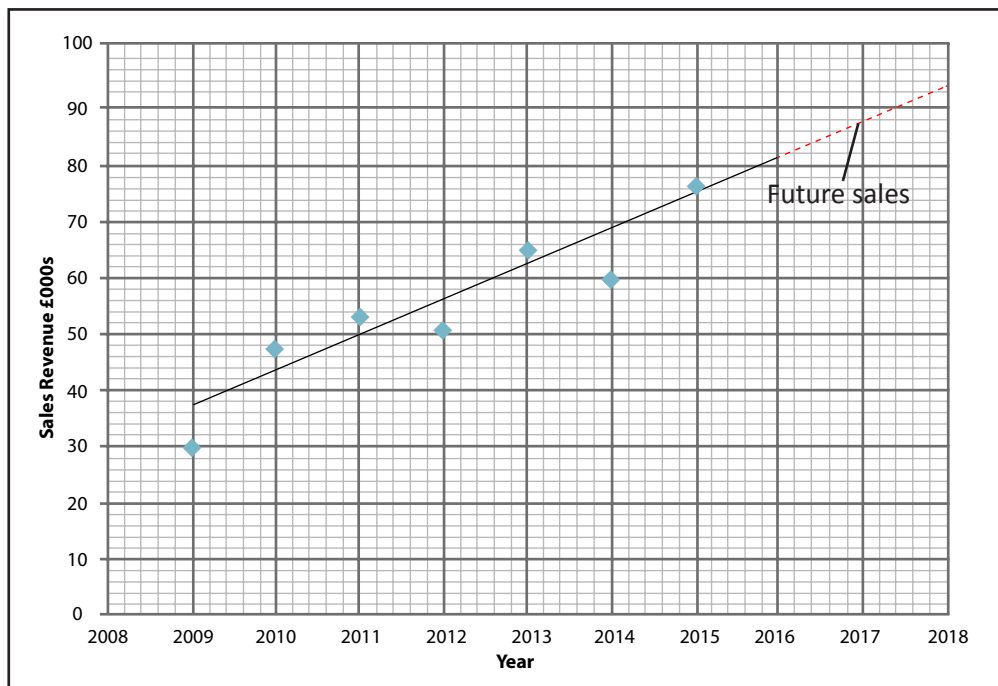


Line of best fit

In order to gain a clearer picture of the data and to extrapolate, a line of best fit can be drawn. This is a line that, as best as possible, should run through the middle of all of the data points on the graph. In this way, the points are evenly distributed on each side of the drawn line, as shown in the graph below.



The line of best fit can then be used to help predict future sales revenue by simply extending this line in order to forecast future figures, as shown in the graph below:



The usefulness of time-series analysis for a business:

- Helps the business plan ahead
- Helps financial planning, including cash flow management
- Production planning to determine the right level of supplies are ordered and the production process is efficient to meet either higher levels or lower levels of production
- Human resource planning, getting the right number and type of staff in the jobs that are needed. This may mean recruiting more staff, retaining staff or making staff redundant.
- Is useful in identifying seasonal variations
- Reduces the risk of unexpected surprises that could affect business performance.

However time-series analysis does have some problems:

- It is not always easy to predict the future
- Historical data is not always a good indication of what might happen in the future
- Even complicated sales forecasting methods can get it wrong and no forecast can be correct 100% of the time
- Less useful for long-term forecasts
- As with all forecasting methods, success is not guaranteed.

Use of market research data

Another method of quantitative sales forecasting is using market research data. There are a number of types of market research data that can be used in sales forecasting. These include:

Surveys of consumers' intentions

This method of forecasting makes predictions by asking people directly what they intend to do in the future. There are a number of large market research companies that are continually gathering vast quantities of information and make money by selling this research to businesses (Mintel is an example). They may ask consumers questions such as 'Do you intend to purchase a new car in the next 12 months, 36 months or 60 months?' or 'Do you plan to go on holiday in Spain in the next three years?' The results of these surveys allow businesses to predict sales patterns and plan for the future in terms of staffing and production levels.

Direct sales information

Sales teams within businesses interact closely with customers. Sales staff might notice any developing trends, and they have the experience to spot market changes and shifts in customer preferences and attitudes. This direct sales information can be collected by management requesting statistical predictions of future sales, and by encouraging the upward flow of information through their organisation.

Test marketing

Test marketing involves testing consumers' response to a product, before the full release of the product. Test marketing can involve the release of a product in a limited geographical area, or to a small section of the target market. For example, many films are test marketed before they are put on general release (by being shown to invited audiences), and if the response of the test marketing process is negative then changes can be made to the films before being made available to the general market.

Another example is with new food items made by supermarkets; ready meals for example which are trialled with a limited amount of customers or in a limited number of stores in order to gauge how well the product will do if introduced more widely so as to gain customer feedback on the product. The response of the test market groups is used to determine whether adjustments need to be made to the product, or whether forecasts are likely to be achieved. Sale forecasts may be adjusted to take account of test marketing data.

Qualitative methods of sales forecasting

Qualitative forecasting methods are used when historical data is not available to carry out quantitative methods. Qualitative methods involve the use of opinions to predict future events and are subjective.

The Delphi method

The Delphi method is a forecasting technique developed by the RAND Corporation in the late 1950s and it is based on researching the views of a panel of experts.

The Delphi method begins with the initial development of a questionnaire focusing on the problem or issue in question. A panel of experts is selected, and then the questionnaire is sent to each of them. Each participant answers the questionnaire independently and returns it. Responses to the questionnaire are summarised before a further questionnaire is developed, based on findings of first questionnaire, and sent to the same panel of experts.

The members of the expert panel independently rate and prioritise ideas included in the second questionnaire. This enables the group of experts to arrive at a consensus forecast on the subject being discussed.

