Advanced Business Decision Support Systems

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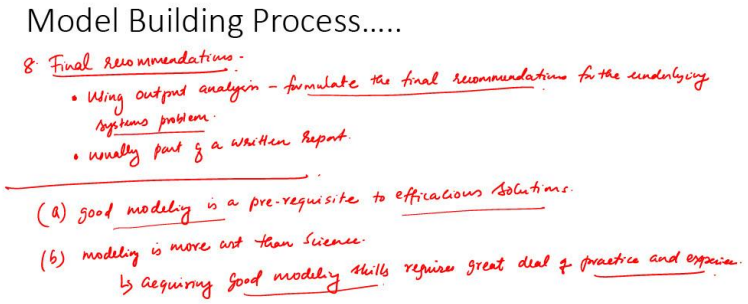
Lecture 07

Basics of Modeling and developing for DSS (Part-2)

Good afternoon everyone. Welcome to yet another lecture of the Advanced Business Decision Support System course, which is part of the MOOC's program and I am Dr. Deeu Philip from IIT Kanpur and along with me in this course is Dr. Amandeep Singh Oberoi and Dr. Prabal Pratap Singh. All three of us will be caught teaching this course together.



So, without much delay, let us get into today's topic which is Model Building Process. How do you build a model? We describe this whole thing in the form of an 8 step process, but you may or may not use all the 8 steps depending upon what you are actually trying to do, but these are the major 8 steps. You can use some of them, remove some of them depending upon what it is.

The step number 1 is Problem Analysis and Information Collection. You will see that some of those steps also mirrors with the problem solution approach. We already discussed in the previous class, but this what it is. So, first step is Problem Analysis and Information Collection.

So, the first thing you should understand is, modelling is prompted by some system oriented problem whose solution is vital for the organization . You want to undertake modelling when there is some systemic problem detected by you and solving the systemic problem is very important for the organization.

Just the same way, as a decision maker feels that there is a problem and you want to go ahead and solve that problem. Now we will talk about what will you do? First, you gather structural information on the problem and represent it conveniently. So, you are initially gathering structural information of the problem and you conveniently representing it. Then what does this includes?

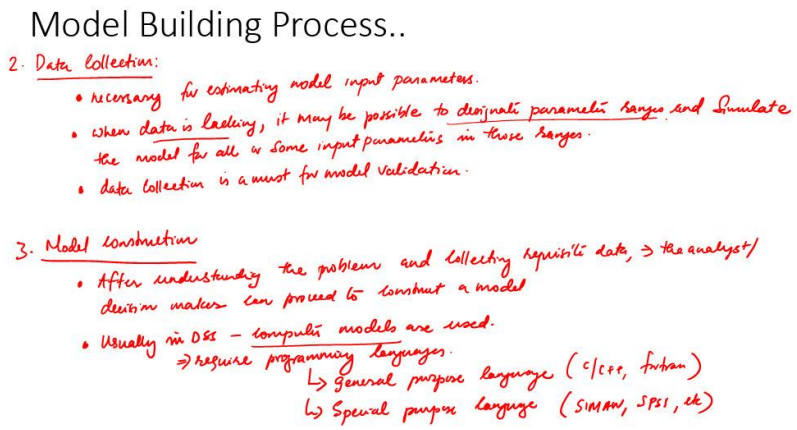
So, this includes identification of input parameters, performance measures, relationships among parameters and variables, governing rules etcetera . So, this is a structural information.

So, you are trying about what are the input values? How do you identify the input? What are the performance measures? How do you quantify? What is the performance measure? The relationship between among various parameters and variables.

Variables are values that change. Parameters are specifically denoting the behaviour of a system and they typically take a value that is more representative of what is the performance of the system and what are the governing rules, all these kind of things etcetera.

Then, what you do next is, such information is then represented as Logic Flow Diagrams like flow charts, hierarchy trees, narratives or any other convenient means of representation. So, once you collected, once you understand that there is a systemic problem what you collect all these structural information and then you represent it as logic flow diagrams which are called as Flow Charts or Hierarchy Trees which are typically used to denote the rules or governing rules, narratives, typed text, etc.

