Introduction to System Dynamics Modeling
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Lecture – 25.2
System Archetypes

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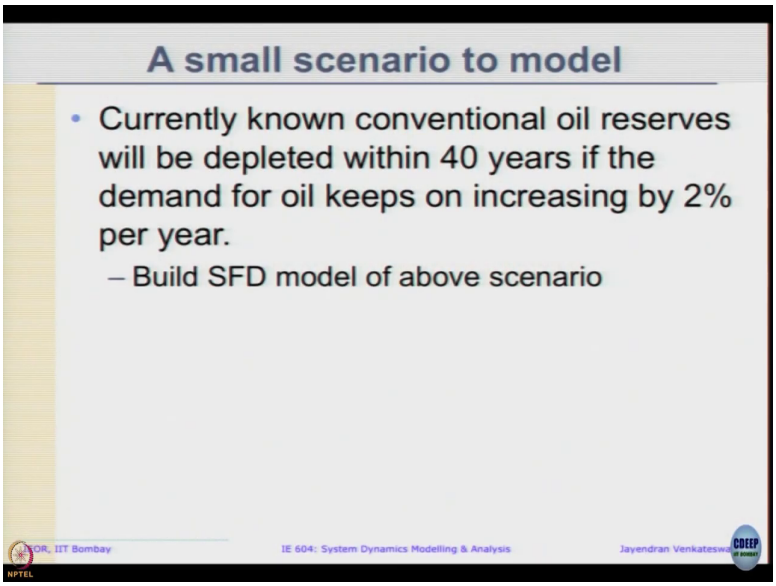

Now, we have looked at various models with in our course.

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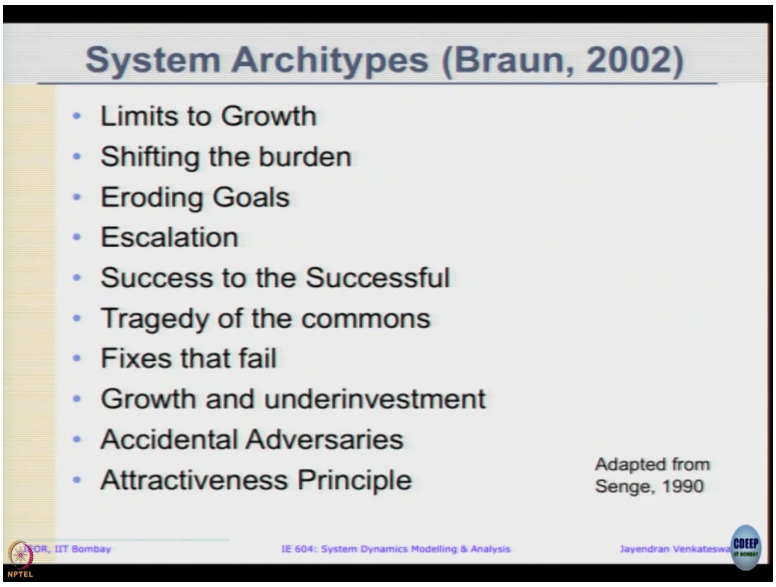

Many of these models can end up falling in any of these what is called a system archetypes, limits to growth shifting the burden, eroding goals, escalation, success of to the successful, tragedy of the common, fixes that fail, growth and underinvestment, accidental adversaries, attractiveness principle. Its from Braun 2002 extended notes for this uploaded in Moodle.

So, it is extended from Peters, Senges book called the Fifth Discipline which talks about nothing, but the systems thinking till 1990. Let me quickly explain about the different types of the system architypes and where it is applicable.

