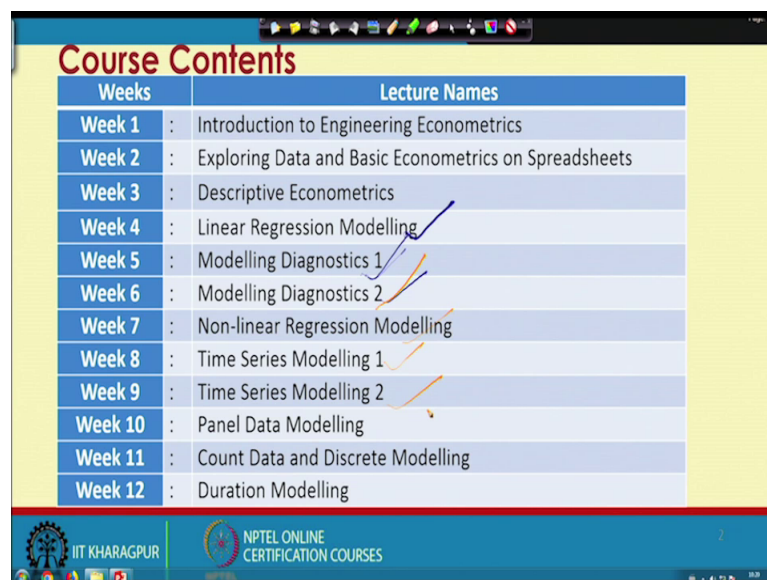**Engineering Econometrics**
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Lecture – 01
Introduction to Engineering Econometrics

Hello everybody this is Rudra Pradhan here, instructor in charge for Engineering Econometrics and first of all welcome to this particular you know subject, that is engineering econometrics. And today is our you know first lecture that to Introduction to Engineering Econometrics. Before we start the first lectures let me first highlight the course contents that will be from unit 1 to unit 12.

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So, the course content will be like this, a in the unit 1 will discuss introduction to engineering econometrics and, here will discuss various aspects of you know econometrics the kind of you know requirement the kind of you know scope and, the kind of you know engineering area, where we can target and address the problem.

And then we will move to unit two where we need to know the use of the data and the spreadsheets, because this is a contractive subject and here, we like to use mathematic statistics and statistical software's and, for that the use of data and the kind of you know spreadsheet is very essential.

And that is how in the unit two will discuss all details and, then in unit 3 will have descriptive econometrics here, all kinds of you know requirements will address the need of the particular you know techniques and the kind of you know requirements like, you know inference distributions probability and something like that, because these are all essentials for some of the complex you, know modeling and as per the particular you know engineering problems requirement.

And then we will move to unit four where we will discuss, some kind of you know really econometrics work that is one regression modeling. And in the regression modeling that is on linear regression modeling and, in the linear regression modeling, we will discuss various aspects of you know structure starting with you know simple one and the complex one.

And then followed by unit 5 and unit 6, where will we discuss various aspects of model diagnostics and, then will have some kind of you know testing and something like that and, then we will address the particular you know requirement will move to unit 7ths.

Where we will be discuss you know non-linear regression modeling, in the like you know linear regression modeling will have a plenty of you know different models and, the kind of you know requirements the kind of you know testing, then the kind of you know diagnostic checks. And then we will move to week 8 and week 9, where will we discuss time series aspects of regression modeling because, some of the engineering problems can be connected with time series data and for that different types of you know time series models are there, where we can you know use this time series model and, then we can address the engineering problem as per the particular you know engineering requirement.
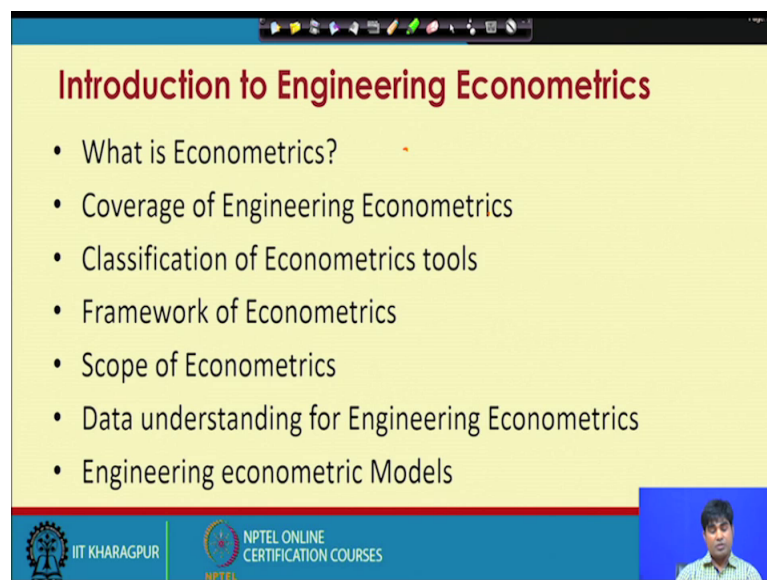
And then we will move to unit 10's, where we will discuss panel data modeling. And in the panel data modeling we have a different types of you know models depending upon the particular you know engineering problems you know requirement and, where we will discuss types of model like you know fixed effect model, random effect model and generalized methods of movements and so on.