Or any other convenient means, some people use UML or those kind of things to basically represent the this information. So, this is the first step which happens I remember I told you about the thought of these two lines the thought and reality aspects and we talked about how we alternate between these. So, this is the first part we are talking about.



Now the second part of the model building process is the second step. The second step is Data Collection. So, we are going to collect data and why do we need to do that? Because data collection is important, it is needed or necessary for estimating model input parameters.

So, you want to estimate the input parameters of the model that is number 1. So, when data is lacking or when you really do not have adequate data, then it may be possible that you may have a chance to designate parameter ranges and simulate the model for all or some input parameters in the range parameters in those ranges.

So, what he is saying is that, when you do not have sufficient data, you may be able to designate parameter ranges and then using that parameter range, you may simulate for some more all of that range. So, that is another way of looking at this and third aspect is data collection is a must for model validation.

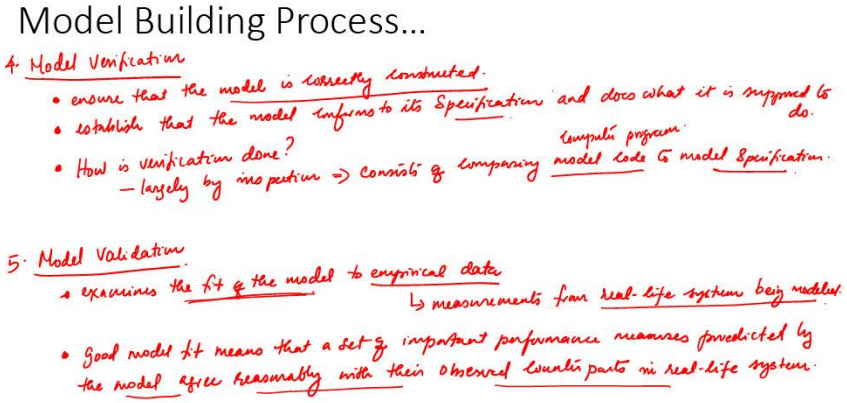
We will talk about what is Validation in a minute, but if you want to validate a model, then you need data to validate that . So, that is the 3 major aspects of data collection. Then comes the third step which is your Model Construction.

So, first you feel the problem, you find out an issue, you describe that one then you collect the data and then after, you construct the model and you have 2 major aspects. So, after understanding the problem and collecting requisite data, the analyst or decision

maker can proceed to construct a model or can implement it as a computer program. It is up to you.

So, after you have understood the problem and collected data, then you can build the model. And, usually in DSS, computer models are used. So, it require programming languages and there are 2 type of programming languages. A general purpose programming language or special purpose language.

So, general purpose language would be C, C plus plus, FORTRAN, etcetera. You can use some of those programming languages to do that. A special purpose language, you can do something like SIMON, SPSS, etcetera, where you can use them to build simulation models, etcetera. So, for us, we are mostly focused in this course on computer models. Things that you can model, you can convert it into computer models and then, use that to study or make the decision .



So, then the next major step of this is the step number 4. Now you have built the model. Now the fourth step is Model Verification. You are trying to verify the model and this is very critical for this process. So, we need to understand what it is.

So, what you are doing is, ensure that the model is correctly constructed. So, you are accurately constructed the model. Second part is, you establish that the model confirms to its specification and does what it is supposed to do.

So, it confirms the specification whatever it was intended to do. It is doing that and you also have specified certain aspects based on the data collection that is also being taken care of. Then how is this done? How is verification done? This is a big question, largely by inspection- consists of comparing model code to model specification. So, what you

are trying to do is, compute the model code, is this is a computer program? You are taking the computer program, checking it, going through it or debugging also, but it is not really debugging, it is not removing the log the programming error.

So, it is basically saying that the program is actually doing to what the model is specified, what is supposed to do. So, that is the Model Verification. Then, the fifth step is the Model Validation.

