ISB- Product Management

Week 5: New Products and The Product Development Process Revisited; A/B and A/A Testing, MVP and Growth Hacking

Video 1: Module Overview

Hi, welcome to Module 5 of the Product Management programme. In this module, we'll cover the following topics: what are products? why do they succeed or fail? the new product development process, context of new product development. And within this context, we'll cover how much time should be spent on the new product development process? Should all the steps in the process be followed? The framework of opportunity cost and development risk, the framework of product market fit, and product company fit and minimum viable product. We'll cover experimentation, A/B testing, A/A testing and growth hacking.

In this module, you will learn about products, the commonly considered types of new products and factors impacting their success and failure. You'll learn about the implications on the context of a new product development process, or NPD process on its application. You will learn to make decisions about how fast or slow the NPD process should be in any given context. During the NPD process, a company uses marketing research to obtain information from potential consumers to improve a product concept.

In this module, you'll also learn about what information you need to get from potential consumers and the means to get the same, and when you can go to the market with a minimum viable product or MVP, given the context of your NPD process. Further, you will learn about causality, reasons for conducting experiments and issues of validity in your experiments. Finally, you will learn about A/B and A/A testing and growth hacking.

Video 2: The New Product Development Process Revisited

In this video, we will discuss products and the commonly considered types of new products. We will revisit the new product development process and discuss the role of marketing research in it. We could look at any product in different ways. One useful way to look at a product is to consider it as having three layers. The first layer is the core product.

It is the need or want a customer satisfies by buying the product. For example, if a customer wants to drill a hole in a wall, then this need is the core product. The second layer of a product is called a tangible product. It is the transformation of the core product into something customers can buy.

For example, a drill bit is a tangible product associated with the core product of the need for drilling a hole in the wall. The third layer of a product is called the augmented product. This layer contains enhancements to the tangible product to

make it competitively attractive, such as a warranty, great customer service, loyalty programme and so on. Let us consider an example of a visa card. The core product in this example is the need for secure and quick access to credit when needed. The tangible product is the visa card, and the augmented product are the features such as 24 hours customer service, protection against theft, loyalty points on spending and so on.

Recall that in discussing the fuzzy front end of the new product development process, we had emphasised that a company must start with customer needs. When we consider a product or a solution as having three layers, then the core product represents the needs of the customer that the product is solving. Therefore, in a new product development process, we must always start with the core product to address it first.

Then we consider the tangible product and augmented product to design the full product or full solution. Now, some categories of products that are commonly accepted as new products are: new-to-the-world products, that is inventions, new category entries such as AT&T's universal card, additions to product lines such as bud light, product improvements and products reposition to target new segments or markets of users, such as Arm and Hammer baking soda.

Arm and Hammer baking soda was first positioned for use as a baking ingredient. Then it was repositioned in a different market for use as a refrigerator deodorant. And, then once again repositioned in another different market to be used for cleaning the kitchen sink. Product variations that are not commonly accepted as new products are: products from one country sold in another country, new channels of distribution, packaging improvements and different resources or methods of manufacture. The chart shows the positions of various types of new products based on how new they are to the company that offers them to consumers and how new they are to the market where they are introduced.

As you can see, the new to the world products typically new inventions are at the extreme top right corner. These are products that rate very high on the newness to the company dimension as well as the newness to the market dimension. Take the example of repositioning. Since the company repositioning a product into a new market is very familiar with the product, the product rates very low on the company newness dimension.

However, it is repositioned in a new market and if the market is not familiar with this type of product, the repositioned product rates high on market newness. The position of other types of new products is interpreted similarly. Let us now do a small exercise. Assume that you are developing the following new products: an electric car, a software for data analysis and an online portal to support medical profession.

In each case, would the steps involved in the new product development process be the same or different? Why? How much time would you spend on the new product development process for each of these products? Why? Please take five minutes to think about these questions. Before we answer the questions, let us revisit the new product development process.

As you can see, the new product development process starts with the opportunity identification, idea generation stage, then goes to the design stage, then to the test stage, finally leading to the launch stage.

