

ISB- Product Management

Week 6: Concept Development and Testing

Video 1: Module Overview

Welcome to Module 6. In this module, we will discuss: Concept testing, New product opportunities in the digital world, Market potential assessment and Sales forecasting.

Specifically, we will cover the following topics: what is a product concept, what is concept testing, types of concept tests, issues in concept testing, example of a concept test, how digital technologies are changing new product development due to the long tail effect, and market potential assessment and sales forecasting.

Video 2: Learning Objectives

In this module, we'll learn about the importance of concept testing in the new product development process. We will look at the different types of concept tests and learn how to conduct a concept test. We will learn about the long tail effect, that explains how digital technologies are changing the new product development in some category. We will understand the difference between potential and forecast and learn how to estimate market potential and forecast sales. Finally, we'll learn about the matrix used to evaluate model forecasts and compare models.

Video 3: Product Concept and Concept Testing

In this video, we learn about product concepts and how they are tested. The process to create a product requires three inputs, namely, Form, Technology and Benefit. The first input, the Form, is the physical thing created, or the sequence of steps for creation of a service. The second input, Technology, is the source by which the form was attained, i.e., power and capability to do work.

The third input, Benefit, is the customer need addressed by the product. Technology permits us to develop a form that provides the benefit. When only one of these three inputs is present, we call it an 'Idea'. When two of these are present, we call it a 'Concept'. And, we have a complete product when all the three inputs are finalised. Most of the new product development process works with the product concept. Your slide shows the models and methods frequently used by companies in their New Product Development process. In the table, the first method is called concept tests. This refers to survey-based concept tests that we will discuss in detail later.

Survey-based concept tests are commonly referred to as concept test. Although technically, any test of a concept formal or informal can be referred to as a concept test. As shown in the table, survey-based concept tests are the most popular in practice, and 77% of the companies studied, admitted to using them. Note, that an

earlier study showed only 26% of companies use them in their NPD process. Other methods, such as focus groups and limited rollout, are also popular.

Such data as shown in the table are difficult to obtain due to the reluctance of companies to share them. The table simply gives a flavour of the wide variety of methods used in this area. It also shows the growth in popularity of some methods over time. Note that conjoint analysis has become more popular over time and Professor Manish Gangwar will discuss this technique in detail later. While companies may use many methods, what is the level of satisfaction with each of the methods used? The table on your slide shows this data. In the table, 37 users had used survey-based concept tests and 92% of them were satisfied with the method.

Other data in the table can be read similarly. Obviously, concept tests are popular and very important to develop a customer centric product. In concept testing, typically we have three main objectives. First, we test selected concepts to forecast how much the potential product will sell. This information is essential for deciding whether a particular concept should be dropped or developed further. Recall that the context of the NPD process is set by three factors.

One of them is the reason why the company is developing the new product in the first place. Most commonly, the reason is to increase sales and revenues. Therefore, this forecast helps the firm decide whether to drop the tested concept or keep it and develop it further. In other words, this forecast helps the firm make the go/no-go decision regarding the concept. It would be too costly for any company to develop all the possible concepts to the final product state. Therefore, companies are interested in eliminating concepts early in the NPD process to save resources and focus on the promising alternatives.

The second objective of concept testing is concept selection; which concept should be pursued to development stage? And the third objective is to obtain diagnostic information about the selected concepts to improve them and develop them further. In all concept tests, data is gathered from potential customers. The process of concept testing involves some kind of representation of the product concept to a sample of potential customers. Early on in the NPD process, that is, at the fuzzy front end of the funnel or close to it.

There are a very large number of concepts to be tested, and the company needs to narrow them down quickly. Therefore, qualitative methods are used to test them. These may be formal methods like focus groups or quick and dirty methods like brainstorming with your team or friends. The purpose is to eliminate concepts that are clearly not promising as early and cheaply as possible. As the NPD process progresses, more formal and quantitative testing methods, such as survey-based concept tests are used. These techniques are more expensive but are required to make better decisions in this important area for the company.