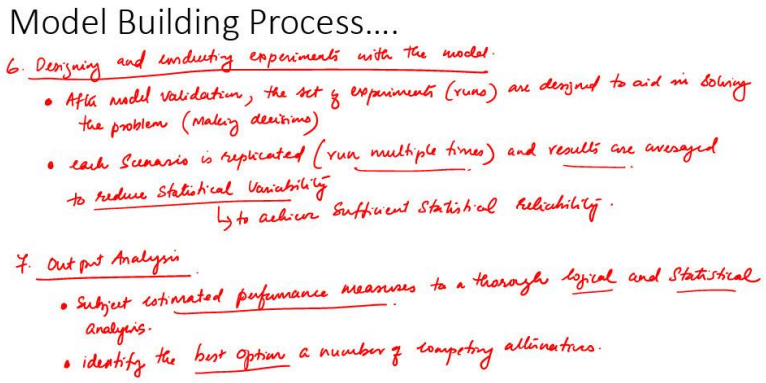
So, verification, validation are different in this regard. So what it does is, it examines the fit of the model to empirical data. You are trying to examine the fit of the model to the empirical data . So, what is this empirical data for us for the time being. Measurements from real life system being modeled.

So, whichever this real life system we are being modeled you, actually take the measurement from them and then you examine, whether the output of the model fits that data. And, then good model fit means that a set of important performance measures predicted by the model or provided by the model .

You can use the word predicted or provided by the model agree reasonably not exactly, reasonably with their observed counterparts in real life system. So, what you are actually saying here is an important performance measures, whatever you are saying an important performance measures, whatever you are predicted by the model, that agree reasonably with the observed counterparts in real life that is the Validation.

So, you are saying whether trying to find out that the model values that are provided by the model, actually agrees with the actual values that are provided by the system.

So, if you look into this verification and validation, the verification focuses on whether the model is built correctly. Correct construction of the model. Whereas, the validation is, whether the model, the output of the model fits the actual performance or the empirical data or the measurements taken from the actual system.



So, we have gone through 5 steps. Now, the next in the Model Building Process the sixth step.

Now, designing and conducting experiments with the model. So, what you are doing here is, designing and now, you have established, that the model is correctly built and the output values are reasonably agreeing with the actual performance of the system.

Now, you can use the model to conduct experiments or you can do analysis using the model can help you in making the decision. So, after Model Validation, after you verify and validate the set of experiments or sometimes we call it as Runs are designed to aid in solving the problem. What is solving the problem? That is making decisions.

So, you are interested aimed at aid in solving the problem. So, you are trying to make that decision. So, what you typically do is, each scenario is replicated. Replicated means done over and over again . This is the other colloquial word (run multiple times) and results are averaged.

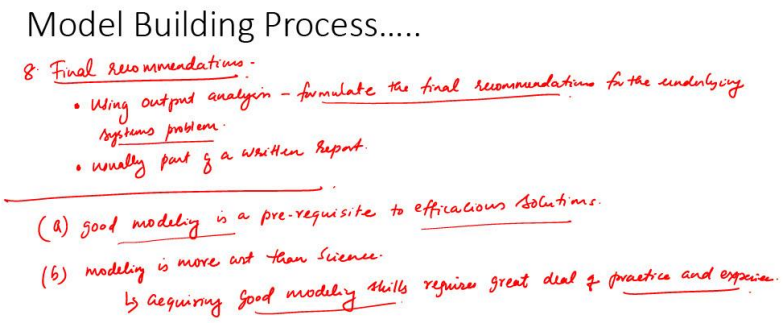
You average the results. Why do you average them? To reduce statistical variability . So, you replicate or do this experiment, run it multiple times and whatever the results you are getting of the performance measure or the parameter or the variable, you average it to reduce statistical variability. And, why do you want to reduce statistical variability?

To achieve sufficient statistical reliability. So, what you are saying is, instead of taking one experimental run, you said I have done 100 experiments of this and these are the output values and I have taken that all output values and averaged all those 100 values and this is the average I am getting. That average is far more reliable statistically than just taking the value of one of the outputs.

So, that is the ideas part of it. Then. the seventh step is once you done this, you have all these outputs and other things you analyze the outputs or output analysis, that is the

seventh step. So what do you do here majorly? Subject estimated performance measures to a thorough logical and statistical analysis.