At each of these stages, decisions have to be made that require information from consumers obtained using marketing research. At the beginning of the process, marketing research is used to clarify whose needs are we going to satisfy and what exactly are those needs? For this purpose, both primary and secondary marketing research is used to understand customer needs and behaviour. When we have clarity on customer needs and behaviour and we reach the design stage, marketing research used to test concepts at the design stage is commonly called concept testing. Concept testing informs the firm about which concepts to drop and which ones to take forward and how to develop them further.

Let us now look at an example of the full new product development process. The example concerns R.J. Reynolds Tobacco Company in the US. The company identified a new product opportunity in the increasing social objections to smoking and came up with the idea of a smokeless cigarette. At the design stage, it designed the cigarette such that tobacco was heated instead of burnt, thereby reducing environmental tobacco smoke by 65-99% as compared to a regular cigarette. The new cigarette came in a sleek package with thin golden diagonal lines on a white background to convey the image of a cleaner cigarette. It was named 'Premier' to indicate a superior product. At the test stage, the test market results showed that consumers did not value the social benefits high enough to overcome the poor taste. The cigarette had a charcoal-like aftertaste.

Each package of cigarette contains special instructions on how to light the cigarette and consumers perceived the product as strange. They also thought that the price was high. The product received a high trial but low repeat purchase rates. As a result, the product was not introduced nationally.

Video 3: Success and Failure of New Products

In this video, we will discuss what makes new products successful and why many new products fail. Many research studies find that a systematic approach to new product development, such as the new product development process discussed earlier, significantly increases the probability of success of the resulting new product. One study report that firms that follow the systematic approach religiously have a 73% success rate compared to 29% otherwise.

In addition, many studies find that close cooperation between marketing and R&D during the entire product development process is very important for increasing the likelihood of success of the new product. The table summarises the findings of four research studies that investigated factors correlated with the success of new products. All four studies found that the fit of the new product with internal company strengths was correlated with new product success.

Recall that the targeting decision at the opportunity identification stage of the New Product Development process takes care of this factor.

Three of the four studies found that the match of the new product to customer needs, the screening of the new product on growth potential, the use of New Product Development process and top management support for the new project were correlated with the success of the new product in the marketplace. It is useful to note that the first three of these factors are addressed directly in the New Product Development process.

The fourth factor of top management support is generally present for a New Product Development project to take off in the first place. There are many reasons for product failures, and they relate to a host of factors such as market and marketing, financial timing of market entry, technical aspects of the product, the organisation managing the product and the regulatory and macroeconomic environment of the product context.

Video 4: Context of New Product Development

In this video, we will discuss the context of a New Product Development project and its implications for marketing research for the New Product Development process. Any New Product Development project is embedded in a context set by three factors. The first factor is, why does the New Product Development project exist in the first place?

In other words, what is the reason for the existence of the New Product Development? The second factor concerns how new the product being developed is to the market for which it is being developed, and how new it is to the company which is developing it. In other words, how does the new product rate on market newness and company newness dimensions? The third factor concerns the opportunity cost and development risk associated with the new product.

These three factors define the context and lead to different optimal New Product Development processes. As a result, the marketing research used for developing the new product must also vary with the context. In other words, depending upon the context, the four must ask a different set of questions and utilise a different set of research methods to obtain the necessary market data. Companies that try to standardise the marketing research for the New Product Development projects to cut costs, find that the research efforts are not very relevant to the success of the new products. And developing a new product without the support of relevant marketing research, is like shooting in the dark based on a hunch.

Let us now consider each of the three factors in detail. The first factor of the reason why the company is developing the new product defines the success and failure criteria for the new product. Therefore, in the marketing research used for testing and developing a concept, the firm must obtain relevant information that is useful to check how well the concept measures on these criteria.

For example, if the reason for developing the new product is to grow market share, then the firm must check how many new customers the new product concept is attracting during the concept test. This factor is a hurdle that every new product concept must pass before it can be developed further. After all, if a concept fails this test, then what is the point of developing it? If there is only one main concept, then the company tries to develop it in a manner that it can pass this hurdle. The second factor of firm newness and market newness is shown in the newness map on your slide. A newness map summarises the key areas of concern, that is, the key marketing issues that the firm must address in testing and developing the product concept. Firm newness means how new the new product is for the firm.