As the process commences, more sophisticated techniques such as 'Conjoint Analysis' are used. At the end of the process, 'Pre-test Market Systems' and 'Test Marketing' is done as required before the launch. Concept Testing is not necessary for products where the cost of testing is large relative to launching the product and

testing it directly in the market. Experiments are done by fast food companies such as McDonald's to test new food items for their menu are examples of this situation. Growth hacking is another example of this situation.

It is far easier and cheaper to test alternative decisions directly with consumers through online experiments, than test them in their traditional manner using concept tests. Note that, unless mentioned otherwise by concept test, we would refer to a survey-based concept test. Let us consider some examples of new products. Assume that you are developing a new perfume. Would you conduct a concept test? A concept test faces all the issues that are faced by surveys. After all, a concept test is an application of a survey in the process of new product development.

An important consideration in a survey is whether the respondent is willing and able to answer the questions in the survey. Also, do all the respondents have the same or very similar understanding of the survey question. In case of a perfume, the key attribute that drives purchases is fragrance, and fragrance is very hard to judge by common people. There is no common language to evaluate it. Even for the same person, the perception of the same fragrance may change from one context to another. Therefore, we cannot get reliable reactions from consumers when they are exposed to the perfume concept, in a concept test. It may be better for the company to test the fragrance in house, using people who have the ability to discriminate between subtle variations in fragrances.

It can then produce the promising alternatives and test them directly in the market. Now consider movies, would you test the concept of a movie before producing it. In case of products, where past is not a good predictor of the future, concept testing is unlikely to work. In movies, if one movie becomes a hit and a producer makes another very similar movie, then the likelihood of the new movie becoming a hit would be low. And it is very difficult to predict which new movie would consumers like in future.

Therefore, concept tests are unlikely to help, and that is the reason why we have talented people such as directors and scriptwriters who make key decisions. Now, however, even this industry is changing significantly due to digital technologies, as we will see later when we discuss the long tail effect. In short, the power has shifted from artists to the consumers who vote through their choices on streaming platforms. And companies have a lot of leeway in experimenting with innovative content, thus reducing the power of the artists that was sustained earlier due to distribution channel constraints.

Video 4: Concept Testing—The Seven Step Method Part 1

In this video, we will discuss the first part of the seven-step method to conduct concept tests. In the first step of a concept test, we must define the purpose of the concept test. Typical questions that a concept test answers are; which of the several alternative concepts need to be pursued further? How can the concept be improved to meet customer needs better? And approximately how many units are likely to be

sold? The last question helps us decide whether the concept should be developed further or dropped. In the second step, we choose a survey population.

The population surveyed should mirror the target market population for the product. Screener questions are used first to verify that the respondent meets the definition of the target population. In case there are multiple segments in the target market, then potential customers in each segment are surveyed during the concept test. In step three, we choose a survey format from among the several options available.

These can be as follows; Face-to-face interactions, in this interviewer interacts directly with the respondent. This can happen through intercepting potential customers at a mall, called Mall Intercept, or through pre-arranged interviews, or at a trade show booth, it can also happen in focus groups. This method is better for presenting multiple alternative concepts, or when soliciting ideas for improving a concept. The survey can be done via telephone, and this is called Telephone Interview. A telephone interview can be pre-arranged for very specific individuals, such as Pediatric Dentist, or even cold calls to consumers from a target population can be made. Postal Mail is another survey format, in this survey sent by mail to respondents who can fill it and return. This method is very old and decreasing in popularity. It can be useful when a sample of product or some physical material is to be evaluated during the concept test.

Typically, postal mail takes time and has poor response rate. Another survey format is Electronic mail or Email. This is similar to postal mail but has better response rate. However, selection bias may be an issue. Since unsolicited mail is increasingly becoming a problem, this format is used when the researcher or the company has a positive relationship with the target population. Alternatively, incentives can be provided to the respondents to improve the response rate. Survey can also be conducted through a website on the Internet used to create a virtual concept testing site, where survey participants can observe concepts and provide responses. In this format, Email message can be used to recruit respondents to visit the site. In any format where respondents choose to participate, sample selection bias may be an issue that we have to be careful about.

In a step four, we communicate the concept using one of several methods available to us. These can be verbal description in which a short paragraph or bullet points are used to summarise the product concept. A sketch of the concept that is, line drawings showing the product in perspective can be used. Photos and renderings can be used. These are photographs of models or photo realistic illustrations called renderings of the concept, are shown to the respondents.