Whatever the outputs you got the performance measures, whatever you estimated with sufficient statistical reliability, you think about it logically and statistically. And, then what you do is, identify the best option among a number of competing alternatives. So, you have multiple alternatives and from that, you identify the best option as part of it, such a seventh step. So, that best option will give you the best decision.



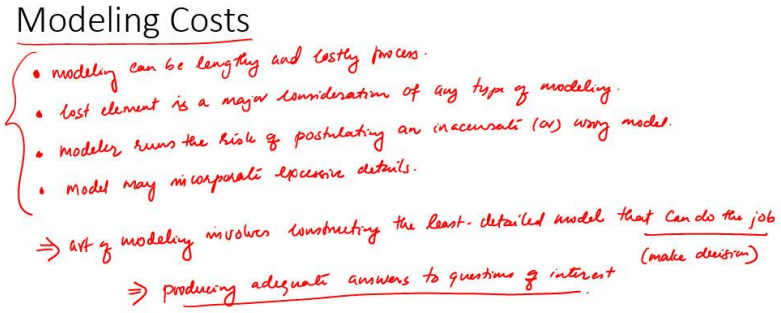
So, the continuing on the Model Building Process, the eighth step is Final Recommendations. You make the final recommendation. So, what do you do? The major thing what you do here is, using output analysis- formulate the final recommendations for the underlying systems problem.

So, you are formulating the recommendations for what and usually part of a written report. So, based on the findings, you formulate the final recommendation, what to be done? and how it is to be done? So, that the systems problem or the organizational issue or the business decision can be solved and addressed.

So, these are the major aspects of the Model Building Process. But you need to remember two important points. The first important point is, good modeling is a prerequisite to efficacious solutions.

You want an efficacious solution or you want solution efficacy, then you need good modeling Then, second part, modeling is more art than science, you need experience. So, that actually implies that acquiring good modeling skills requires great deal of practice and experience.

So, your practice and experience actually helps you in getting good modeling skills and so, one aspect is, you need good modeling to make efficacious solutions and modeling is more of an art than the science. So, these two aspects are important when you make the decision as part of the Model Building process you should remember that.



Then, before we conclude this lecture, we need to look into the cause associated with modeling. What are the major modeling cause? So, one of the important consideration that you need to understand is, modeling can be lengthy and costly process. You cannot go ahead and say that I will build a model in 24 hours.

May be it is the simpler problem but some of the complex problem, it may be a very lengthy and costly process. The cost element is a major consideration of any type of modeling, depending upon what the type complexity of the model, the cost is really a big thing. The modeler runs the risk of postulating an inaccurate or wrong model.

You may build a model or the modeler may build a model, but it could be a inaccurate or a wrong model. It can also be that, a model may incorporate excessive details that are not required for you to make the decision.

So, all these aspects, they all for it drives the cost on this. So, you should understand that art of modeling involves constructing. You are constructing the least detailed model that can do the job.

What is do the job? (make decision). Least detailed model that can help you in making that decision. So, what does that do the job? So, producing adequate answers to questions of interest, that is the main aspect you need to think about adequate answers to questions of interest.

You may not make the optimal answers, you may sometimes not, but you may get to the adequate answers and then you can continuously improve your adequate answers and you can approach close to optimality. That is another way of doing this. With that we come to the conclusion of this modeling approach.

The modeling process and how is that modeling process is important and critical for Decision Support System especially, for Business Decision Support System and what are the major steps of modeling. Also, we have seen through and validation verification and how do you do experiments and how do you make achieve statistical liability.

More aspects you will learn once we start playing with different models and you will see different positives and negatives of different type of models, but remember most of this from this point onwards, when we talk about models, we are mostly will be dealing with computer models or you will be using computer programming general purpose or sometimes specific packages that we use to build these computer models and how do we use that models to make decision or support the decision in a organization or a business standpoint is what in the remaining classes we will cover.

So, thank you for your patient hearing and wish you good luck and I will see you soon with the continuation of the last part of the this second week lecture very soon.

Thank you very much.