And then we will move to unit 11, where will have a count data and discrete modeling and, then in the last unit will we discuss couple of you know different special kind of you

know modeling, that is called as you know duration modeling. And the details you know items will be highlight in the in the first lecture itself.

And let us start with you know the kind of you know introduction to this particular you know, engineering econometrics ultimately, ultimately the structure is like this say so, what we can you know do.

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So, we start with the introduction to engineering econometrics and, where will you know address some of the issues behind this econometrics and the kind of you know engineering problem. And in the in the introduction to engineering econometrics, we start with the following components, what is all about econometrics.

And second the coverage of a engineering econometrics, then classification of econometrics tools. And then finally, framework you know econometrics depending on the particular you know classification and, scope of econometrics and finally, data understanding for engineering you know econometrics. And in the last part we did discuss engineering econometric models so; that means, you know these are the following components, we like to address in our you know first lecture. So, let us start with the what is all about you know econometrics.

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So, econometrics a technically is a quantitative subject. And where we have the structure you know quantitative analysis, of actual you know kind of you know scenario, based on you know particular development you know theory and observations and relating to appropriate, you know methods of you know inference.

So, a technically a it is a you know part of the mechanical science and, as the things are like this you know is a like you know applied kind of you know subjects, where we have the integration of both mathematics and statistics to some of the engineering problems.

So, there is no specific engineering area, but here the idea is already you will be discussed different kind of you know techniques and, then we will connect with the a particular you know engineering problem. So, all together econometrics is the systematic process of using a theory a model and using theory model, then you know data and you know and to get innovative insights for the decision making process.

That means, you know all together three things heres so, theory is one part model is the second part and data is the third part, then we like to actually integrate an insight in the model itself, we have the structure of you know mathematical modeling. And we have the structure you know statistical modeling, there is a little bit difference between the mathematical modeling and statistical modeling, where you know the idea is you know the theoretical aspect are the kind of you know problem.

The real life engineering problems can be transferred into a form of a mathematical model and, using that mathematical models we convert into a statistical form and, then we will go for some kind of you know empirical testing by using the data and the kind of you know techniques.

And hoping that you know there will be something new insights from the existing theory, or the kind of you know the revisit of the this particular you know theory with the help of you know different techniques, different tools and different you know data structure. And the particular insights can give you some kind you know aims tools of the engineering problems. And so, technically it is the integration of it is the integration of theory then model and data. So, this is your kind of you know empirical process all together.
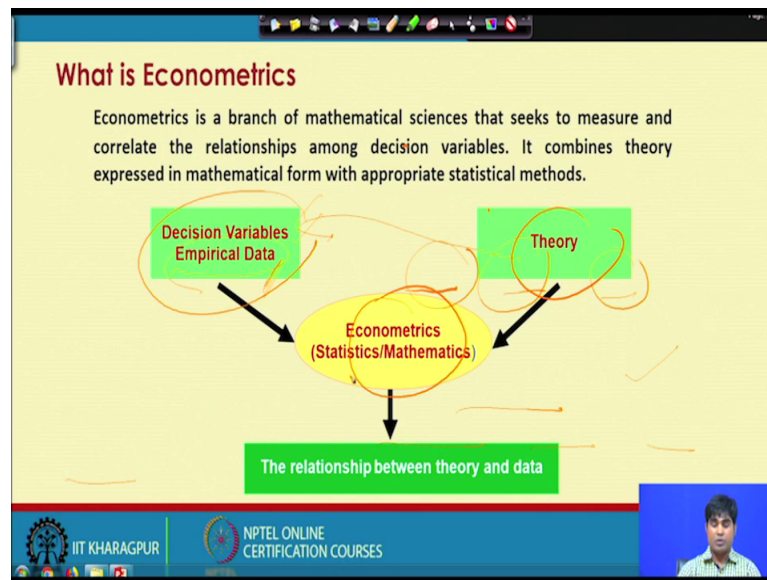
And then will get some kind of you know new insights and, that new insights will help you to proper some kind of you know decision making process. So, econometrics all together you know extensive use of you know mathematics, then statistics a as usual I have discussed that there is a requirement you know data and models.