The company could use a storyboard to share the concept with the respondents. In this, we have a series of images communicating a temporal sequence of images involving the product illustrating different benefits. The concept can be communicated by using a video that shows the form and use of the product. Simulation is another method. A simulation is generally implemented as a software that mimics the functions or interactive features of the product.

We could also use interactive multimedia, in which video and simulations are used together to communicate the concept and respondent can choose what to view and play with. We could also use a physical appearance model, that displays the form and appearance of the product. These are often made of wood or polymer and painted to look like a real product. Limited functionality of the product may be included in these models. Finally, working prototypes can be used to communicate the concept.

Video 5: Concept Testing—The Seven Step Method Part 2

To illustrate the process of concept testing, let us consider the example of an electric scooter as shown in your slide. The purpose of the concept test is to decide what market to be in. The sample population consists of two groups of people. One is college students who live 1-3 miles from campus, and the other is those who may use it inside a factory for transportation. The survey format chosen is face-to-face interviews.

The concept can be communicated through either of verbal description, sketch, photograph or rendering storyboard, video, simulation, interactive multimedia, physical appearance model, and working prototype. In this example, a verbal description of the concept would be something like this. The product is a lightweight electric scooter that can be easily folded and taken with you inside a building or on public transportation. The scooter weighs about 25 pounds. It travels at speeds of up to 15 mph and can go about 12 miles on a single charge.

The scooter can be recharged in about two hours from a standard electric outlet. The scooter is easy to ride and has simple controls, just an accelerator button and a break. If a sketch is used to communicate the concept, it may look something like this sketch shown in your slide. The slide also shows an example of rendering that may be used to communicate the concept. You can see a storyboard example in your next slide.

A working prototype is shown next. Note that the survey format is linked to the means of communicating the concept as shown in the table. The X's marked in the table show the means of communicating the concept available to the researcher when a particular survey format is selected.

For example; a verbal description of the concept can be used with all survey formats. However, a working prototype can only be used in a face-to-face survey format. Let us now discuss some issues in communicating the concept. First, description of the concept should match the information users are likely to consider when making a purchase decision.

If your new product is creating a new category, then measure purchase intention. If your new product will be part of an existing product category, then in addition to measuring purchase intention, you can ask respondents to choose from several alternatives that include the concept and other existing products. In this case, if you already have another product in the category, then you can ask the respondents

what product they're currently using to estimate the extent your new product will cannibalise the sales of your existing products. In your concept test, include price only if it is expected to be unusually high or low.

For example; if your product primarily provides some benefit at low price, then include price. If price is not included in the concept test, then ask the respondents how much they would be willing to pay for the product if available.

This or any other measure of the expectations of price that consumers have can be very helpful in the NPD process. If the expectation of price by respondents is very different from what the company is expecting the price to be, then either modify the concept or repeat testing after including price as an attribute.

Video 6: Concept Testing Part 3

In this video, we'll continue with our discussion of concept testing using the seven-step method. So far, we have looked at the first four steps in the method. In step five, we measure customer response. Commonly, we take the following measures: Purchase intent, uniqueness of the concept, believability of the concept, questions about product attributes, problems they see in use, reaction to price and information about respondent. In step six, we interpret the results.

When comparing two or more concepts, if we find that one concept dominates, then we should choose it. If results are inconclusive, then we can choose on the basis of other criteria, such as cost of production or the strategic factor. Alternatively, we may decide to offer multiple versions of the product. Let us consider an example of the most common measure taken in a concept test, which is the purchase intention measure. On your slide, you can see the question that is commonly used to measure purchase intention.

The question asks the respondents, "How interested would you be in buying the product described above, if it were available at a store near you?" The respondent has to choose one of five options as follows. I would definitely buy, I would probably buy, I might or might not buy, I would probably not buy, and I would definitely not buy. The slide shows a summary of the responses to this question from a sample of respondents.

