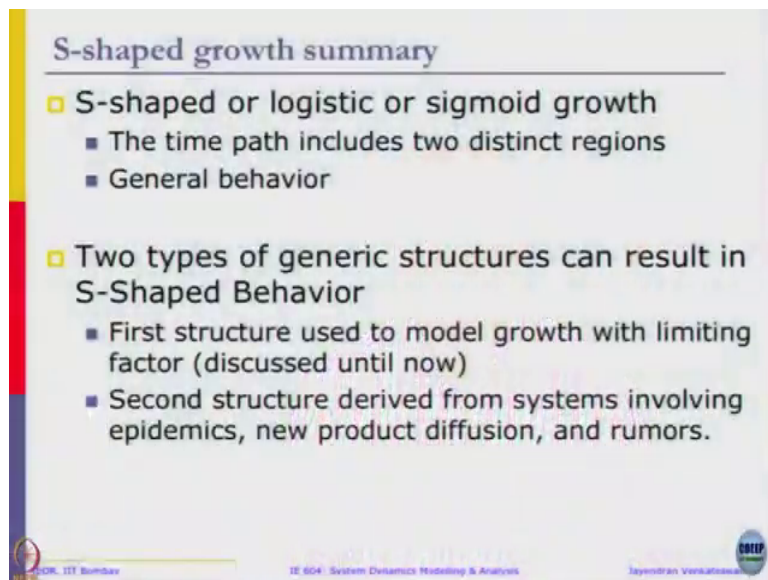


Introduction to System Dynamics Modeling
Prof. Jayendran Venkateswaran
Department of Industrial Engineering and Operations Research
Indian Institute of Technology, Bombay

Dynamics of Simple Structures: S - Shaped Growth (Contd.)
Lecture - 11.2
Dynamic of Simple Structures: Second Structure of S-Shaped Growth

We will look at this second structure of the system.

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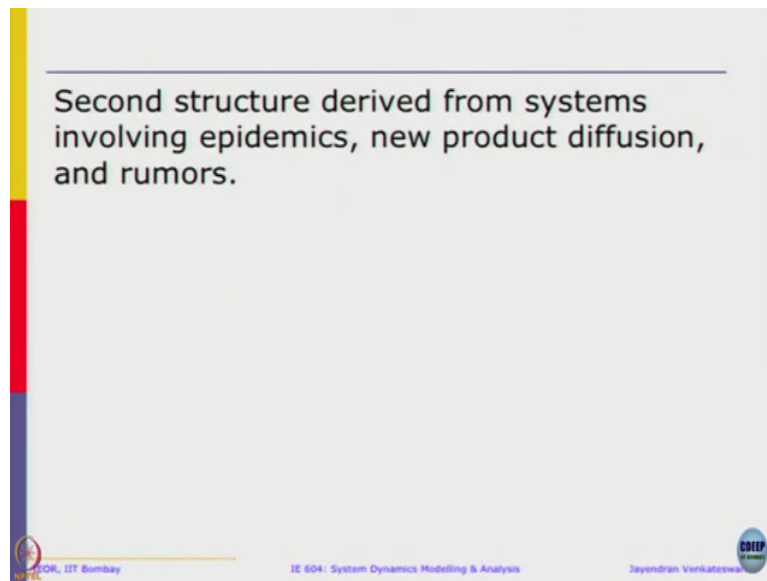


S-shaped growth summary

- S-shaped or logistic or sigmoid growth
 - The time path includes two distinct regions
 - General behavior
- Two types of generic structures can result in S-Shaped Behavior
 - First structure used to model growth with limiting factor (discussed until now)
 - Second structure derived from systems involving epidemics, new product diffusion, and rumors.

