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TUTORIAL: SIMULATION IN THE HOSPITALITY INDUSTRY

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ABSTRACT

This tutorial article addresses the use of simulation in the hospitality industry, in particular the use of simulation in the fast food restaurant industry. Although the application of simulation to any system follows the same basic series of steps in an iterative fashion, there are unique aspects of the fast food restaurant industry that must be addressed when applying simulation to that industry's needs. In particular in the data collection, model building and in the validation steps there seem to be somewhat unique problems due to the wide variability of the same restaurant in different locations. Another aspect that will be addressed is the use of simulation in one of two ways, either as a planning tool at a central location in a particular company versus a field based tool. All in all simulation is just coming into wide spread use in this industry and will be a valuable analysis tool for an industry with wide variability among its various components.

1 INTRODUCTION

The application of simulation to the fast food restaurant industry follows the same basic steps as in the simulation of all systems:

1) Conceptualization
2) Data Collection
3) Model Building
4) Verification
5) Validation
6) Analysis
7) Implementation

However, within the hospitality industry there are certain aspects that must be given special attention. Since the hospitality industry is a service industry there are areas that must be considered such as the critical emphasis on customer timeliness, the variability in service times, and the fact that it is labor intensive.

2 CONCEPTUALIZATION

During the conceptualization phase the most important aspect is to determine the objective or objectives of the simulation model. These objectives will drive the entire project of modeling the desired system. It is at this time during a project kickoff meeting that the following be determined:

a) the specific objective of the model
b) the scope and the boundary of the system to be modeled
c) the level of detail to achieve the objectives of the model
d) the complete description of the model through flowcharting activities
e) the data required to drive the model
f) a description of the user interface
g) the description of the animation
h) a detailed list of the inputs and outputs from the model
i) the method of validation
j) the list of scenarios to be analyzed
k) the list of deliverables

It is most desirable to have an initial specifications document already available at this kickoff meeting and use that document as the agenda for the kickoff meeting. This initial specifications document can be determined by information obtained at an initial marketing meeting and other communications prior to the project kickoff meeting. This specification document will evolve over the project duration and can then be used as the basis for the documentation of the project and the simulation model.

3 DATA COLLECTION

The time delays of various processes must be determined as well as the arrival processes of customers to the restaurant in order to drive the model and to validate the model. These activities and arrival processes must be

determined for the dine-in, carry out and drive-thru customers and sometimes for home delivery. Four primary activities that must be timed are as follows:

1) Place order time
2) Money exchange time
3) Order packing or preparation time
4) Order handoff time

In order to collect data for both the inputs to the model and to validate the model two methods have been employed:

1) Using the standard clipboard and stop watch method where a person captures the beginning and ending of a process or captures the arrivals and departures of the customers.
2) Using video cameras to capture the processes and then timing the processes through the time stamp on the video or capturing the arrivals and departures from the video.

Once the times have been collected from one of the two methods these raw data are then used to derive a distribution for the models. Several commercial packages are available for this activity, including the model building packages that are available in the market.
One should note that there may be data already available and if so should be used but should also be scrutinized carefully. Some data has been found to be collected incorrectly, thereby biasing the distributions. It should also be noted that some clients that are not familiar with simulation have wanted to use the number of customers served in a given time period for the number of arrivals since the number served is readily available data. The number served must not be confused with the number of arrivals.

4 MODEL BUILDING

There are two schools of thought on how models should be built. These two schools are founded upon how the models will be used. One school builds models that can be used at a centrally located department within the organization and are usually used by either the model builder or someone who is intimately involved in the model building. These models usually are not what one would call user friendly outside of that department. Sometimes these are not really models but are templates that allow the user to more quickly build models of a given system.

The other school of thought provides a user interface which allows anyone familiar with the fast food restaurant to parameterize a general model of the given fast food restaurant. Underlying this general purpose model may actually be several models which mimic different restaurant setups. Such models allow the analysis to be performed not only at a centrally located department but in field offices as well. It should be noted that if this second school of thought is applied those using the models should be educated in the models as far as what the inputs must be, the limitations of the models themselves, and the interpretation of the outputs.

During the model building phase an animation should also be built using either specific or general layouts of the restaurants. Most fast food industries have layouts readily available that can be imported into the particular modeling software being used. In particular the Arena software of Systems Modeling Corporation allows for a DXF file format to be used as the animation background upon which the animation constructs are then built.

5 VERIFICATION

Verification of course is the process of determining that the model represents the restaurant to the detail required to achieve the objectives of the modeling process as stated in the conceptualization step. The first step in doing the verification should have already occurred prior to the model building step. Either at a kickoff meeting or via other communication prior to a kickoff meeting flow charts of the logic of the various restaurants to be modeled should be constructed. This allows for the system experts to view the logic of their system and to either agree or correct the logic at that time. As the models are constructed these flow charts should be updated and during the verification phase these can be used to verify the logic a final time. Although this can be somewhat tedious it must be done if one wishes to have accurate models.

A second means of verifying the models comes by reviewing the model outputs to determine if the outputs are in the “ballpark”. This involves reviewing the performance measures such as system time, order to delivery time, number of arrivals and number served.

And finally the verification process is greatly simplified by viewing the animations of the restaurant models with the system experts. This is perhaps one of the best uses of the animation capabilities of the simulation languages today. This allows those not familiar with simulation to become part of the verification process. And perhaps most importantly of all it gives the model credibility within the fast food organization.

6 VALIDATION

Once the user and the modeler have agreed that the models have been verified, the next step is to validate the models. Using the arrivals and restaurant statistics that were collected in the data collection phase, the models can be driven with those arrival patterns and the model outputs can be compared to the system outputs for the given time

periods. The four primary performance measures that have been used to determine if the models are valid are as follows:

1) The front counter time in system (time from the arrival of the customer until the customer leaves the system or receives their order).
2) The front counter order to delivery time (time from the beginning of the placement of the order until the customer receives their order).
3) The drive-thru time in system (time from the arrival of the customer until the customer leaves the system or receives their order).
4) The drive-thru order to delivery time (time from the beginning of the placement of the order until the customer receives their order).

Additional performance measures to be considered would be the number of arrivals both at front counter and drive-thru as well as the number of customers served.

7 ANALYSIS

Once the models have been verified and validated the analysis phase can begin. This is the time at which the user can now begin to play out various scenarios. Prior to this of course the model builder will have considered the following:

1) The length of the warm-up period
2) The length of the simulation run
3) The number of replicates required to achieve a given confidence level

Once that has been achieved the user can perform a given scenario. Another area to consider will be scenario comparison to determine if there is a difference between two or among more than two scenarios. And finally consideration should be given to experimental design to determine the significant factors.

8 IMPLEMENTATION

Once a simulationist has performed all of the above the user can then feel comfortable when making recommendations using the performance measures from the simulation. It should be noted that with such a dynamic and stochastic system as a fast food restaurant, simulation certainly can provide useful answers to what sometimes seem to be perplexing problems. Simulation can be used both prior to the introduction of a new restaurant or when attempting to improve current restaurants. SIMULATION the crystal ball of the 21st century must be the analysis tool of choice but must also be applied in a knowledgeable way if it is to be accepted in this fast paced environment.

REFERENCES

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