We can see that, 5% of the respondents selected, "I would definitely buy" as their answer. And 35% of respondents selected, "I would probably buy" as their answer. The other numbers are interpreted similarly. The percentage of respondents who choose the first option of, "I would definitely buy" is referred to as the top box score. And the percentage of the respondents who select the second option of, "I would probably buy" is called the second box score. In our example, the top box score is 5%, and the second box score is 35%. If the plan new product is a consumable product to be used at frequent intervals, then you may want to measure the expected frequency of usage in your concept test to obtain an estimate of the annual or monthly sales.

To do this, a common question asked in the concept test is as follows. "Assuming you tried the product described above and like it, how often do you think you would buy it?" The response options are shown in the slide. These options may be changed if needed. Continuing with step six of interpreting the results, let us use hypothetical data to illustrate the process of demand estimation using the concept test results.

Typically, demand is estimated in the period following launch, which is usually one year. For simplicity, consider demand estimation for durables that last several years. This assumes negligible repeat purchase rate. As shown in your slide, Q represents the Quantity of product expected to be sold during a time period, and Q is estimated as the product of N , A and P ; where, N is the number of potential customers expected to make purchases during the time period.

In an existing product category, ' N ' is the expected number of purchases of the existing products to be made in the category over the time period. In a new product category, ' N ' is the number of customers in the target market for the new product. ' A ' is the fraction of these potential customers or purchases for which the product is available, and the customer is aware of the product. And ' P ' is the probability that the product is purchased if available and if the customer is aware of it. ' P ' is estimated as shown in the slide, where ' F_d ' is the fraction of survey respondents indicating in the concept test survey that they would definitely purchase; that is the top box score. ' F_p ' is the fraction of survey respondents indicating that they would probably purchase; that is the second box score. ' C_d ' and ' C_p ' are constants, usually based on company experience with similar products in the past.

Generally, C_d lies between 0.1 and 0.5 and C_p lies between 0 and 0.25. In the absence of any other information, many people use C_d value 0.4 and C_p value 0.2. Consider an example. Assume that you are introducing a new scooter in the market, and scooters are sold currently at the rate of 150,000 units per year. Assume further that the company sells through a single distributor accounting for 25% sales in this category. Also, assume that the concept testing yielded a definitely would buy fraction of 0.3 and probably would buy fraction of 0.2. You can use C_d equal to 0.4 and C_p equal to 0.2.

Please take a minute to estimate P and Q . Where P is the probability that the product will be purchased if available and if the customer is aware of it, and Q is the quantity of the product expected to be sold during a time period.

Here is your answer. Since scooters are sold currently at the rate of 150,000 units per year, N is equal to 150,000. The company sells through a single distributor, accounting for 25% sales in this category. Therefore, A is equal to 0.25, P is equal to $0.4 \times 0.3 + 0.2 \times 0.2$, multiplied by 0.2 and equal to 0.16. And Q is equal to N multiplied by A multiplied by P , which is equal to $150,000 \times 0.25 \times 0.16$, equal to 6,000 units per year. Consider another usage of concept testing. In a concept test, companies often ask questions about the importance of product attributes because they want to know which attributes to strengthen and which ones to reduce emphasis on. The importance ratings not only answer the

question, "Are we focusing on the right attributes?" But also allow benefit segmentation.

Consider the example of a swimsuit concept test results shown in your slide. It has two attributes, fashion and comfort. The concept test shows that some consumers consider fashion as the important attribute in their purchase decisions. Some others prefer comfort, and some others prefer both attributes. This indicates that there might be three segments of customers.

At this point, the company may decide to target all the three segments and choose to develop three different solutions, one for each segment, or it may target only one or two segments and develop a solution for each targeted segment. The new product development process shown in the form of funnel earlier is rarely linear. Instead, it happens in an iterative manner. As the company develops a product and gets more information through concept tests, it may revise both the customer group targeted and the solution for the targeted customer group. The iterations finally result in a superior solution for the targeted segment of customers. Finally, in step seven, you must reflect on the results and the process.

The primary benefit of concept testing is getting feedback from real potential customers to develop an offering for them. At this stage, qualitative insights gathered through open-minded discussions are very important for refining the concept. In this step, you should also think about how you can increase potential sales. In your forecasting model, you have three key variables. These are the overall market size represented by N , the availability and awareness of the product represented by A , and the fraction of customers likely to purchase represented by P .