A low firm newness indicates that the firm is familiar with developing and marketing similar products. For example, Hyundai would rate low on firm newness when it brings its electric vehicles sold in Korea to other countries. A high firm newness indicates that the firm is not very familiar with the development and marketing of the product. For example, if Hyundai decides to enter into the office furniture business, it will rate high on firm newness. Similarly, market newness means how new the new product is to the market for which it is intended. Are consumers in the market familiar with such products? Examples of high market newness and high firm newness would be new inventions. Now, let us consider the newness map again.

As the map shows, if the new product rates low on both firm and market newness dimensions, then the issue that becomes important are cannibalisation and incremental sales. During concept testing of this product, measures of potential cannibalisation must be obtained to address this concern. For example, in the concept test, questions can be asked about what existing products the respondent is currently using and how likely is the respondent to switch to the new product if available at a reasonable price? Answers to such questions can be used to estimate the potential extent of cannibalisation from the new product.

Similarly, if the new product rates high on firm newness and low on market newness, then the product company fit becomes an issue. In this case, the company must ask how well suited its marketing assets such as its brand, distribution channel and customer knowledge are to the success of the planned new product. It must ask whether its R&D and manufacturing capabilities would help the new product.

It must also ask what impact the new product will have on its other products. Would the new product cannibalise its existing products or compliment them? Would it help the company diversify into new areas and thus reduce business risk? Would it enhance the reputation of the company? On the other hand, if the new product rates high on market newness and low firm newness, the product market fit becomes an issue. In this, the company has to find out whether the product satisfies the needs of the consumers well or not. What would be the market size at different prices? How much money would be required to build the market? and how much money would be required to maintain the market?

Obviously, if the product falls in the top right corner of the map, then both product company fit and product market fit become issues, and the marketing research must obtain all the relevant information to decide how to develop the concept further.

Video 5: Opportunity Cost and Development Risk

In this video, we will discuss the third factor that defines the context of a New Product Development process, namely, the opportunity cost and development risk associated with the new product. Opportunity cost is the risk of losing a fast-moving window of opportunity in the market. The opportunity cost helps the firm decide how fast or slow the New Product Development process should be.

Development risk on the other hand is the risk of launching a wrong product in the market, or not so developed product in the market. It helps the firm decide about the speed-precision trade-off in the marketing research used in the New Product Development process. Consider the risk map shown here. A company has significant freedom to manage its New Product Development process, when both the opportunity cost and development risks are low. However, it would be under significant pressure to manage the process well and conclude quickly, if its new product opportunity falls in the top right-hand corner of the risk map where both the opportunity cost and development risks are high.

This is a challenging position to be in for any company. And those with limited resources and capabilities may want to consider such new product opportunities very carefully before targeting them. Consider the case where the development risk is high and the opportunity cost is low, that is the lower right-hand corner of the risk map. Here, the company would want to conduct a full product development process and test the product concept thoroughly to make sure that it launches the right product in the market. Since the opportunity cost is low, there is little pressure to conclude the process quickly.

Finally, let us consider the case where the opportunity cost is high, and the development risk is low. That is, the upper left corner of the risk map. In this case, the company would want to enter the market quickly with a good enough product, and then improve it over time. Now, consider the Minimum Viable Product. For a company to enter the market with a minimum viable product or MVP, what part of the risk map should the new product be in? For success, such a product would lie on the left part of the risk map where the development risk is low. In such cases, one can introduce a minimum viable product in the market, and then improve it over time. The minimum viable product would be close to or the same as the fully developed product, if it is to be successful when the development risk is high.

Let us revisit the exercise of the three new product development projects, that is, an electric car, a software for data analysis and an online portal to support medical profession. Take the electric car first and consider the opportunity cost and development risk associated with it. The opportunity cost is low to medium because there are many models in the market now, and the category is still growing. Therefore, the opportunity will not go away soon. The development risk for an electric car is very high for two reasons. What happens when a car fails? The consequences for a customer could be fatal.

Also, given the competition in this category, a company cannot succeed by bringing in less than a fully developed product into the market. Now, consider a software for data analysis. There are many such products already in the market. The opportunity cost for such software may range from low to medium depending upon other factors such as the functions it plans to offer. However, the development risk is low since the software can be launched with a few key functions and expanded later. Since the information about core data analysis functions is commonly available and tested thoroughly, I'm assuming that whatever functions the software performs, it will do so well.