The Delphi method is based on the principle that forecasts from a structured group of experts are more accurate

than those from individuals or unstructured groups.

There are a number of advantages to using the Delphi method:

- It is flexible enough to be used in a variety of situations and can be applied to a range of complex problems
- Provides a structured way for a group of people to make decisions
- Participants have time to think through their ideas leading to a better quality of response
- The Delphi method creates a record of the expert group's responses and ideas which can be used when needed.

But of course there are weaknesses to the method:

- The method will more than likely require a substantial period of time to complete as the process is time consuming to coordinate and manage
- It assumes that experts are willing to come to a consensus and allow their opinions to be altered by the views of other experts
- Monetary payments to the experts may lead to bias in the results of the study.

Brainstorming (thought showers)

Brainstorming is a subjective technique for generating new, useful ideas and promoting creative thinking, usually between a group of people. It can be used to predict outcomes based on the group's subjective thoughts and feelings.

The basis of the brainstorm is 'The Problem Statement', which is the focus of discussion. Examples of problem statements might be 'How can we improve the product to increase sales?', 'What actions are competitors taking in order to gain market share?' or 'What will be different about our market in five years' time?'

During a brainstorm all ideas are welcome and there are no wrong answers as no judgements should be made of ideas. The brainstorm will work best if members are creative in their contributions and attempt to contribute a high quantity of ideas in a short amount of time.

Brainstorming is most effective with groups of 6-12 people and works best with a varied group. So within a business a brainstorming session should include participants from various departments from across the organisation and with different backgrounds (qualifications, experience etc.). Even when the brainstorm is supposed to be focused on a specific or even specialist area, outsiders can bring fresh ideas that can inspire the experts.

Intuition

It is difficult to predict the future if products are new to the market as there may be very little historical data available or if the market a business operates in is unstable and is constantly changing.

With limited data available to collect and examine, business leaders and managers may instead use their 'gut feeling' or intuition. They may have experience of other existing markets and products that can be transferred to new markets and products.

It is often said that successful entrepreneurs have good intuition. Steve Jobs, founder of Apple, used intuition on more than one occasion to launch successful products. He believed that intuition was "more powerful than intellect". Intuition is sometimes referred to as Genius Forecasting – which combines intuition, insight, and luck.

The use of intuition is cheap, and fast. There is no need for data gathering, market testing etc. But gut feeling and experience should not be the only guide. Even if experienced managers 'feel it in their bones', there is no excuse not to carry out some further forecasting techniques. There are many examples of experienced entrepreneurs and business managers who have lost a lot of money due to their intuitive decision making.

Expert opinion

There is a huge variety of expert opinion available on individual markets, and more general business issues which may also be considered by businesses trying to forecast the future.

There are consultants who specialise in the motor industry, in food retailing, in internet marketing and so on. There are different types of economists such as motor industry economists, energy economists, and political economists, all of whom have opinions on future demand and expenditure patterns in the UK and the global markets.

Some businesses, affected by seasonal variations in sales, consult specialists on long term weather forecasts in an attempt to predict sales of weather-dependent products. Other experts to be consulted can include distributors, wholesalers, suppliers and trade organisations.

Experts are useful for gaining specialised insights into likely future patterns and trends but should not be used on a 'standalone basis'. Panels of experts are more reliable than consulting individual experts. The opinion of experts should also be combined with information gathered from other sources.

Experts also make mistakes and fail to forecast future trends correctly, particularly in the long term, for example, in the 1950s the head of IBM claimed that the world would never need more than a handful of computers.

External factors affecting quantitative and qualitative sales forecasting

Whatever method or technique is used to forecast sales it is an extremely difficult process for a business to carry out. Even with a wealth of data and a panel full of experts, trying to predict the future is not easy as there are various external factors that a business has no control over. These factors should be considered when carrying out sales forecasting, they include:

- Economic factors - such as unemployment levels, inflation, interest rates, exchange rates, economic growth. For example, if there is an unexpected rise in inflation then this will affect consumer spending and will have an impact on sales forecasts. In this case it will lower the sales forecast. A change in any of these economic variables could reduce the accuracy of the sales forecast.
- Consumer factors - consumers' tastes and fashions are constantly changing and businesses try to anticipate these changes through market research. However, consumers are notoriously unpredictable and their preferences can change quickly. Changes in consumer behaviour can be short term or long term. A long term trend is easier to identify and to take into account when sales forecasting.
- Competition factors – a business cannot control the actions of their competitors. However, their actions will affect not only the present business performance but the future.
- Competitors will have their own strategies and plans for the future and any significant action by competitors could reduce the accuracy of sales forecasting.

Discussion themes

Why is sales forecasting useful for a business?

Explain what is meant by quantitative sales forecasting.

What is meant by trend analysis and extrapolation?

JK Lessing Ltd. manufactures garden ornaments. The company's sales revenue for the last ten years is given in the table below.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Sales Revenue £000s	225	240	270	360	260	340	330	380	280	420

Calculate a three-year moving average of the company's sales revenue.

Plot your answers on a graph and draw in a line of best fit.

Use the line of best fit to predict the sales revenue for 2017.

Assess the usefulness of this prediction to the company.

Explain the Delphi method of qualitative forecasting.

Explain why sales forecasting is not always reliable.

The effectiveness of quantitative forecasting methods makes the use of qualitative forecasting methods redundant. To what extent do you agree with this statement?

Adventures in Test Marketing - YouTube

<https://www.youtube.com/watch?v=7wx5B2p8qyg>

False Correlation

Have some fun with these!

<http://www.dailymail.co.uk/sciencetech/article-2640550/Does-sour-cream-cause-bike-accidents-No-looks-like-does-Graphs-reveal-statistics-produce-false-connections.html>