To increase expected sales, you can consider alternative markets to increase N . Availability and awareness of product can be increased through distributional arrangements and promotional plans. And finally, fraction of customers likely to purchase can be increased through changes in product design and possibly advertising to improve the product's attractiveness.

In step seven, you also ask diagnostic questions to make sure that everything is going on as planned. First, you should ask, "Was the concept communicated properly to elicit true intent?" For example, if the primary benefit is aesthetic appeal, was the concept presented such that this benefit was evident? The second diagnostic question is, "Is the resulting forecast consistent with observed sales rates of similar products?" If not, then there may be issues in the concept test.

Video 7: Impact on Product: The Long Tail Effect

In this video, we will discuss how digital technologies have created significant opportunities for new products that were not economically viable earlier. It is called, commonly, the long tail effect. The long tail effect was first highlighted by Chris Anderson in his New York Times best-selling book 'The Long Tail'.

When this effect operates, a company can shorten its product development process and directly test new offerings in the market. It can experiment with many types of

offerings and then decide what types of products to offer, more or less based on the response in the market. In old days, physical store limitations did not allow vendors to keep stock of niche products. Consumers of niche products were few in any geographical area, and they didn't form a profitable segment for the store. Digital technologies have removed physical limitations and opened up tremendous opportunities for such products.

The Internet has changed the game for physical product: Google for search and discovery, Facebook and social media for word of mouth and crowd reviews for ecommerce, all contribute key enabling technology, which allows people to find every needle in the haystack or niche product.

Let us consider some examples. Consider hot sauces. The demand for any specific sauce in any geographic area would be very limited making it unviable for a store to carry significant variety. However, an Internet store can aggregate demand from a very large geographical area; the whole country, or even beyond. The aggregate demand would make the business focusing on specialised hot sauces economically viable. Another example concerns movies.

In the older world, physical store space limitations prevented a DVD rental store for keeping many titles that were not popular. All stores carried popular titles for maximising rentals. This also meant that producers spent time analysing what type of movies would succeed in the marketplace, and artists played a dominant role. Look at what the Internet has done. Netflix has no physical limitations. Therefore, Netflix can keep all kinds of titles, even niche titles that very few would want in any geographical area.

But the aggregated demand across a large region would be significant. In addition, due to aggregation and demand and online streaming of content, Netflix has experimented with many types of movies that would rarely be produced in the older world. Such experimentation has created many new types of offerings for the consumer, propelling Netflix to become one of the largest media companies in the world.

Not just the niche offering, but also the subsequent change in content and economics of movie production have resulted in disrupting the entire industry, enriching consumer experience in the process, all brought about by digital.

Video 8: Market Potential and Forecasting for New Products

In this session, we'll learn about market potential, sales potential, market forecast, and sales forecast. We'll also learn how to estimate market potential and discuss different types of sales forecasting methods.

Then we'll understand and learn the use of two models for forecasting sales, namely the moving average, and exponential smoothing. Finally, we'll understand some statistics used to measure the accuracy of model forecasts.

These statistics can be used to compare the performance of different forecasting models to select a model for use.

Video 9: Potential vs Forecast

In this video, we'll understand the difference between potential and forecast. Let us consider the new product development process displayed on your slide. At each stage of the process, market research is used to obtain information to make decisions. And one of the key decisions is whether to take a particular concept forward for more development or drop it.

This decision is made on the basis of the estimate of the sales of the potential product that the concept test reveals. Therefore, sales forecasting is important. Potential estimation is useful at the targeting stage to assist the attractiveness of a market or a segment. Higher the size of the market, higher is the sales potential in the market. Before we get into specific model, let us first understand the difference between potential and forecast.

Potential is the maximum sales reasonably attainable under a given set of conditions within a specified period of time. It refers to what you might or could achieve. Forecast, on the other hand, is the number of sales expected to be achieved under a set of conditions within a specified period of time.

It refers to what you probably will achieve. As the chart on your slide shows, sales forecast refers to the expected sales at the firm or brand level, and market forecast is the expected sales at the category level. Both, under a given set of conditions within a specified period of time.

Similarly, sales potential is the maximum sales possible at the firm or brand level, and market potential is the maximum sales possible at the category level. Both, under a given set of conditions within a specified period of time.