It need not be a complete product offering the full range of analytic solutions before it can be launched. In other words, the company can launch a minimum viable product, and then evolve the product based on customer feedback and other input from the market, after launching. In this case, only a partial new product development process is required to decide upon the core functions, to include in the first version and the user interface. Consider our third example of an online portal to support the medical profession. The development risk is low. What happens if there are issues with the product? Not much harm would come out of it and the company can correct any mistakes.

However, the opportunity cost is very high since the success of such products is critically dependent upon network effects, and there is a significant first- mover advantage. In this case, the company can select some key functions to satisfy the core need of the members of the profession, and then launch a Minimum Viable Product as soon as it can. It could even use an open source or an off-the-shelf option to start quickly. Over times, it can add more functions as required. Therefore, in this case, there is no need for the company to implement the full New Product Development process.

The company can launch quickly and conduct marketing research including experiments to go fast after launch. It can do growth hacking that we will discuss later. Let us consider another example from my own experience at Johnson and Johnson. When I was a product manager at Ethicon in India, I was asked to launch a new product called PowerStar Bipolar Scissors. PowerStar provided a new way to cut and coagulate tissues. In a surgery, the surgeon may need to cut one or more layers of tissues. The surgeon may need to cut blood vessels as well. And all these need to be tied or sutured for the surgery to conclude.

A suture is simply a specialised needle attached with a specialised string, to tie layers of tissues together, for healing. Ethicon is a leader in suture with more than 60% market share. Traditionally, each tissue or a vessel that is cut in surgery is tied with the suture, and this is still the dominant method. Then came monopolar pencils. A Monopolar pencil is a surgical device shaped like a pencil, with a sharp blade at one end to cut tissues. In addition, it has a wire connecting it to a power generator at the other end. For use, it requires the patient to lie down on a metal plate, and the plate is connected to the generator.

During surgery, electrical current goes from the generator to the blade of the monopolar pencil, and then through the patient's body to the metal plate and back to

the generator, completing the circuit. In surgery, as a monopolar pencil is used on tissues, the blade cuts the tissue, and the current coagulates any blood, thus preventing bleeding. Therefore, the bleeding is stopped by the current instead of the suture. One potential problem with this device is that the current passes through the patient's body, and therefore can impact any other device embedded in the body. Also, skin burns at the site of the metal plate are commonly observed. PowerStar was designed to solve both these issues with the monopolar pencil.

PowerStar was in the form of a scissor in which both arms of the scissor were connected to a wire, and these two wires were connected to a power generator. Therefore, the electrical current passed through one edge of the scissor blade and went through the tissue that was required to be cut and coagulated, and then passed through the opposite edge of the scissor back to the generator to complete the circuit. Only the tissue that was required to be cut and coagulated experience the current. Now, let us revisit the risk map. What was the opportunity cost for PowerStar? Was it high, or low, or medium? It was low because the product was protected by patents. The intellectual property residing in such inventions is typically protected. Therefore, there is little fear of some other company taking away the window of opportunity. On the other hand, the development risk was very high. It was supposed to be used in surgery, and if something goes wrong, the patient may die, the doctor may face severe consequences and the company's brand name may suffer.

Therefore, a long and thorough product development process was adopted, and the product was tested thoroughly before launch. Where do you think the product would fall in the newness map? The firm newness was low to medium, since Johnson and Johnson was thoroughly familiar with the customers and had many other surgical products. The market newness was also low to medium because the market was familiar with the usage of monopolar pencils and other electrical products used in surgery. What happened? The product was very well received in India, however, the company withdrew it after a year.

Can you speculate on the reasons? Although I was never told the reasons, I can make an informed guess. Go back to the newness map. What would be the main concern? What marketing issues would become important? As you can see, cannibalisation should be a concern when developing this product. In India, the monopolar pencil was still not popular when this product was launched. Every time a surgeon used this product, the company lost sales of sutures.

The company recommended this product for 30 surgeries and had priced it accounting for the cannibalisation of sutures when used in 30 surgeries. Product usage can be managed in developed countries where doctors are afraid of legal issues and follow the recommendations of the manufacturers carefully. In India, the situation is different. We would get calls from surgeons praising the product and saying that they've been using it for 100 surgeries, and it is still going strong.

