ABSTRACT

This paper provides a discussion of the purposes of simulation documentation and the role of documentation in gaining management acceptance and implementation of recommendations. A documentation approach is suggested which is directed toward providing management with an end-product, documentation, which will be useful in decision making. Guidelines are given for writing simulation documents which are aimed at several levels of management audiences.

INTRODUCTION

Most of the material which has been written concerning documentation of computer models has dwelt on writing for the computer specialist. Following the lead set by those documenting computer systems, the simulation practitioner has also written documentation for the technical specialist. Too often the documentation of a simulation project consists only of a block diagram, a program listing and some scanty information on verification and experimentation results.

Management, on the other hand, continues to complain that the results it receives from consultants or project directors are incomplete and inadequately backed by comprehensible reports outlining research procedures. (2,5,6) It is not difficult to understand the perplexity with which a manager may view results, sometimes counter-intuitive results, for which he can see no factual base. A manager will rarely base a decision which commits hundreds of thousands of dollars on research that he does not believe.

The analyst who approaches a problem using the simulation technique has an advantage in gaining management acceptance over those using mathematical algorithms. Simulation models often closely parallel the reality of the operating system. Block diagrams can be drawn which closely resemble the real system and which show the relationship of the model to the system. The simulation practitioner who perceives the manager's need to understand the model can represent the model so that a layman can gain at least a macro view of the project.

This paper focuses on documenting the simulation project so that undistorted communication is achieved between all parties of the project, including management. Guidelines are proposed for writing documentation which is aimed at four distinct audiences: 1) top management; 2) the manager who initiated the study; 3) the project director; and 4) the user. Each group has specific informational needs and requires a different approach.

PURPOSES OF SIMULATION DOCUMENTATION

The documentation of a simulation project serves four functions.

1) It defines the problem to be solved or the decision which must be made based on the simulation experimentation. It specifies the scope of the project as agreed upon by management and the project personnel.

2) It describes the development of the model and outlines the experimentation process so that updating may be done more efficiently.

3) It provides a reference for future projects which may be similar in nature.

4) It communicates the results of the project to management and facilitates implementation of the recommendations based on the study.

The primary goal of documentation, then, is undistorted communication between the parties interested in the project, both present and future. The documentation of the simulation project should be a complete reference to the project. Equipped only with the documentation: 1) users of the model should be able to experiment with new data; 2) analysts should be able to update the model or revise the model for a similar, future project; and 3) management personnel should be able to evaluate the work which was done on the project and make decisions based on the results of the experimentation.

Previous work in the area of simulation documentation and documentation of computer models in general has focused on the need to communicate with the technical personnel involved in the project. (4,7,8,10) A recent study suggests, however, that consultants and practitioners have neglected to communicate adequately with the individuals responsible for initiating and funding the project, management. (1)

The membership of the TIMS (The Institute of Management Science) College of Simulations and Gaming participated in a mail survey in 1974. (1)
The purpose of the survey was to assess "the attitudes of users relative to a number of topics bearing on the education and preparation of those who would engage in the practice of simulation."

The responses to the questionnaire indicated that documentation is of major importance. The respondents were particularly concerned with writing user guides and providing the references necessary for users to modify the model for closely related situations. Some specific responses show the concern for better communication with management:

"...the ability to convey to laymen the results of technical [investigations]."

"...ability to communicate, both orally and in writing, to colleagues, clients, and subordinates."

"...ability to present results to management in an intelligent manner."

"The future emphasis should contain a kind of simulator's morality: Clear statements of assumptions, models, and sources of data; sensitivity analysis; and truthful statement of the results in laymen terms, stating as well as possibility [sic] the regions of validity and uncertainties."

In addition to being concerned about documentation, the respondents suggested that a major problem was gaining implementation of simulation results. Some excerpts from their responses are:

"Behavioral characteristics are perhaps more important than technical expertise in implementing simulations. The reason is that the model builder must constantly be able to sell the validity of the simulation to the user."

"A key pitfall in simulation is that [it] becomes and end in itself. The practitioner pursues a more sophisticated/elegant/complex model, often to the detriment of its value and usefulness to the managers and decision makers. [It is] better that simple, rudimentary models be used, and not state-of-the-art efforts that are shelved... and not used in [actual] practice."

In viewing the two problems of communicating with management and implementation of simulation results, it becomes clear that there are not two problems; there is one problem which is viewed from two different perspectives. The simulation practitioner complains that management does not believe him and will not act on his recommendations. The manager complains that the reports he receives from the analyst are incomprehensible, written in computer and statistical jargon. Neither seems to be able to understand why thousands (or hundreds of thousands) of dollars were spent on the project. The underlying problem, then, is that the manager must be sufficiently involved in the project so that he understands the basic framework of the model along with its assumptions and limitations. Only then will the results of experimentation be useful to him for decision making purposes.