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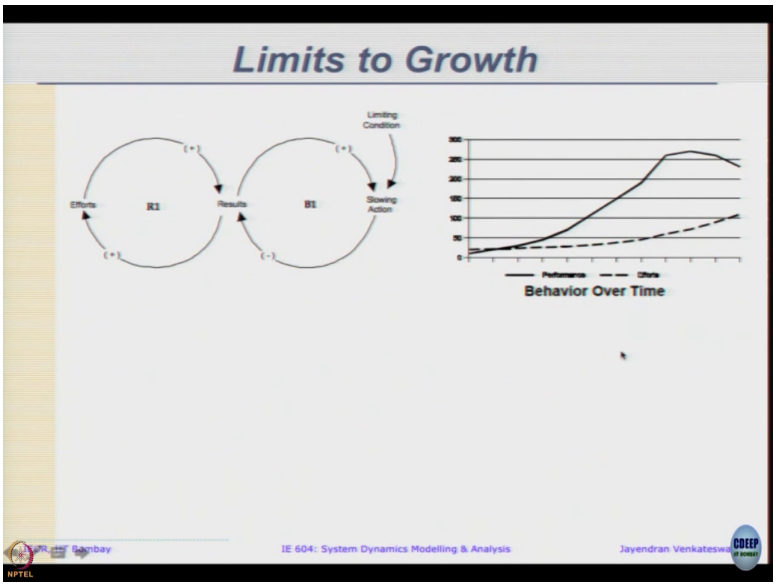

The limits to growth again classical model is attributed, I mean it came from 1970s by introduced by Meadows Donella Meadows and Dennis Meadows and their 1970s book; books also title Limits to Growth. So, essential idea that they saying is we are always looking at the results and efforts and it keeps reinforcing each other. However, our there is a limiting condition which over slowly over time gets affected like how much we are extracting.

Like right now there has sufficient amount of say bauxite ore, then we are going to keep exploiting it because we are looking at next quarter what is the forecast and really short term things right. But only over a long period of time, this is going to slowly start hitting. So, that is defining limiting condition and this slowing action since this loop is takes a much longer time period eventually everything will take limit hit at some point in time after which your growth will start to come down. So, that is the classical limits to growth model archetype.

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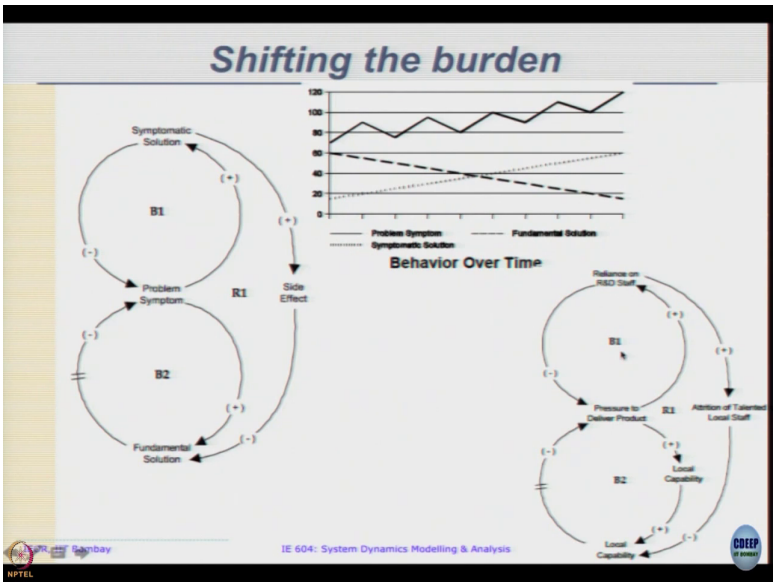

Second is shifting the burden archetype: This left side here shows the generic structure. So, we have problem symptom, then there is a symptomatic solution. Once we give in the problem, symptom disappears. Based on symptom, we treat the problem and the problem disappears very fast.

However, because of a side effects, this symptomatic solutions that we are providing it keeps the fundamental solution is always is avoided; it is delayed. So, after sometime the problem, again appears again it gives the symptomatic solution, again the problem disappears temporarily. However, your fundamental solution was never addressed. It results in a kind of a behavior what we called as we just instead of looking for a solution for this fundamental solution, we are looking at solving this symptoms.

In example that is showed here is suppose there is pressure to deliver a product, you may quickly relay on the say R and D staff to may quick fixes to our particular say products. So, any problem is there and then we delivery part ok let us jut worry about today's shipment, let us just finish it.