And then fact based you know kind of you know theory to obtain the decisions and actions as for the particular you know engineering requirement. So, we have a couple of you know engineering problems, were we need actually some kind of you know systematic decision, or you know accurate decision and having theoretical information having some kind of you know data. So, engineer cannot you know easily come with the kind of you know excellent decision, or proper decision to address the problem.

So, what we can do here you know we will take the you know econometrics, which can you know simplify the particular you know process, much better way and with the kind of you know new insights and some kind of you know fact based, you know you know observation through which you can address the engineering problem in a much better way.

So, that is how the kind of you know structure and, then ultimately so, we will moved to the this particular you know structure called as you know the understanding of you know econometrics and that to the particular you know engineering area.

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So, all together econometrics is a you know, if I summarize you know like whatever we discussed in the last slide, you know our focus is for aspects the use of mathematics the use of statistics and the data and, the kind of you know model. So, here you know you know we just summarize the kind of you know structure.

So, it is the branch of mechanical you know science and, is to measure and coordinate the relationship among decision variables. And it combines theory expressed mathematical form with appropriate statistical methods that means, you now we will start with the particular you know engineering problem.

And that engineering problems can be address, or can be analysis with a set of decision variables and, the whole process is to empirically verify, or test the theory with this decision variables and by the way for the decision variables we must have data and, must have some kind of you know baskets of technique, through which you can pit it up a technique and then the use we can use the data.

And, then we will visit or you know restructure the particular theory, to get some kind of you know new insights where to address the engineering problem. And ultimately the structure is like this. So, we have here we have here a theory and, the then we have decision variables of course, of the decision variables are coming from the theory.
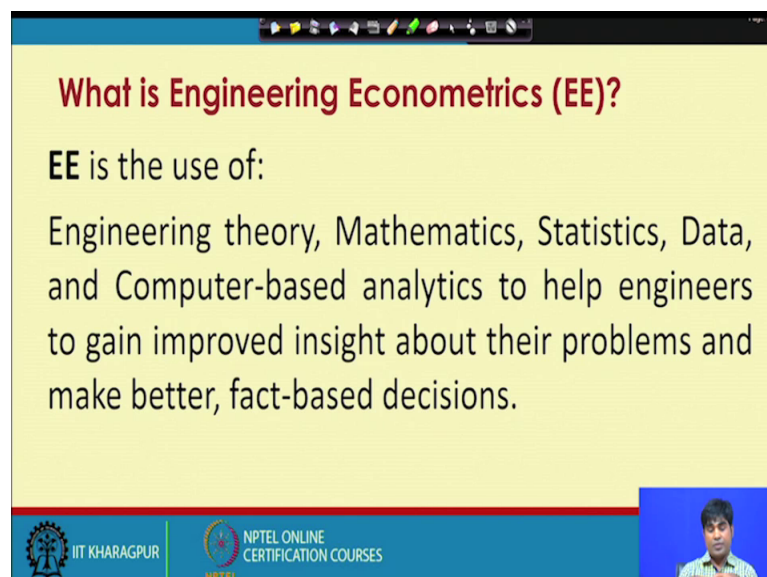
And then we have some kind of you know data and, then we look up for you know empirical process, the empirical process technically you know needs a data and the technique to you know examine the existing theory, that with help of you know decision variables.