Video 10: Potential Estimation

In this video, we'll talk about potential estimation. In the estimation of sales or market potential, one must use multiple sources of information. Both secondary and primary data are used, and statistical models may be applied to arrive at the estimate. Here, secondary data refers to the data already available within the firm or outside. And primary data is the data acquired primarily for the purpose of the estimation, such as through a survey.

In the entire process, judgement is always applied and overrides anything else. Note that the accuracy of an estimate is likely to improve when more time, resources and capabilities are deployed in the estimation process. However, with accuracy, cost also improves, and the opportunity cost may be high. Therefore, a good forecast may not be a more accurate forecast.

Like with all marketing research projects, estimation of potential or sales forecast should be good enough for the purpose and done within the constraints of time and resources. Let us assume that you are planning to produce diapers and at most you can produce 20,000 units per year. A back of the envelope calculation using publicly available demographic data, tells you that the market potential is 250 million diapers per year.

Would you spend resources to get a more accurate estimate of the market potential before moving forward with your NPD process? The answer is no. Because even if the estimate changes by 50 million diapers per year, it will not make any difference in your decision to move forward. If your decision is not going to change irrespective of the research outcome, then don't conduct any marketing research.

Now, consider another example. Let us say that you want to produce fighter aircrafts. Would you trust a back of the envelope calculation for the market potential in this case? Like you did in the case of diapers earlier? No. In this case, you need a much more accurate potential estimate before you spend billions of dollars on the product development process. In fact, you would set up a team of experts and have them spend significant amount and time on researching the possibilities and coming up with an accurate estimate of the potential. In estimating market potential, you can use a three-step process.

First, determine the potential buyers or users of the product. In this, interpret buyers broadly as customers who have the need, resources necessary to use the product and ability to pay. There can be many groups of customers.

In step two, determine how many potential buyers are in each potential group of buyers defined in step one. And in step three, estimate the purchase or usage rate. You can estimate the average purchasing rate through surveys or other marketing research.

The usage rate will typically vary across users. Use the rate of the heaviest buyer, because in estimating potential, you consider what is possible. And such overestimation of potential is reasonable. After all, there is always a possibility of increasing product usage by customers. Please check your understanding of market potential estimation by doing exercise one.

Relevant data is provided to you. Using the data provided to you, please estimate the market potential for diapers and ice cream. To get an estimate of sales potential, multiply the estimated market potential by some market share figure for your product. You can use the potential share which the firm could achieve under optimal conditions.

Video 11: Sales Forecasting Methods

In this video, we'll study some methods for forecasting sales. The chart on your slide gives an overview of commonly used methods for forecasting sales. These are grouped into four categories, and we'll discuss them in sequence now. The first category of methods contains Judgement-based methods.

In this category, we have three common methods, namely; Naive extrapolation, sales force composite and jury of expert opinion. We will discuss each of these later in the module. The second group of methods is called customer-based methods, and this includes market testing and market surveys. These methods use primary data from customers to forecast.

Traditional survey-based concept tests discussed earlier fall into this category. The third category of methods is called Sales Extrapolation Methods. These methods analyse time series data to forecast for the next period. Moving average, exponential smoothing and regression methods fall into this category. We will discuss moving average and exponentially smoothing in detail later.

Finally, the fourth category of methods, is the model-based methods. Within this, we have some types of regression analysis, the Bass model and Conjoint Analysis. Professor Manish Gangwar will discuss conjoint analysis in detail in his sessions. This slide shows the usage of different types of forecasting methods over different forecast periods by US corporations.

As you can see, for forecasts in the immediate future, that is less than a month from now, the most common methods are Manager's opinion, Sales force composite, moving average and jury of expert opinion. For long-term forecast, that is between now and more than a year in future, jury of expert opinion and regression are the most common methods. The former was used by 26.2% of corporations in the sample and the latter was used by 16.5% of the corporations in the sample. The methods most used for other forecasting periods can be read similarly. Let us now understand judgement-based methods for forecasting.

The first method is called Naive Extrapolation. When you have a stable growth rate, you can use last period sales level and add X%, the estimated change to forecast the next period sales. Alternatively, you can use the actual sales in the last period, to forecast the same for next period.