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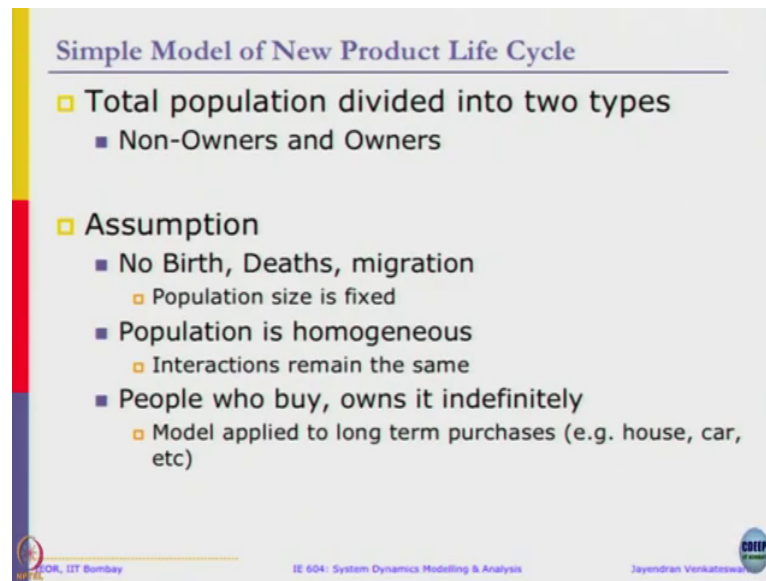
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Now, one we have seen was carrying capacity was involved and the effect resource adequacy. So, we are positive feedback system can be negative feedback system now. So, let us imagine that in that in our case of the population as well as a carrying capacity, we have defined both in the same terms right. Population carrying capacity we had similar units, right. So, in that sense then carrying capacity can be assumed like a stock and births and total population is the stock.

So, initially we have lot of people from the total pool to move towards a population and as this stock depletes, then that is going to put a constraint on how much the resource system can group. So, that is kind of very broad explanation. We will modulate and then we can look at the system better understand.

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Simple Model of New Product Life Cycle

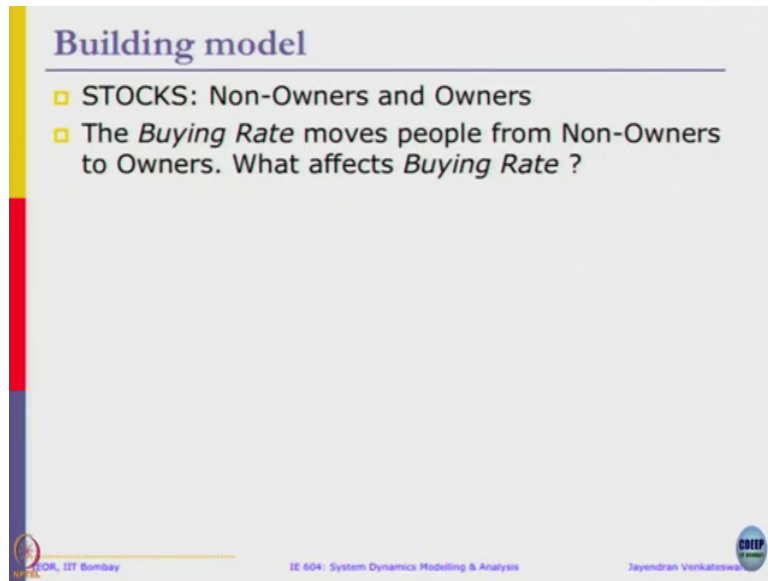
- Total population divided into two types
 - Non-Owners and Owners
- Assumption
 - No Birth, Deaths, migration
 - Population size is fixed
 - Population is homogeneous
 - Interactions remain the same
 - People who buy, owns it indefinitely
 - Model applied to long term purchases (e.g. house, car, etc)

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Let us take a very simple model of new product life cycle or new product diffusion. There are more complex model size. We can have you see later, but let us divide the population into just two distinct types; non-owners and owners. You can imagine any new product like a cell phone or a cycle or watch or whatever it is bags anything. There are people who does not have a product and people have the products and for simplest sake we will assume no births, deaths and migrations occur during this time which affects the population say and fix location.

Nothing is going to change and product, population, homogeneous interactions remain same among the population and people who buy it owns it indefinitely. So, we will make that assumption also and all the population is trying to purchase that same product or a similar kind of products. So, we will make that simple assumption.