After all, the product quality was very high, and the cannibalisation of sutures was significantly higher than anticipated. From an economic point of view, the suture pricing was questionable. Roughly, a pair costs around ₹15,000-₹20,000. One option

could have been to increase the price of the scissors. It seems simple, but Ethicon could not have done it because the move could weaken the relationship of the company with doctors, a key asset of the company.

This was because doctors already perceived it as costly. They felt that even if the company buys the most expensive scissors in the world and converts them into these scissors, the price will not be very high. The knowledge of the customer regarding surgical products acted as a barrier to raise prices. We didn't want to be seen as making unnecessary profits from hospitals and patients that were always short of funds. The real reasons for the withdrawal of the product may be something else, and there may be multiple reasons.

However, on the basis of the analysis that we have done, both cannibalisation and product-market fit were issues in this case. In this session, we have learned about the context of a New Product Development process, and how it is defined by three factors. First is the purpose for the introduction of the new product that establishes evaluation criteria for the product concept.

Second is the position of the idea on the newness map. This surfaces key marketing questions and the data requirements. And third is the position on the risk map. This help determine the optimal trade-off of speed vs accuracy in the research process.

Video 6: Online Experimentation

Hi. In this video, we'll talk about causality, experiments, and different types of experiments. Before we understand experiments, we need to understand the difference between correlation and causality. Let us assume two variables X and Y, where X is the presumed cause and Y is the presumed effect. In other words, we believe that X causes Y. For example, X could be the education level of a person and Y could be future income. Or X could be a specific type of advertising and Y could be sales. Correlation is a statistical measure that shows the extent to which two variables are linearly related. In simple terms, when we say X and Y are correlated, we mean that X and Y move together to some degree.

Causality, on the other hand, means that one variable causes the other. For example, in our case, we may say X causes Y, if the relationship is causal. correlation is often confused with causality, and this can have important implications. Let me explain this with an example of scurvy that shows the value of experiments. Scurvy is caused due to a vitamin C deficiency in the diet. Between 1500-1800 years, about two million sailors died due to scurvy since ships didn't have adequate supplies of fruits on long voyages. In 1747 Dr. James Lind, a surgeon in the Royal Navy, experimented to test six possible cures. On one voyage, he gave some sailors oranges and lemons, and gave alternative remedies like vinegar to sailors in other voyages. He found that the group that received oranges and lemons did not suffer from scurvy and concluded that Citrus foods can prevent scurvy.

However, the reason why these foods prevented scurvy was not known. Lind wrongly believed that the acidity of the fruit was the cure and created a less

perishable remedy by heating the Citrus juice into concentrate, which destroyed the vitamin C in it. It took another 50 years when unheated lemon juice was added to sailors rations that the Royal Navy finally eliminated scurvy. If Lind had run a controlled experiment of two groups of sailors with heated and unheated lemon juice, the remedy could have been found much earlier.

Now, why is causality important? Consider another example for Microsoft. Microsoft conducted two observational studies of two advanced features of MS Office and concluded that new advanced features reduced attrition. However, new advanced features may be correlated with attrition, but didn't they cause it? If they caused it, then the company would want to expand more resources on introducing new advanced features.

However, if the new advanced features did not cause lower attrition, then there may not be any reason for this additional unnecessary expense. Digging deeper into this issue, we can see that heavy user of MS Office use advanced features more and also have lower attrition. Therefore, it is not the advanced features that cause lower attrition. In this case, it is easy to make wrong conclusions if we assume correlation to be the same as causality. Understanding causality helps in understanding, growth and avoiding mistakes, but may not always be necessary. Experiments are the gold standard in establishing causal relationships.

For establishing a causal relationship between two variables, X and Y, three conditions have to be satisfied. First, X must be correlated with Y. In simple terms, X and Y must move together. Second, X must precede Y. In other words, Y must follow X no matter how closely. And third, we must rule out other alternative explanations for Y to occur other than the occurrence of X. Once these conditions are satisfied, we can say that X causes Y. Note that we can never prove causality, we can only establish it until more information may disprove it. A natural question that arises now is, what are experiments? An experiment is a scientific investigation in which an investigator manipulates and controls one or more independent variables and observes the dependent variable for variation related to the manipulation of the independent variables. There are, broadly two types of experiments: Laboratory experiments and Field experiments.