Let us quickly fix the machine. So, that this afternoon shipment goes it tomorrow shipment goes, next week somehow the model is that we will get the better process later. The problem is we were relaying on a very few experts to solve their problem. Result is since they lot of pressure deliver, the all the experts looking at the R and D, they are setting at chart flow trying to fix the problem to ensure that the products are going; it is going to affect the local capability actually solve the problem.

The result is they may also not want to stick around if they are you know always fire fighting. They may say I do not want to continue I might leave the organization which is the side effects, you may end up actually facing. So, it kind of the problem symptom with keeps appearing again and again in this kind of sawtooth pattern that is there and the symptomatic solution initially we may do a solution again and again we know that the some solution does not work. So, I refers to that also kind of keeps reducing and the fundamental problem keeps increasing.

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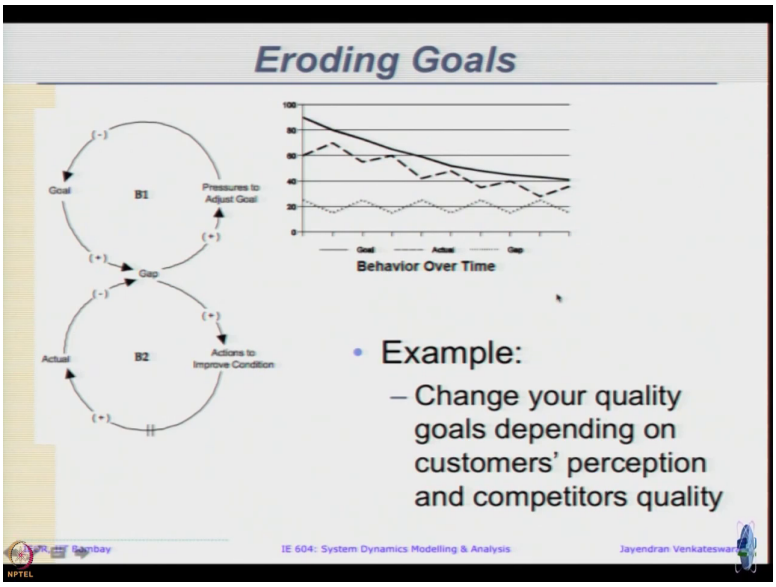

Third kind of example is what is called as eroding goals. Say this is to talk about we have a goal and we actually change the goal instead of trying to change the system to achieve the goal, we actually change the goal. So, that it is in line with what we want to what we have been achieving that is what eroding goals. I am sure you all familiar with. I am sure your current CPI is no relation to your goal CPI final semester settled; settle is a very common term. You settle in courses, settle in everything [FL] settle [FL]. So, that is eroding goals.

Another example is to change the quality goal depending on customers perception and competitors quality. See you might want to improve quality only if the competitors as much higher quality or if they are also not providing that much quality you might just saturate ok, this much quality is enough.

In fact, one of the thing in India sorry some of the product demand is so, high that they say look we are going to produce grade a products goes to this market, grade b goes to this market, grade c goes to this market. I do not really want to micromanage the quality. I am going to produce in this anyway. So, those depends on based on what customer is doing you are actually changing your own goals as what you are setting.

You have to observe that almost all these loops previous figures also in the one coming forward. They are always these double lines indicating delays within the system that is actually causing this dynamic behavior over time.

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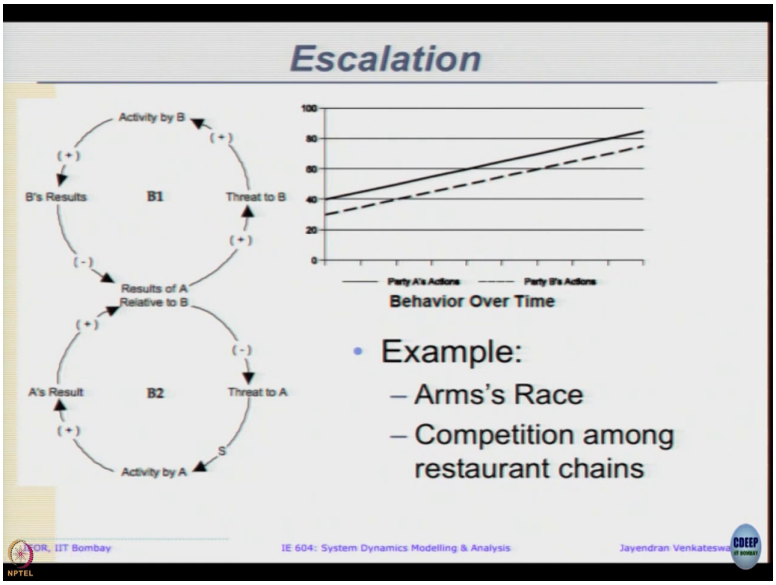