So, so in the one part it is a theory and theory will give you the structure of you know decision variables. So, we then need data and techniques and, then in the technique baskets what we call as you know you know you know econometrics. So, so this is what the kind of you know technique baskets. So, theory will give you a kind of you know structure of decision variables.

And then (Refer Time: 13:04) all the decision variables we have here data that is the information and, then econometrics show this how this information corresponding to this decision variables that to corresponding to the particular theory, will be examine in a systematic way to gets some kind of you know insights which may be very innovative, which may be something new and to address the this term engineering problems, in a different way and what will give you some kind of you know excellent and prefect decision making outcome.

And all together it is the equation of you know, the relationship between theory and data and, what to with the help of the econometrics technique or econometrics tools. So, this is how the kind of you know you know structure.

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So, you know after knowing the kind of concept econometrics, then we will move to the concept of you know engineering econometrics, which is denote something actually different it is a econometric. So, the field which you know or where we can apply, the particular you know quantity technique is called as you know engineering area.

We have a plenty of you know engineering area starting with you know aerospace engineering, agriculture engineering, you know mining engineering, mechanical engineering, so we like to you know address you know some kinds of you know engineering problems not specifically for a particular you know engineering and, then will address the you know the problem in a more effective way.

The idea is that you know this is a kind of you know technique, when this particular you know subject that is the econometrics. It can be use you know any kind of you know engineering problems. So, the whole idea or the objective of this course is like this. So, you should know the econometric concept of the tools of you know econometrics and, then you think where we can actually apply this particular technique to address the engineering problem more effective way.
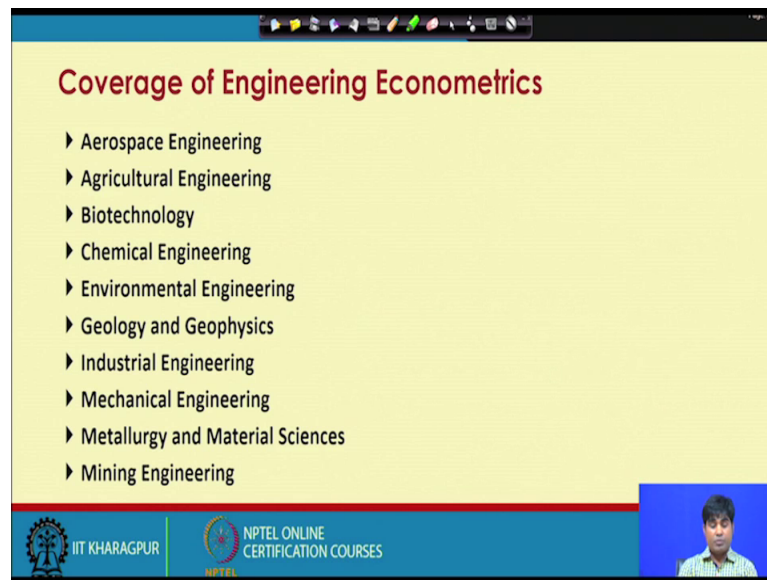
So, once we you know the techniques. So, then you can apply as per you know aspartase and the as per the particular you know your requirement. So, that is how we should know first you know the kind of you know econometric structures and, then you can you know go for kind of you know decision.

So, engineering econometrics technically this the use of engineering theory, mathematics, statistics, data, then you can say that you know subtypes, or some kind of you know computer base analytics to help specifically engineers to gain improve insight about their problems and, you know make better or some kind of you know (Refer Time: 16:04) you know observations, or you know decisions.

So, this is what actually the whole you know concept of know engineering econometrics, or the literately meaning of you know engineering econometrics.

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So, now the thing is that you know what are the coverage, which will you can which will have here in the case of you now engineering econometrics. So, the structure is a start you know you know we can start with you know aerospace engineering.

And then again agricultural engineering, biotechnology chemical engineering, environmental engineering, geology and geophysics, then will then we connect with also industrial engineering, industrial engineering, mechanical engineering metallurgy and material sciences and, then mining engineering.

So that means, in fact this are not the only engineering area, so, we have lots of you know other engineering area, but in the in the course particularly you know whatever units we already highlighted.