A laboratory experiment is a research investigation. In which the investigator creates a situation with exact conditions to control some and manipulate other variables. A field experiment is a research study in a realistic situation, in which one or more independent variables are manipulated by the experimental under a carefully controlled conditions, as the situation will permit. Here's an example of a classic scientific experiment to test whether a particular medicine... Say, vitamin C tablets can prevent flu. In this experiment, a random sample of healthy individuals is selected during the flu season.

Out of these, 50 are randomly selected to be assigned to one group and the remaining 50 are assigned to another group. One group of 50 individuals gets the medicine tablets daily and the other group gets placebo tablets daily. After a few days, the researcher counts the number of people with cold in each group. If the number of people who get cold is significantly less in the group that got the medicine

tablets daily, then this would be scientific evidence that the medicine can prevent flu. Let us consider the example of a marketing research experiment shown in your slide.

This simple experiment is designed to select the package design that would lead to higher purchases. A random sample of 100 consumers is obtained. These consumers are randomly assigned to two groups of 50 consumers each. One group sees package design A and the other group sees package designed B. After this, we count the number of purchases of the brand in each group. The package design of the group, with the higher number of purchases is selected as it leads to more purchases. So, far, we have seen examples of different types of experiments.

There can be many other experimental designs. I want to share with you a few terms used in this domain first, before discussing some common types of experimental designs. A treatment group is the group of units, such as individuals who participate in the experiment that get the treatment, such as the medicine in the earlier example. A control group is a group of units that is used as a benchmark to compare the effect of the treatment in the treatment group. In our notation, 'R' represents random assignment to treatment and control groups, 'X' represents the treatment, and 'O' represents the observation taken from an experimental unit. Now, let us discuss some common types of experimental designs. The first design is called the Static Group Comparison design, as shown in your slide. EG represents the Experimental Group, and CG represents a Control Group and X is the treatment or intervention. O1 and O2 are observations taken on the experimental units in each group. An example of this design is as follows.

Suppose you want to measure the impact of a 5% increase in sales commission on the performance of your salespersons. You assign salespersons randomly to the Experimental Group, which is the group that gets 5% extra commission and the Control Group that does not get this extra commission. Here, a 5% increase in commission stands for X in the design, which is the treatment. Overall sales of each group are measured at the end of the study, and these measures are represented by O1 and O2 for the experimental and control groups, respectively. The second design is called before after with control group design and its schematic is shown in the slide. Terms have the usual meaning. In some cases, it is important to measure the dependent variable before the treatment to establish the equivalence of the experimental and control groups. These measures are represented by O1 and O3 in the figure. These measures are also called pre-measures.

The independent variable is then manipulated. In other words, the treatment is administered to the Experimental Group. And measures of the dependent variables are taken again after the treatment for both the experimental and control groups. These are represented by O2 and O4 and are also called post-measures. In another variation of this design, a company could test multiple treatments, such as a 5% increase in commission and a 10% increase in commission on sales, to test each one of them. The design would remain the same, except that there would be two experimental groups now, with one control group.

In one experimental group, the first treatment of 5% increase in commission would be administered. And in the second experimental group, the second treatment of

10% increase in commission would be administered. And the dependent variables would be measured across all the three groups, both before and after the intervention. As the number of conditions to test increases, larger sample size is required, and the management of the experiment becomes more complex. Besides, through experimental designs such as those discussed so far, companies sometimes use Quasi-experimental designs.

A common example of such a design is a time-series experiment as shown on the slide. Note that, drawing causal conclusions from quasi-experimental designs is very difficult because of the challenges associated with ruling out alternative explanations for the effect observed.

