The DSS Approach in Forest Operations and Planning*
——Recent Trends in North America——

Edward Robak**

In North America over the last few years, a fair percentage of managers have come to have either microcomputers on their desks or at least good access to a microcomputer. Furthermore, almost all managers depend to some extent upon computer-generated reports. However, when we look at the actual application of computers, we find that computers have not had as great an effect as we would expect upon the manager's main task : decision-making. It's true that almost every company could describe various decision-related applications that they have and use, but as a portion of the overall decisional environment, computers have not had nearly the impact that we would expect.

Now, we could ask ourselves why this might be. In my own experience working with forest product company managers, who are typical or perhaps even a bit more advanced than the average manager, I have found that these following reasons seem to come up most often :

1. Managers are too busy to learn the technology and develop applications.
2. Managers find the technology confusing and "scary".
3. Computer departments are not oriented toward managerial decision-making applications.
4. The time and money needed to develop applications are difficult to justify objectively.
5. There is a lack of good solid applications that exist.

Before going on to explain how the design, development and implementation of truly good MIS applications can be undertaken, I want to discuss what are the implications of this poor record of applications in management.

In North America it has been noted that, although computer sales are still rising, the rate of sales increases is going down. After all, now that the innovators and status-seekers have already purchased their computers, the market is no longer as easy as it once was.

The average manager, who sees many computers gathering dust or taking up other managers' time on relatively trivial applications, may not be willing to stick his neck out and

*意志決定支援システム (DSS) による森林施業計画 —北アメリカにおける近年の傾向—
**Faculty of Forestry, Univ. of New Brunswick, Fredericton, N. B., CANADA

try to justify the acquisition of more computers or better computers when the cost/benefit relationship is largely ambiguous.

Research has shown, for instance, that although the level of reliance of executives on computers may have grown in recent years, few executives bother actually using the technology themselves. Therefore, it is realistic to expect that since they don't become familiar with or comfortable with the technology, they are much less likely to acquire, or allow others to acquire, the newest technology.

It is for these kinds of reasons that, although the level of computer acquisition and usage has increased tremendously in North America compared to the 1960's or compared to some other countries, the technology is still only scratching the surface of its potential.

Now there are two possible reactions to this situation. One is to throw up our hands and say, "What is the use working with such stubborn stick-in-the-muds? Let's wait for the younger generation to take over!". However, for a company like Fujitsu, that is not a reasonable alternative, and for an impatient man, like myself, it is also not acceptable.

The reaction I have to this situation is that since so many billions of dollars have been spent on software, hardware, and training without getting into the managerial DM environment to any great extent, imagine how big the market truly is!

So in a sense, we are partners in this, or rather we are looking at different parts of the same problem. I want to see more and better applications being designed, developed and implemented so that the quality of managerial decision-making is improved. Fujitsu should want to see more good applications because this will get more managers interested in acquiring the best of the new technology.

How, then, are we to get more and better applications in the hands of managers? In North America the trend is toward the development of a specialized kind of MIS, which has its own particular philosophy.

As a result of research into decision processes, experience with management information systems and developments in computer technology, various researchers and practitioners began to promote another approach to system design and development. Decision support system (DSS) applications attempt to blend the conclusions of research and practice in these areas into an effective system the purpose of which is to improve the quality of managerial decision making.

The label 'decison support system' is meant to describe computerized systems:
- that are aimed at the unstructured problems that managers face;
- that combine the use of models with traditional DBMS functions;

- that provide support for all phases of decision-making;
- that focus on features which make them easy to use;
- that emphasize flexibility and adaptability to accommodate changes in the environment and the decision-making approach of the user.

DSSs are interactive systems that provide the user with easy access to decision models and data in order to support semistructured and unstructured decision-making tasks.

In fact, every manager has and uses a decision support system (dss): a set of procedures and mechanisms for examining the desirability of possible choices. Such a system might include decision rules, policy manuals, recollections, and advisors that the manager uses when solving problems. A DSS is, therefore, that portion of the decision support system (dss) that contains data and models which are computer-retrievable and manipulable.

It has been suggested that DSSs would be most effective for tasks where managerial judgement alone will not be adequate because of problem complexity, but where the model and data in themselves are inadequate because the solution involves some judgement and subjective analysis. Under these conditions the manager plus the computer system (the DSS) can provide a more effective solution than either alone.

Now, these are only definitions of what DSSs are supposed to be. It is the actual approach to DSS design and development which modelers should find helpful in producing successful applications and promoting an atmosphere that is conducive to increased managerial acceptance of computer applications and technology. The following are the essential elements of the approach:

a) Decision Analysis — This refers to the determination of <u>what</u> decisions must be made without necessarily trying to understand <u>why</u> they are made. For example, if a DSS for forest operation planning is to be developed, the goals of the planning exercise and the essential planning decisions that a manager must make are identified. The objective is to provide tools that help managers plan a forest operation, so the analyst need not dig very deeply to find out why these particular decisions are made, but only needs to verify that those decision actually are an integral part of the planning process.