Escalation this is when say two parties are competing with each other, then activity of A is seen as a perceived a threat by B and then B takes counter activity which is seen as threat to

A, who then takes counter activity the classical result is both their activities is reinforced each other and causes escalating behavior classical example is arms race.

Another example you can think of is say restaurant chains, you know Burger King opens, McDonald opens, Subway opens, Pizza Hut opens, Papa Johns opens everybody starts competing and as an more and more chains happen. Then some closes some may feel the print, some may go out of business because a bit too much Walmart's 7-Eleven. Many of these even among corporations, there is race. It is not just arms race as in between nation's even corporations has to for them the physical footprint may actually matter right.

It also works for healthcare also when there are multiple clinics nowadays are coming up. So, in competing clinics combine then they want to position themselves there. So, that is leads to escalation.

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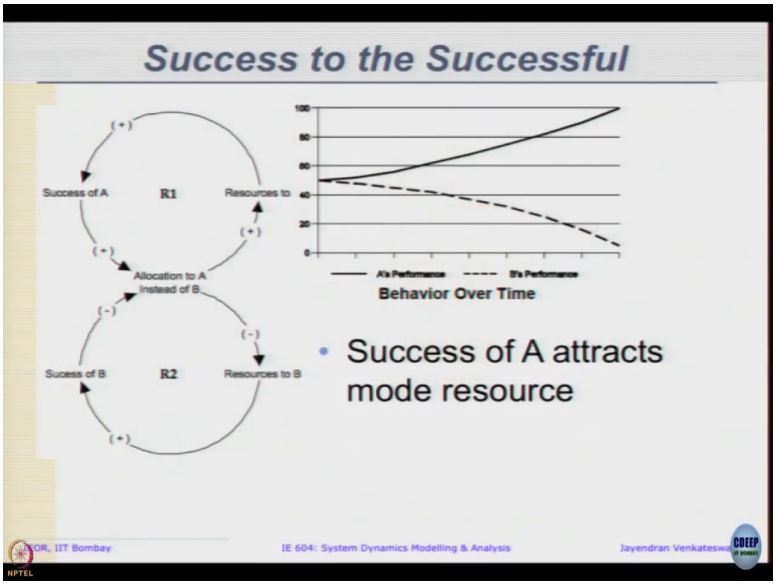

Success to successful another interesting archetype. This again many of us might have perceived or at least heard of. Suppose some resources kind of are given to say two parties A and B say may be initially the equal resources. Suppose A produce some reasonable success, then in future people may more willing to give more resources to A than B. Now since A has more resource, he can produce much better. So, that start to reinforce the affect in A where it causes an exponential collapse for B because B's performance is going down. So, they are unwilling to invest more in B.

As a result performance even worsens over time may be like you know when there are competing startups, some may gets slightly better than that because initially they had a slight better success and that snowballed into attracting more and more investments. So, some become success some kind of collapse right. So, that is what we mean by success to the successful. This is much more complicated looking causal loop.