Video 7: Experimental Validity in Causal Research

In this video, we will discuss experimental validity in causal research and the main types of threats to experimental validity. In an experiment, marketing researchers are concerned with two types of validity. The first type is internal validity. Internal validity refers to an experiment ability to clearly show a cause-and-effect relationship between the independent variable or the treatment and the dependent variable or the effect. Internal validity is critically important for an experiment. An experiment with high internal validity allows the researcher to rule out alternative explanations other than the presumed cause for the observed effect. One way that experiments address a key concern related to internal validity is by establishing the equivalence between the experimental group and the control group.
Random assignment of units is the best way to do so. When a random assignment of units is not possible, then matched samples are used in the experimental and control groups. The matching is done on multiple observed variables, and there are other considerations that must be addressed. The second type of experimental validity is external validity. It is the extent to which the results of the experiment can be generalised to other people, settings, and times. In other words, external validity refers to how generalisable our results from the experiment are. In marketing research experiments, typically, there is a tradeoff between internal and external validity. For example, if a researcher uses similar test units in both the experimental and control groups, the internal validity increases because it is easier to rule out alternative explanations when the test units are homogenous all across. However, external validity decreases because results from a homogeneous sample of units in the study may not hold for other different units.

Generally, it is more important to have internal validity. If external validity is also important, then a series of experiments can be conducted with higher sample sizes to check for external validity. Once causality is established. However, this may take both time and resources. Threats to internal validity are factors that can contaminate the research results. And there are many types of threats to internal validity. We will now discuss the main threats.

The first is called history. It refers to an event external to an experiment that happens between the pre and post measures and affects the value of the criterion or

response or dependent variable. In our example of the sales commission. It may happen that while the experiment was taking place, a rival company also increased the commission for its salespersons by 20%, thus contaminating the results of the experiment. This event may impact the sales of the salespersons beyond any impact of the increase in commission within the experiment.

The second threat is called maturation. This includes any biological, economic or psychological processes operating within the test units in an experiment that very systematically with time. For instance, if the salesperson studies held over a long duration, then the salespersons may get more experienced and improve their sales performance, that may have nothing to do with the experimental intervention.

The third threat is called testing. This includes contamination in an experiment due to the fact that the process of experimentation itself affected the observed response. Within this threat, we have the main testing effect that refers to the impact of a prior observation on a later observation. And the interactive testing effect, which refers to the condition when a prior measurement affects the test units response to the experimental variable.

The fourth threat is called instrument variation. This refers to any and all changes in the measuring. In the sales example, the price of products may increase due to inflation, resulting in higher sales figures. The company may have to adjust for this factor before it gets to the correct impact of the treatment.

The fifth threat is called selection bias. This threat occurs when the treatment and control groups are initially unequal with respect to the dependent variable or in their propensity to respond to the treatment.

The sixth threat is called statistical regression. It is a type of selection bias and refers to the any of extreme cases of a phenomenon to move towards a more central position during the course of an experiment. This happens when individuals are assigned to groups based on their scores or some measure.

Then their performance regresses towards the mean. In our sales example, if only than performing salespersons persons are given the experimental treatment of additional sales commission and the others are not, then over time, these high performing salespersons may regress to the mean sales of all salespersons, resulting in the wrong estimation of the impact of the commission on Sales. The seventh threat to internal validity is called experimental mortality. It is a condition in which test units are lost during the course of an experiment.

This may result in non-equivalence between the control and experimental group. In our example, if good salespersons leave the company in different proportions from the experimental and control groups, then the results of the experiment would be contaminated. Note that multiple threats to internal validity may be present in an experimental setting, and the researcher has to carefully rule them out through the use of good experimental design.

Video 8: Growth Hacking

Consider the example of the beggar that we had discussed earlier. We had mentioned that the beggar must have experimented again and again to reach an optimal solution. We had also discussed how fast-food companies tested new products.

They typically don't go through the full new product development process. Instead, they develop a new food item to test directly among consumers. And experimentation has always been common among direct marketing companies. Note that in all these examples, the development risk is low. What would happen if something that the beggar tried did not work? Not much, he could try something else the next day.

In the case of fast food, what would happen if the new food item was not popular? The company would discontinue it and try something different. When development risk is not high, companies can experiment directly in the marketplace to grow fast. In the digital world, such experimentation, typically A/B tests to grow fast by making quick decisions, can be done at a massive scale, and the process is called Growth Hacking. Growth hacking transforms decision making into scientific evidence driven process as compared to intuitive reaction.

Growth hacking has become very popular among online companies. However, it is not worthy that the availability of big data does not reduce the importance of understanding causality. Today, almost all companies with an online presence conduct growth hacking to some extent. For example, Microsoft, Amazon, Facebook, Google and bookings.com each conduct more than 10,000 online controlled experiments annually engaging millions of users.