If F represents forecast and A represents actual sales and T represents time. Then in this case, we have the actual sales at time, $t-1$ equal to the forecast at time, t of $F(t) = A(t-1)$. This method is simple and easy, with virtually no cost. However, there is no data analysis here. To improve it, one could include seasonal variations. Here, forecast is the same as the last actual observation when we were in the same point in the cycle where a cycle lasts 'n' periods. We represented symbolically as, $F(t) = A(t-n)$, as an example; the forecast for January, would be the actual observed sales in the latest January.

If the data contains trends, then we can further refine these methods. If there is a constant trend, then the change from time period $(t-2)$ to $(t-1)$ will be exactly the same as the change from time period $(t-1)$ to (t) . Symbolically, we can represent this as $F(t) = A(t-1) + [A(t-1) - A(t-2)]$ as shown on the slide.

The second method in the category of judgement-based methods, is sales force composite. In this, we ask salespeople to make forecasts and aggregate these forecasts, to get forecast for the product. We have to be careful here, because salespersons may have their own reasons to give higher or lower forecasts.

The third method in this category of judgement-based methods, is the jury of expert opinion. In this method, we take opinion of experts to arrive at the forecast. This method supplements other methods and can overcome some limitations of quantitative techniques. All methods can go wrong, and it is a good practice to use multiple methods to arrive at a range of forecasts, that one can work with.

On a lighter note, consider the following predictions made by experts, as cited in Cerf and Navarsky 1984 and I quote, "With over 50 foreign cars already on sale here, the Japanese auto industry isn't likely to carve out a big slice of the US market for itself." This was in business week on August 2, 1968. What happened, we all know.

Here is another one. "A severe depression like that of 1920 to '21 is outside the range of probability." This was predicted by the Harvard Economic Society on November 16, 1929, right before the great depression.

And here's a third quote. "The phonograph is not of any commercial value." This was assessed by Thomas Edison in 1880. Now you can see even the best experts can go completely wrong.

Video 12: Moving Average

In this video, we will understand and use the forecasting methods of Moving Average and Weighted Moving Average. A Moving Average is a quantitative technique used in stable markets to forecast sales. A Moving Average or MA forecast, as it is often called, looks at the sales achieved in the latest time periods and averages them to get a forecast for the next time period.

Please consider the formula for Moving Average on your slide. In this, $F(t)$ represents the moving average forecast for period t . $MA(t, n)$ represents the moving average forecast in period $(t-1)$ for period t , n represents the number of past terms used in averaging and $A(i)$ represents the actual sales in period i . Let us understand the formula better using an example.

Example 1 of moving averages shows two moving average forecasts. Moving Average 3 and Moving Average 5, represented by $MA(3)$ and $MA(5)$ in the table. The column titled Sales, shows actual sales in the time period given in Column 1. $MA(3)$ forecasts for Period 4 represented in red font in the table, is simply the average of the actual sales in the latest three periods also shown in red font. Similarly, $MA(5)$ forecast for a period is the average of the latest actual last five period sales.

The other numbers in the table for each forecast data are arrived at similarly. The column titled Raw Change, shows the change in actual sales between the current and the previous period. A negative Raw Change means that the sale has decreased during this period as compared to the last period. The changes in $MA(3)$ and $MA(5)$ are shown in the last two columns.

Since these are changes in the Moving Averages, it is expected that they would be less volatile as compared to the Raw Change. As we can see in the plots of actual

sales of MA (3) and MA (5), the actual sales are most volatile. MA (3) is less volatile, and MA (5) is least volatile. As the number of averaging periods increases, we get more stable forecast. Please slew your slide for another simple example of the calculation of Moving Averages, based on the notation discussed earlier.

The calculations are self-explanatory. The Moving Average discussed so far gives equal weight to the past actual sales. However, in some cases you may want to give different weights to different observations from the past. For example, if the market is volatile, you may want to give more weight to the more recent observations. In such situations, you can use Weighted Moving Average.

Weighted Moving Average is similar to Moving Average, except that it assigns more weight to the most recent values in a time series. Because most recent observations are expected to be better indicators of the future than older observations.