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Building model

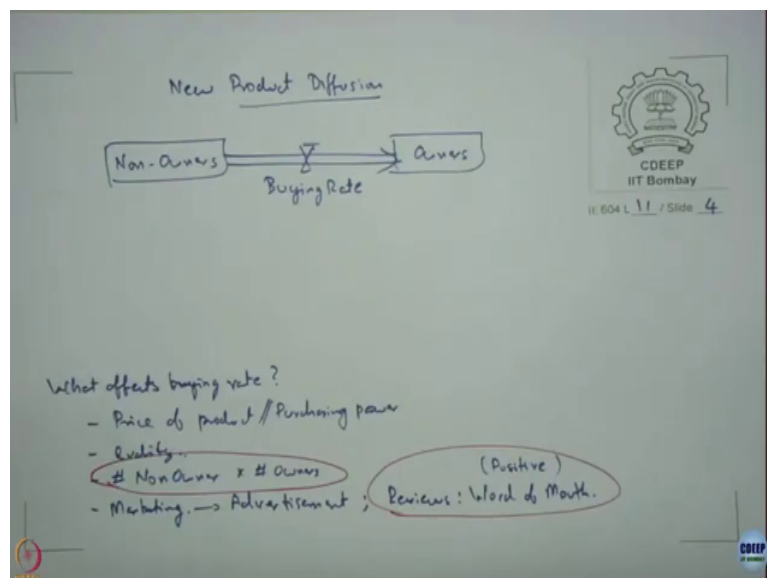
- STOCKS: Non-Owners and Owners
- The *Buying Rate* moves people from Non-Owners to Owners. What affects *Buying Rate* ?

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Jayendran Venkateswara

So, with that let us so building this model as I told let us assume two stocks. One we have non-owners another we have owners. So, non-owners become owners if they buy the product right. So, the buying rate we can define a simple parameter called as buying rate moves up a people from non-owners to owners. So, that is the rate which affects the non-owners and moves them into owners. My question is what affects the buying rate.

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So, let us go to the let us define non-owners owners buying rate you have observed. What we have done here I have taken a stock and connected to another stock. So, rate as you can see here as a buying rate increases, the non-owners are going to come down. The buying rate goes up; non-owners are going to come down. That is buying rate goes up, owners are going to increase. So, that is the simple causal link that has been captured by this diagram.

As you can observe there is no inflow into the non owners right. That means, non owners is fixed whatever initial value is there, only thing its get effected is a buying rate. So, non-owners should keep reducing as long as a buying rate is positive, right. As every period as long as a positive buying people buying and those many non-owners are going to get converted into owners and you can observe is as equal in stocks matter is conserved.

So, over non-owners gets depleted here, the same amount get increased here has owners. The matter is conserved is same 5 people buy it that week. So, then non-owners reduces by 5 that week, owners get increased by 5 the same week. So, non-owners start its initial value, the owners also have start with some initial value and buying rate increases.

Non-owners are going to fall down, buying rate increase, owners are going to increase simple system that we have. Now what affects this buying rate? Ok. There are various seeing some more assumption probably I have to list, so that I can ask you that question and all fairness let us write whatever comes to your mind cost or price what else income. So, let us just changing into something called as purchasing power, that takes care of your income as well as the price of product etcetera.

So, let us just get rid of their quality number of non-owners, number of owners is lot of non-owners are there, then buying rate should be higher if number of non-owners are low, buying rate should be low ok. Here we have marketing. There are two types of marketing right. One is through advertisement; the other is through and other is through reviews advertisement, other is reviews which part we are going to use the phrase called as a word of mouth.

The word of mouth if remain is a kind of when you here positive reviews about a product, then people are more tempted to buy it and whatever be the advertisement word of mouth finally will be the dominating factor and selling things. Advertisement can help in the initial sales beyond which word of mouth has to be taken. Now, word of mouth has been facilitated much better these days through Social Media. So, all is social media posts and post your all your thumbs up and smiley's all accounted as part of word of mouth, right. You can imagine like you know you can think of any movie initial advertisements will make you watch it, but within the second day word of mouth takes and we will either thrash it or beside is going and then you go on watch it yeah.

So, among them this kind of dominates more than this one and another good thing about this from the company point of you is word of mouth is free. So, as long as you get a good

product and a good word out, then social media and other sources will take care of the sales and you do not really need to do much. I would explain this is very expensive, this is very cheap, but this can be very critical and very cruel. It may not go your way you wanted to go, but still you will not get this out as soon as possible.

The positive word of mouth about positive and negative that is initially worry about positive word of mouth ok. So, you have to keep the model simple. We are going to only focus on this on this, we will initially focus on this or we can come with a very basic model, then we can expand the model and you know always try to bring an advertisement and other things as you go along.