So, more or less will we discuss some of the problems corresponding to this engineering only. So, that is how we know you know our focus is not a particular engineering kind of an aspect like, you know when it specifically towards so, something like you know agriculture, or something like you know biotechnology.

So, the whole idea is you know we have a plenty of you know hydrometric tools. So, whenever we will discuss a particular tool will pit up a particular problems and to address the technique and, then we will check how this technique can help to solve this

engineering problems and to look for some kind of you know new insights, or better insights of the requirement, you know decision making process.

So, we can start with the aerospace engineering and, in the next problem or in the next techniques the particular know you application may be towards you know biotechnology, or chemical engineering so; that means, you know once you know the techniques.

So, you know you can use your you know engineering you know problems, that to you know apply this particular techniques and to get some kind of you know new insights. So, you know in some we like to target different aspects of you know engineering, with you know different econometric tools.

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So, the structure is like this; that means, technically we like to see are the components under you know econometrics modeling that look for you know engineering problems. So, in the unit structure itself we have already highlighted, but now I will give you the you know complete structure etymology requirement, you know from the linear regression modeling it to some kind of you know complex you know modeling.

And then and in the first case we will start within the linear regression modeling, where we will discuss some kind of you know simple structure that is called as bivariate structure and, then we will connect with the trivariate structure and, multivariate structure and then finally, we have some kind of you know model diagnostics.

So that means, first you know first-hand requirement of econometric starts with you know a linear regression modeling and, where will be discuss different aspects of you know linear regression modeling and, to address the engineering problems as per the particular you know requirement.

In fact, the particular subject this particular subject engineering econometrics is the extensive use of you know regression modeling of course, we have a different in structure you know the we can change the particular, you know diagnose on something like that as per the particular you know requirement, but ultimately the interest you know technical structure is on the basis of regression modeling.

And in the second unit a you know under the classification, it will be non-linear regression modeling and, that to will discuss different aspects of non-linear regression modeling, starting with the starting with understanding various functional forms, qualitative response regression modeling, models of discrete data.

Then binary and multinomial probit models discrete data and utility theory, then nested logit models. So, likewise we have a different kind of you know modeling structure though which you can actually address some of the you know issues and, accordingly so, we have a you know we have some kind of you know structures what you can called time series modeling.

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And then in the time series modeling we have something like you know components like you know trend analysis, stationarity issue, autoregressive models moving average models. Then ARIMA all kinds of you know models are there to address some of the engineering problems.

And we have volatility modeling, var modeling, then we will move to the particular structure called as a panel data modeling and, in the panel data modeling we have a structure of you know fixed effect model, random effect model, dynamic panel data model and generalize methods of you know movements.
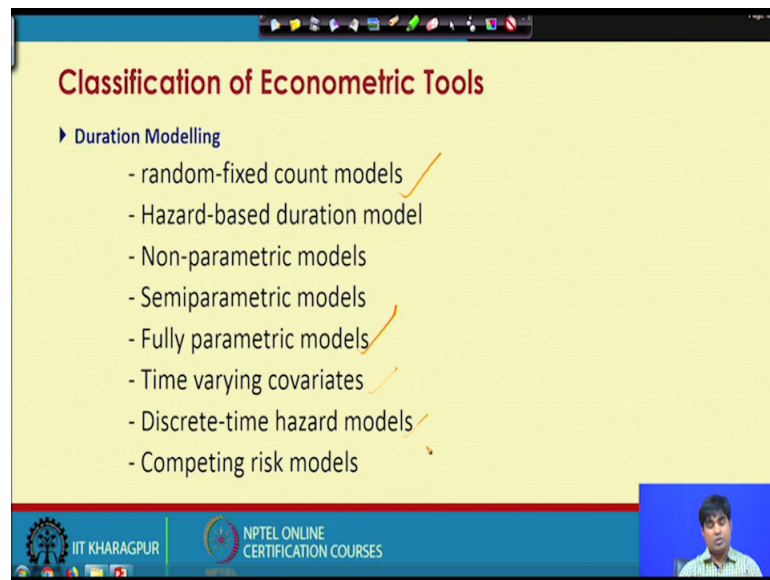
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So, against will we have some kind of you know classification, related to counting data and, then where we discuss some kind of you know Poisson regression modeling, some kind of you know facility truncated passion regression modeling, negative binomial regression modeling, zero inflated poison and negative binomial regression modeling and, then random fixed count modeling.