b) Information Requirements — Once the decisions have been identified, it is necessary to determine what information (not data) the manager requires in order to make those decisions. Since you are working with managers experienced with the decision making process that is being analyzed, this may be a relatively simple exercise, but managers may occasionaly find it difficult to describe what information is acually used to make decisions.

c) Data and Models—Once the information requirements have been determined (at least tentatively), the analyst must determine what data is actually available and what models must be used to process data into useful information.

d) DSS Structure—The objective of a DSS is to support a manager's decision process, not to model or duplicate it. Therefore, it should be structured in such a way that it makes available the appropriate information (from computer-based models and data) to a manager that can be combined with other sources of information, experience and intuition to facilitate the entire problem solution process. This often requires a degree of flexibility from the system that may not usually be expected from management information systems. For example, this might mean that although a forest operation planning DSS would be designed to calculate estimated machine productivity, it would still allow managers to "over-ride" the system and designate productivities that they feel are more realistic.

e) Prototyping—Except in the simplest of cases, an iterative, progressive design and development process is advised. I have found that managers are much better able (and more willing) to criticize a prototype model than to describe what the model should look like in the first place. The development of rough prototypes and even mock-ups of menus and information screens often helps managers articulate their decision processes and information needs. Also, in those circumstances where some models within the system can be developed for immediate use, the manager is able to see a quicker pay-off and may be more willing to maintain interest in the project.

f) User Involvement—As should be obvious from the foregoing, the user/manager is necessarily an integral part of the analysis, design, development and evaluation process. The system's design is based upon the manager's cognitive processes and information requirements. It is the manager who must decide whether the system actually accomplishes the project's objectives rather than simply satisfying the original design specifications.

There are other benefits of the DSS approach which may influence the success of the project and the manager's interest in working with the analyst on other projects. The manager's involvement in the design, development and evaluation process should ensure that he understands how the system works, engender a feeling of "ownership" in the system and a commitment to make it succeed. The prototyping approach should greatly reduce implementation and training time. The flexible structure allows managers to explore new ways of formulating and analyzing problems and designing solutions and may help them to

understand and improve their decision processes. Furthermore, since the system must usually evolve with the changing decisional environment, the manager's familiarity with and understanding of the entire approach should make the system maintenance and modification process much easier. In my own experience with system design and development projects for the forest industry, I have found considerable evidence that this approach does yield positive results concerning the broader issue of managerial acceptance and application of O.R. technology. In several cases, subsequent to using simple, effective planning tools for which their ideas had formed the basis of the design, managers made spontaneous suggestions concerning the design and development of more sophisticated and/or integrated planning models. In one company the adoption of microcomputer-based analytical and planning tools greatly increased the quantity and quality of interaction among planners throughout a forest operation division. A more dynamic planning process evolved, one which recognized the importance of interactive and iterative analysis, planning and decision-making. What is most remarkable about this is that this change occurred within one year in a division that had not used computers for anything but accounting and payroll before.

Even DSS projects that fail to be implemented have been found to increase managerial interest in O.R. technology. In once case, where a company finally decided not to go through with system development because of the projected costs, the managers involved indicated that the preliminary analysis was enough to point out serious problems in their planning processes. Although they decided not to develop the DSS, they became interested enough in modelling to hire someone to develop smaller models on a full-time basis. In another situation where operating managers were involved in the analysis and design of large, integrated operational planning decision support systems which was only partially implemented, upper management in the client firms reported an increase in the application of analytical tools and support for development of new planning methods. Operating managers declared that the process forced them to look at their current planning methods critically, and trained them to make decisions on a more "scientific" basis.

So that is the trend in North America, and it does appear to be having some success. But there are many things that researchers and engineers could do to help this process. What developers like myself need are better development languages and aids, including true 4 GL' s (which I don't believe really exist yet) and 5 GL's. Some of the kinds of things that you are working on (like interfacing, learning pattern recognition) will do wonders to produce proper development languages and then to help produce better DSSs and Expert systems.

So what do I want to see from computer companies to help me sell managers on

applications? I want to see these companies working closely with language developers, I want to see them maintaining open architecture (since this leaves the door open for innovation for entrepreneurs), and I want to see them support their systems.

Finally, at a more technical level, there are some speckfic trends with respect to what managers who are using the technology perceive to be their needs, and what I, as a developer, would expect to have:

Trends

1. Managers are insisting on upward software compatibility. They will likely ignore even the most superior hardware if it means that they have to give up development languages or applications, therefore, new systems must be a super-set of DOS (for awhile) or OS/2 (in the future).
2. Similarly, hardware compatibility is important, at least with respect to printers and modems.
3. Future importance of networking.
4. Future importance of multi-tasking.
5. Importance of developer's shell and support to developers either through complete compatibility with OS/2 or by ensuring the poerating systems are a very good shell and promoting some good development languages.
6. Open architecture will continue to be very important. Thousands of software and firmware and peripheral developers will invest in many ideas, some of which will go nowhere but some of which (i. e. 123) will sell many machines.
7. True 4GL's will encourage the development of many applications and more personalized applications which should begin to bring in many users that have tended to hang back.
8. Future development tools will also be aimed at the users themselves. What is needed is a powerful development language with "open" architecture which is the natural language and also generic in approach.

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