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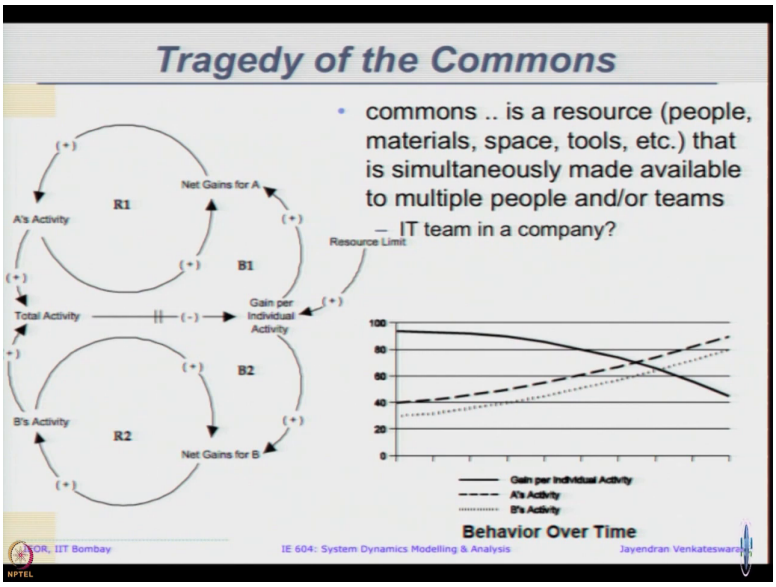

It is not very apparent immediately how to translate this into a start flow also, but what we were saying is ok; first you define what is commons. Commons is any resource people material space whatever it is that is simultaneously made available to multiple people ok. So, when the same resource available to multiple people, everybody thinks that that resource is they are only for them and the result is they overexploit that resource. They do not realize that many others are also competing for the same resource.

One example there is a IT team in a company you may not have some experience, but many large companies have one big IT company. They get request from production department, finance department, admin department. They get from company A, B, C, D many companies kind of give same request to them. So, then they have to deliver everywhere right. So, that is a

tragedy in the sense that their own performance will start declining overtime because they are unable to do their own projects, they are always firefighting.

So, one of the thing is when people try to start up technology hub in India or somewhere which is to solve all this is the analytic hub where there is a one company or one centre which will take request from companies or their own companies subsidiary units from Australia, Austria, Brazil everywhere and they try to solve here. Then every company will perceive that this technology centre is to solve only their problem and they will start pasturing them. So, then that is what would be call about tragedy of commons.

So, more non corporate kind of examples would include exploitation of natural resource. See, everybody is going to see that the fishes in the sea is only for me the mining then the entire hill is only for me there is nobody else who is competing for it etcetera. So, then the tragedy is everybody will lose out that is a tragedy part in the future.

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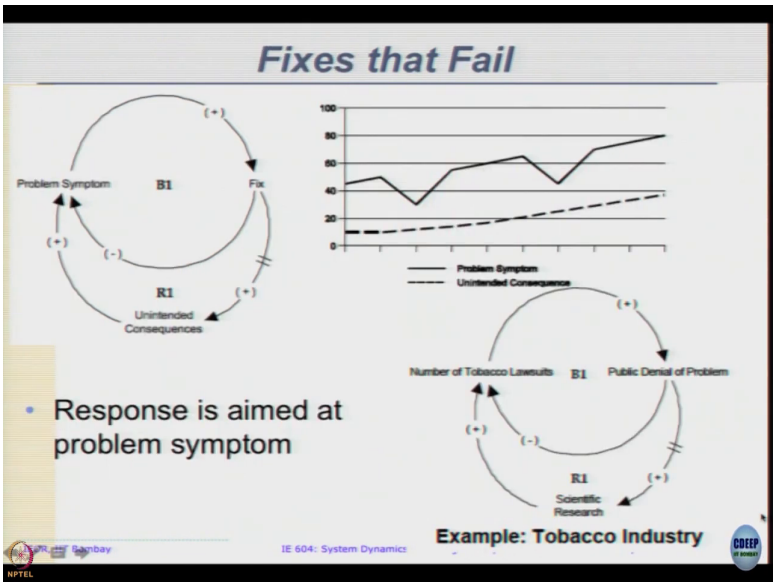

Another archetype is fixes that fail this is common phrases like again it is very similar to the second archetype we saw the because the second one the shifting the burden archetype we saw. Again we only address the problem symptom which may cause some other consequences and the symptom we will keep reappearing. This is a small part of that one of the example given is the number of tobacco lawsuits and then the tobacco companies made lot of public denial saying that and it does not cause a cancer and things like that.