Start-ups conduct growth hacking on a smaller scale. Some issues that companies experiment with our ideas for websites, potential business models, strategies, products, services and marketing campaigns. Let us see, a remarkable example of growth hacking at Bing. In 2012, an employee at Bing had an idea of changing the way headlines were displayed in search engines, as was typical at the time. The idea was lost among hundreds awaiting approval for testing. Although, it needed just a few days of one engineer's time. The idea remained lost for six months when one engineer wrote a simple code to do A/B testing to assess its impact. The result was an abnormally high impact on revenue within hours. Analysis showed a 12% increase in revenues. On an annual basis, this increase was estimated to be $100 million in the US alone, without hurting user experience matrix. It turned out to be the best revenue generating idea in Bing's history.

There are 1000s of examples today. In fact, every day many companies are involved in online experiments engaging millions of consumers in the process. Conducting many online experiments rapidly and harvesting useful results to be implemented quickly for Growth Hacking is not trivial. It requires specialised knowledge and skills. Therefore, companies have used different methods to organise this activity. Some companies use a central unit to manage online experiments.

The advantage of such an approach is that specialisation can be developed within the unit and better tools can be utilised efficiently. However, such a unit may not

understand the reasons for the experimentation well, since what to experiment with is decided by the business units within the organisation. After all, they are close to customers and responsible for generating revenues.

This disconnect between the Central Unit employees who are specialised in running online experiments, and the business unit employees who understand their own unique contexts can make the process less effective. The other approach used by companies is decentralised experimentation. In this different units within the organisation manage their own online experiments. Obviously, this results in inefficient utilisation of resources in this area, due to duplication of assets across different business units.

Further, significant investment in this area, which is so important for growth, becomes difficult. However, this approach results in more relevant experiments due to a better understanding of the needs of the business unit. A third approach that takes the best from the other two models is a hybrid model. In this, a small specialised central unit works in close co-operation with decentralised units spread across the relevant parts of the whole business organisation. Let us now look at some good practices in this domain. A company must first decide it's overall evaluation criteria or OEC for success. The Overall Evaluation Criteria sets measures for the success of the entire process.

The OEC can be decided through internal discussions among senior management. The company must break down the OEC into components and track them to get insights into why an idea was successful. Let us take another example from Bing. Bing's long-term goal is to increase its share of the search engine queries and ad revenues. If Bing decreases the relevance of search results for users, it will make the users issue more queries, thus increasing query share. It will also make users click on more ads, thus increasing ad revenues as well.

However, such short-term gains would be obtained at the expense of long-term gain of search engine market share. As a result, Bing decided to minimise the number of user queries for each task or session and maximise the number of tasks or sessions that users conducted. Another good practise is A/A testing. This is generally done before implementing a new A/B testing platform. The test can check the accuracy of the A/B testing platform. It can point out any issues with the online experimentation or testing platform before implementing A/B testing.

In an A/A test, the testing platform or tool should show no statistically significant difference in conversions between the control and the test groups, if the test is implemented correctly. Essentially, you're testing A against A itself, which is the one group against the same group, one type of intervention against the same type of intervention in A/A test.

Now, the other issue that must be considered carefully is the data. The company must look at how data was obtained and are there any outliers in the data? Few outliers in the data can skew the results and mislead the researcher. It must also check whether there are multiple segments of consumers that are grouped into one group for the purpose of the experiment.

All these factors can bias the results and must be taken care of before running the experiment. Finally, the assumptions of causality must be avoided unless it is established carefully.

Video 9: Summary

In this module, we discussed the categories of products, typically considered new products, and why new products succeed or fail.

We revisited the New Product Development process, and discussed its context set by three factors, which are; the reason why the new product is being developed, the newness map and the risk map.

Understanding these contextual dimensions helps a firm decide what information to bring through its marketing research, used during the New Product Development process, and how fast or slow the NPD process should be. After this, we learned about correlation, causality and experimentation.

We also learned about the threats to validity in an experiment. Finally, we discussed growth hacking; how organisations can manage the process of growth hacking and some good practices in this domain.

Hope you had a great learning experience. See you in the next module.