The example in the slide shows calculations of a Weighted Moving Average forecast, where we assign a weight of 0.4 for the most recent period observation, 0.3 for the next most recent observation, 0.2 for the next observation, and 0.1 for the last observation. The slide shows, example calculations for the Weighted Moving Average forecast.

Video 13: Exponential Smoothing and Comparing Predictions

In this video, we'll discuss the quantitative technique of exponential smoothing and also discuss the most common statistics used to check the accuracy of model forecasts. To understand exponential smoothing method intuitively, consider the following method of forecasting.

Suppose we forecast a demand of 100 units for the current period. And the actual demand was 110 units. Therefore, a forecast error was 110 units minus 100 units equal to 10 units. How can we improve upon our forecast? Since our forecast is low, if there is no clear trend or seasonality, we should make our forecast for the next period higher. But how much higher? This is the key question in using exponential smoothing method. In exponential smoothing model, we deal with previous forecast error by adding a correction to the forecast for the current period. In other words, next forecast is equal to current forecast, plus the correction.

The correction is a fraction of the latest forecast error. It is a constant between zero and one and commonly represented by the Greek letter alpha. The value of alpha represents the smoothing constant. The formula for exponential smoothing forecast is shown in your slide and it is self-explanatory. In case of volatile demand, we choose a higher value of alpha.

For example, during the high growth stage of a product in its life cycle. We choose a low alpha for mature products with relatively stable demand. When we implement the exponential smoothing technique, we forecast for the next period by revising all forecasts and this requires some forecasts for the very first period. Generally, the very first period forecast is either the average of some historical data, or the actual

demand in period one. One benefit of this technique is that we can use optimal smoothing constant, Alpha, to increase forecast accuracy.

Let us consider an example of exponential smoothing shown in your slide. The table shows forecast using exponential smoothing method for two values of alpha, 0.1 and 0.3. The associated forecast errors are also shown. You can check this table provided to you in an Excel spreadsheet to understand how the formula is applied in different cells. The slide shows the plots of the exponential smoothing example with different values of alpha. As you can see, the actual sales are volatile, and the high value of alpha makes better predictions.

So far, we have seen different methods of forecasting. How can we know which method is more accurate? We will now discuss some commonly used statistics to measure forecasting accuracy.

The first statistic is called Mean Absolute Deviation or MAD. It is the arithmetic average of the absolute values of the forecast errors. The second statistic is called the Mean Squared Error, or MSE. It is the sum of squares of the forecast errors, divided by n minus one, Where ' n ' is the number of observations in the data. The third statistic is called Mean Forecast Error, or MFE. It is the simple average of the forecast errors. This statistic should be used carefully. If the forecast errors are high but spread equally on the positive and negative side, then this statistic may show a low value due to low average error, while the actual forecast error may be high.

This statistic is however useful for checking for positive or negative systematic bias in the forecast. For example, if the MFE is a large positive number, then the forecasts tend to be consistently lower than actual demand. Conversely, if the MFE is a large negative number, the forecasts tend to be consistently higher than actual demand.

Please do the exponential smoothing exercise provided to you. In the exercise, you will first forecast using the exponential smoothing method. Then using past forecast data and the forecast errors, you will find an optimal smoothing constant that minimises forecast errors. All details are provided with the exercise.

Video 14: Summary

In this module, we started with an understanding of what constitutes a concept, and how it is different from an idea and a complete product. Then we learned the seven-step method of concept testing; where the seven-steps in sequence are as follows: Define the purpose of the concept test, choose a survey population, choose a survey format, communicate the concept, measure customer response, interpret the results, reflect on the results and the process, then we discussed examples of concept testing.

Moving on from concept testing, we learned about the long tail effect, and how digital technologies have created opportunities for new products. After that, we discussed the definitions of potential and forecast, and how to estimate these. We learned about the different types of forecasting methods, such as judgement-based, survey-

based, and model-based methods. After that, we discussed the judgement-based methods in detail.

Then we learned forecasting using moving averages, weighted moving averages, exponential smoothing. Finally, we discussed the statistics of mean absolute deviation, mean squared error, and mean forecast error to check the accuracy of predictions from a model, and compare predictions from different models to select one for use. I hope you enjoyed this module. I wish you luck in a journey forward.