But then after delay it caused lot of scientific research started publishing and then more number of tobacco lawsuit starts coming much later and much larger. So, the problem did not go away it came in a much larger amount later.

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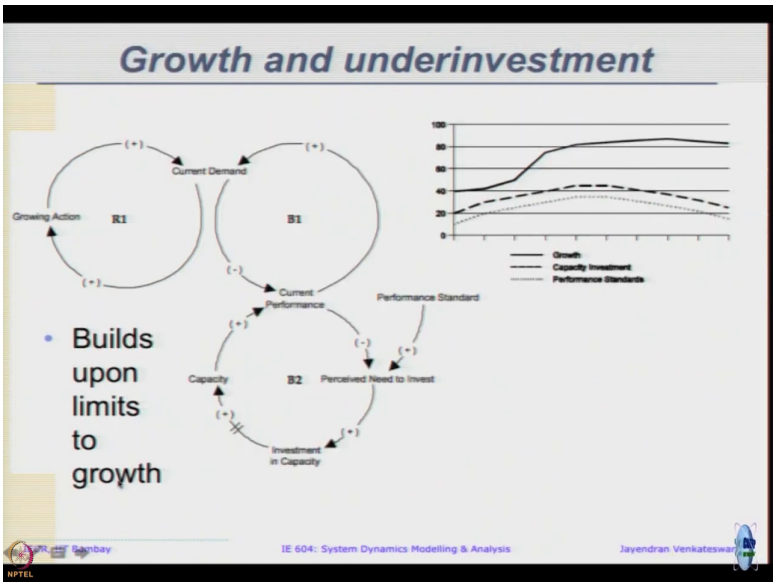

Growth and underinvestment, it builds upon the limits to growth. So, already there is a limit to growth which is happening in this loop here. But based on demand our own growing action gets tapered off as soon as it start hitting limits , our own capacity investment to starts to fall down that will put further restrictions on how much we can actually grow based on initial shock that we may perceive early on.

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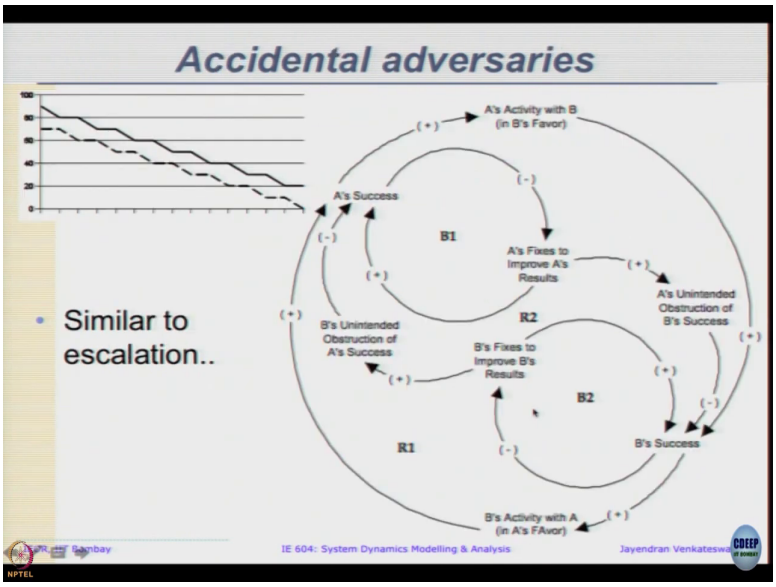

This is even more crazy looking thing, its accidental adversaries it is actually similar to escalation, but happening in the other direction. You can ignore the actual diagram. So, what it is trying to say is suppose two people are equal footing, but then one perceive some wrong doing from the other, then they say you know let me do something else which is going to affect my own success as well as it might have unintended abstraction of B's successes.

Then B gets offended and B does something else to change his successes which inadvertently offends the other person result is everybody both parties starts to lose out on the long term because they felt the other was doing something only to you know spite me, but it was not. So, they just perceived it and the result is both are going down.