So, this are you know special category of you know modeling, were we can address some of the engineering problems, in a much better way as for the particular you know engineering requirement, or you know decision making requirement.
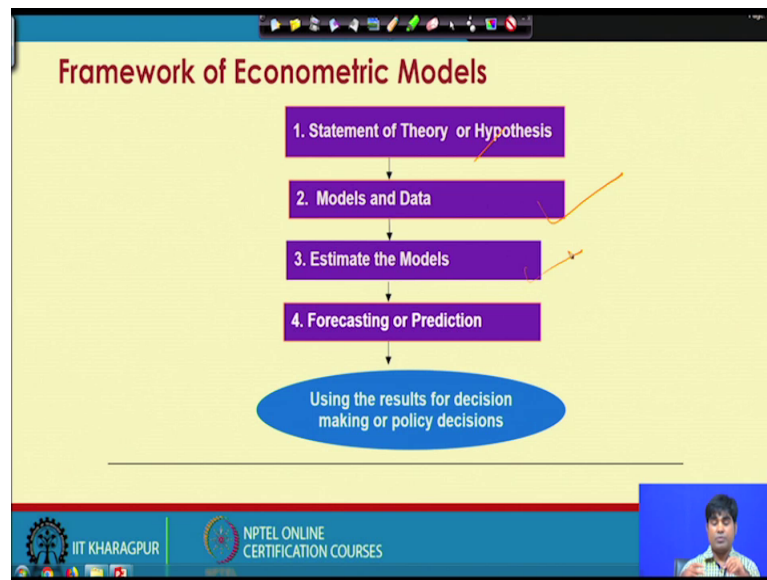
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Then ultimately we will move to the another kind of you know structure called as a duration modeling, the duration modeling we had couple of we know different models. So, the first one is random fixed count models, hazard based duration models, non parametric models. And then semi parametric models, fully parametric models time varying covariates and, then discrete time hazard models and finally, competing risk models.

So, is are you know special categories you know under this kind of you know econometric basket, where we can address some of the you know engineering problems in a most effective much better way. And likewise we have actually, you know all together different structure through which you can actually solve some of the problems, as per the particular you know engineering requirement.

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So, let us start with you know the framework of you know econometric models and, suppose if the framework is concerned start with you know something called as you know theory. So that means, in the definition itself, you know we have theory models and data.

And the models data we have a some kind of you know technique to be a empirical kind of you know output. So, we have a input kind of you know cluster and output kind of you know cluster, then we like to see how this inputs can be connected to gets some kind of you know output, that is what called as you know econometric output and econometric input that means, technically, it is the game between input and output that to the econometric analysis for a engineering problem.

And by default the first requirement is the observations, what you need to do actually that is the statement of theory and, then that can be convert into some kind of you know objectives. And the kind of you know hypothesis and, then we have we have you know models and data, that is in step two.

And once you have models and data and, that to connecting to some theory, then we will go for empirical process that is called as you know estimation process and, where we have to estimate the identify models, or the derive models and once you go for the estimations that is in the step three so, we will we will gets some kind of you know output, that is called as you know empirical output.

And on the basic empirical output, we will go for the by going some kind of you know predation and forecasting to a particular, you know decision variables and, and after that we can you know use this (Refer Time: 26:16) for decision making process for the kind of you know policy requirement.

So, the policy requirement of a particular you know organization, or a particular you know cooperate sectors. So, ultimately this a kind of you know decision making process, where we have some kind of you know tools. So, which helps to make the things in a much better way to gets some kind of you know insights, new insights or something like that and, to address the engineering problems more effective way.

And so, ultimately it is a kind of you know step by step process, starting with a kind of you know hint, or kind of you know theory, or kind of you know observation then, you connect with different levels of you know inputs and kind of you know requirements to gets some kind of you know output that is called as empirical output, or econometric output.

To get insights and to corresponding to a particular you know engineering theory and, to come with a kind of you know decision where the engineering problems can be solve more effectively, the engineering and engineering problem can be address more effectively, with this we will stop here. And the next lecture will start with the typical you know structure of the econometrics and kind of you know step by process with this.

Thank you very much have a nice time.