The project documentation, then, is the formal communication medium between the analyst and the manager. As such, documentation writers should be aware of the role they play in gaining management acceptance of the project.

GUIDELINES IN WRITING FOR MANAGEMENT

To be effective, simulation documentation should be written for the reader, not the writer. The documentation writer should remember that his goal is undistorted communication between the principals of the simulation project. Thus, he is writing for four basic audiences: 1) top management; 2) the manager initiating the study; 3) technical personnel; and 4) the user. Each section of the documentation should be aimed at one of these audiences. Table 1 shows the target audience of each portion of the documentation.

| TABLE 1 |
|-------------------|-------------------|
| Documentation Outline |
| READER | SECTION |
| Top Management | Abstract |
| Manager initiating study | Management Summary |
| Project Director, Technical Supervisor | Technical Summary |

ABSTRACT

Each simulation documentation should begin with an abstract which is aimed at top management. This target audience generally has responsibility for reviewing the decisions made by lower-level operating managers. The abstract will probably be used as a partial justification for any decisions which are based on the study. The interest of top
management is ordinarily confined to the macro aspects of the project. In addition, the abstract may also be distributed to managers of departments which parallel the one for which the study was done. Again, their interest lies primarily in an overview of the problem and its solution.

To satisfy the needs of this audience, the abstract should be brief and should capture the salient points of the project. It should include a brief description of the problem and the problem environment. It should report the relevant results of the study and recommended courses of action. The costs of completing the project should be briefly summarized. Finally, the abstract should suggest other possible uses of the model.

MANAGEMENT SUMMARY

The management summary is written for the manager who initiated the study and is responsible for the funding of the project. He has responsibility for making decisions based on the study. The only purpose of the simulation project is to help him make better decisions. Therefore, the management summary should include all the information necessary for him to understand 1) how the model was developed and 2) how to interpret the results of the experimentation. It is imperative that the management summary be free of technical jargon.

The management summary should begin with a complete description of the problem and the nature of the problem environment. It should concisely define the scope of the project which was undertaken. In addition, any assumptions which were made should be clearly stated.

A description of the model should also be included in the management summary. This description should be written in terms easily understood by a layman. The audience is the manager, not other simulation practitioners. A very general block diagram of the system might help the manager see the relationship between the simulation and the system being modeled. Any limitations of the model should be clearly defined.

The management summary should also include an overview of the statistical procedures used in the experimentation. The goal here is to acquaint the reader with the manner in which the experimentation was done; care should be taken to exclude formal statistical terms. This section should include the data collection procedures, the validation procedures and the general experimental design and analysis procedures.

Next, the management summary should contain the results of the experimentation. It should also contain any suggested courses of action and recommendations for the implementation of these suggestions. The manager should be advised of possible external variables which may affect the success of the plan. The results of sensitivity analysis should be helpful to the manager as he reaches decisions based on the study.

Finally, the summary should include a complete statement of the costs of conducting the simulation project. It should specify all resources which were required to complete the study.

TECHNICAL SUMMARY

The technical summary is written for the project director or technical supervisor. The purpose of this section is communication between simulation specialists. The project should be completely specified to allow efficient updates and to facilitate the building of similar models in the future.

The technical summary should include a technical description of the model. All symbols and notations should be completely specified. A computer diagram and a program listing should be included. In addition, the details of model validation should be presented. All input data should be listed.

The experimentation on the model should be explained. The experimental design procedures and data analysis techniques should be fully specified. All results should be shown.

Finally, a list of pertinent references should be included. The list should include works cited in the report as well as related works which might prove useful to a specialist referring to the simulation project in the future.

USER'S OPERATING INSTRUCTIONS

An additional section may be necessary for simulation models which are to be used as part of the day-to-day decision making process in the firm. Users of the model might be first-level management or even operating personnel. They will not be technically oriented. Nor will the user need the detail necessary in the management summary. This audience needs only to understand how to use the model and to interpret the results. Therefore, the writer should prepare this section so that it may stand alone.

The user's operating instructions should begin with a statement of the purpose for which the model was intended. It should include detailed information concerning 1) the nature of the input data, 2) how it should be prepared and 3) how it should be entered. It should also specify the content of output reports and should explain how the output is to be translated into operating decisions.

CONCLUSION

This paper suggests an approach toward documentation of simulation projects which is based on the premise that management has purchased a product, documentation. When a manager initiates and funds a simulation project, whether it is through an outside consultant or an in-house specialist, he expects usable results. The creative process in which the modeller engages and the model he completes are secondary to the results of the project. The manager is interested only in obtaining results which he can understand and believe. The formal communication of the results of the project and the
method by which they were obtained is the simulation documentation.

As the operating costs of business continue to rise, all projects will be subject to scrutiny. Thus, simulation practitioners will have to be able to show that their efforts have merit. Effective simulation documentation is the key to justifying the costs of simulation projects.

BIBLIOGRAPHY