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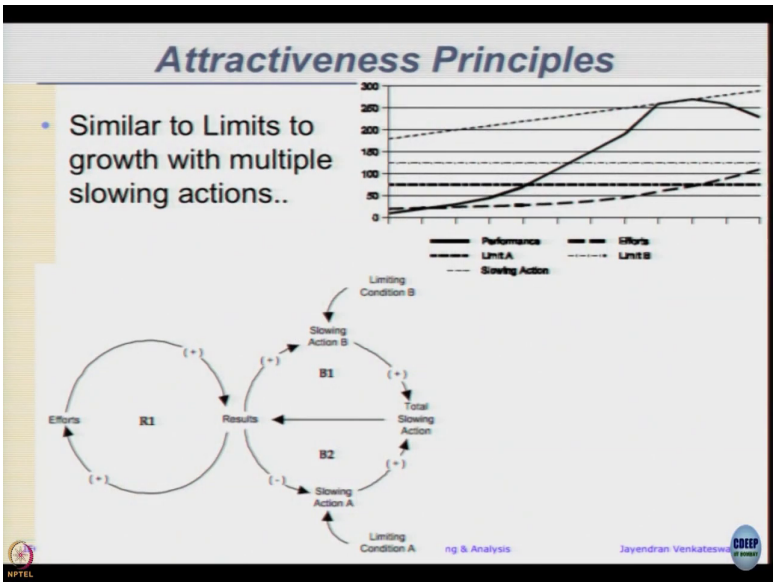

One is called attractiveness principal similar to limits to growth, but with multiple slowing actions. It is not just one activity which slows things down, multiple things may come in parallel to limit your growth. So, when things go bad, multiple things get attracted to that and both has going to affect the end results within a system. So, that is what is captured in this attractiveness principle archetype; more discussions on this is written up.

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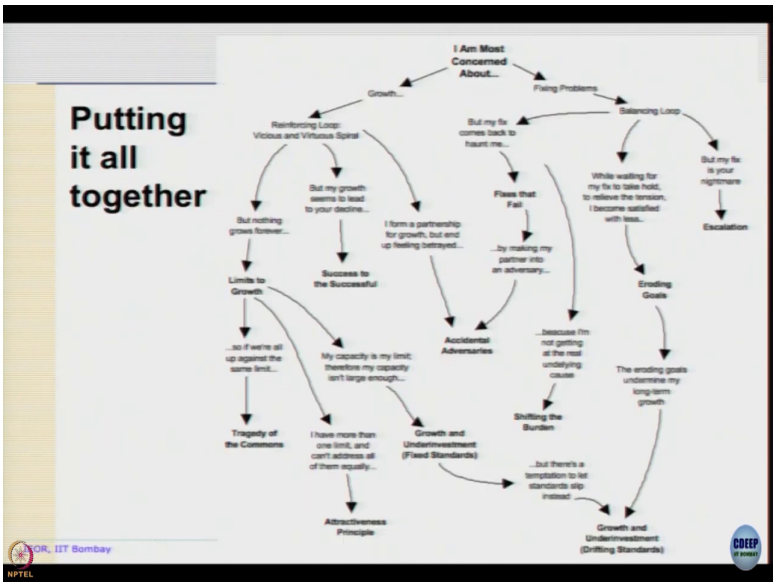

But the interesting thing about is people have actually put it all together in a nice flow chart kind of thing to see. For example, let us say what are we concerned about growth or fixing a problem. So, let us just pick one say I am interested in fixing a problem. So, is there a balancing loop ok? What kind of balancing loop may fix? Again keeps coming back or while waiting for the my fixed to take hold to release the tension. I become satisfied with less or, but my fixes your nightmare.

Suppose we say we are going to wait until my fix is going to work then until then I need to do something, then it can lead to eroding goals kind of models. And if the eroding goals undermine long term growth, yes then we are looking at growth and underinvestment kind of scenarios. So, this is just a kind of interesting flow chart that tries to connect all these

archetypes and what scenarios we might actually be useful for that it take some effort to understand and ok.