Organizational Strategy Making Support Systems
Task Driven Development Requirements

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Abstract

This paper discusses results of a pilot study into the use of computers to support organizational strategy making. Based on investigations into the strategy making task, the paper suggests main software characteristics that these support systems should have. The paper argues and demonstrates that the nature of these support systems can be identified, that implementation is possible with the technology of today, and that such systems can be successful, provided that development is based on a sound understanding of the strategy making task.

1 Introduction

"Where in the planning literature is there a shred of evidence that anyone has bothered to find out how managers make strategies?" (Mintzberg [20]). This paper discusses first results of an ongoing research into computer support to organizational strategy making. In recognition of Mintzberg's views, the research based development of these support systems on the understanding of what strategy making task is about, as first and main point of reference. By demonstration and argument the paper demonstrates that if this is done, then there is little reason why organisational strategy making support systems cannot be developed today.


The literature mentions a number of systems that are presented to support strategy making in one way or another. Most of these systems are of the Management Information Systems (MIS) type, which involves passive reporting of data, but which are generally not concerned with the active formulation of strategies. Executive Information Systems is a particular type of MIS and which was developed to provide higher management with critical information about the organization. Other strategy support systems presented in the literature are of the project management type. They are based on a formalized and structured approach to strategic management, and are mainly concerned with resource allocation. However, they do not assist in diagnosis or in the formulation of strategies. Simulation and linear programming systems can also help with optimization in narrow domains, and other systems exist to help with idea generation, general decision support, and collection of expert opinions. There are papers that introduce principles of OSMSS (for example [6] and [2]), but in general we found no evidence in the literature of research that said, this is what strategy making is about, this is users need, this is why, these are the resulting set of requirements to develop OSMSS.

This paper is concerned with systems that are developed specifically with the purpose to support strategy making in organizations. The name we use for such systems is Organizational Strategy Making Support Systems (OSMSS). The term "Organizational" is used to indicate that the focus is on organized people environments, which are managed to operate as a unit. The term is included to indicate that other domains of strategy making, such as strategies used in design and art, in sport and in politics, are outside the scope of investigations. The term "Strategy Making" comes from Mintzberg [20], and is used to indicate that the emphasis is on the making of strategies, rather than on systems that merely record strategies that were already made. The term “Support System” is used in the same sense as in Decision Support Systems (DSS) literature. It generally involves a computer program (with data) where the user and computer program interact, each providing unique strengths and features, in order to achieve an end result which is better than the sum of the strengths of the program and the user.

1.2 The pilot study

In order to better structure and direct a main body of research into computer support for organizational strategy making, an exploratory pilot study [21] was conducted.
The main objectives, approach, areas researched, and the phases of research are briefly presented here. The emphasis of this paper is to discuss the results of that study, and the conclusions made from the results.

The starting point of the research was our perception that commercially available OSMSS packages are, at best, very rare. Ongoing research and development in the OSMSS domain was also perceived to be limited, particularly work that uses as primary basis a sound understanding of the strategy making task. As a result our first objective was to check if these perceptions could be related to insufficient knowledge of the domain on the authors part. However, with time our opinion of slow development in research and application was strengthened rather than weakened. We argued, perhaps low activity is true, and there is a reason for this low activity. For example, perhaps strategy making is not as important as we thought it was. Perhaps OSMSS research and development are so complicated, or problems in implementing support systems so difficult, that it is not feasible. Perhaps technology or people are not yet ready. Not least because of these questions did we decide to carry out a pilot study before attempting a main body of research.

Mintzberg [20] argued that there is a big difference between strategic planning and strategic thinking. He said, "...strategic planning is not strategic thinking...strategic planning often spoils strategic thinking, causing managers to confuse real vision with the manipulation of numbers...this confusion lies at the heart of the issue: the most successful strategies are visions, not plans". Based on this view in particular, we argue that OSMSS development must, in the first place, come from a deep understanding of what strategy making is really about, a good understanding of the task.

The pilot study was therefore carried out with the following objectives. The first objective was to get a renewed and deeper understanding of the strategy making for the purpose of OSMSS development. The second objective was to see if any reason exists to suggest that the development of OSMSS is not possible. The third objective was to see if an initial set of software characteristics of OSMSS can be suggested.

At the beginning we decided that the OSMSS domain can be investigated along Decision Support Systems (DSS) lines. The argument behind this decision was that at least some main OSMSS attributes are expected to be common with Decision Support Systems, for example the absence of a functional specification and users not knowing what they want or where they will go initially, an ever changing status, a situation where the system shapes user ideas and vice versa, and high autonomy of the user in structuring the solutions. Therefore we used Keen's [15] adaptive framework of Decision Support as basis to structure the research. The framework identifies main actors, namely the task, builder, user and system, factors and their interactions, which were used as guide to subject areas that were investigated.

A literature study was carried out in each subject area, with the purpose to better understand the nature, and to identify characteristics, that could serve as requirements of an OSMSS. Understanding of the strategy making task was the driving force. The context of the strategy making task also dictated the scope of research into other subject areas. In this process main issues were identified in each subject area (for example use of scenarios is an issue in the task domain) and further investigated. From a better understanding of issues involved, requirements of OSMSS were suggested. The requirements identified stated the essential characteristics at a high level, for example, "an OSMSS must match strategic plans with business resources, capabilities and rate of growth", or "a OSMSS must actively support consideration of simultaneous alternatives". In total fifty-five such high level requirements and recommendations were identified, which, together with the understanding of the context from which they were derived, were analyzed to derive the general characteristics of OSMSS. Areas requiring additional research were also identified. Using this approach the three objectives, to get a deeper understanding, to ascertain if any prohibitive barriers exist, and to suggest software characteristics of OSMSS, were satisfied.

1.3 This paper

This paper summarizes the basic findings of the pilot study. In particular it attempts to provide an overview of issues involved in the task of strategy making, to suggest overall characteristics of OSMSS and to address the question if OSMSS can be developed today. The emphasis of this paper is on requirements derived from the strategy making task and the resulting implementation requirements. Other areas are not discussed.

2 Investigating the strategy making task

2.1 What is strategy?

Although most people have an intuitive understanding of what 'strategy' means, closer investigation showed that even professionals differ in their definition of strategy. Evered [11] compared the views of a number of selected authors and found common agreement existed about certain characteristics of strategy as indicated in Table 1.
Strategy making is a never ending process;
Strategy making is practitioner and action oriented;
Strategy making asks what needs to be done and why;
Strategy making deals with the whole (pattern, situation, organization);
Strategy making involves value judgments;
Strategy making assesses and generates change;
The language used in strategy making is non-technical, non-scientific;
Strategy making seeks cohesive action;
Strategy making deals with organizational and interactive processes;
Strategy making mobilizes resources;
Strategy making involves reality testing of concepts;
Strategy making is directed to the future.

Table 1 Characteristics of strategy making (based on [11])

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy making is a never ending process;</td>
<td></td>
</tr>
<tr>
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<td></td>
</tr>
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<td></td>
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<td>Strategy making involves value judgments;</td>
<td></td>
</tr>
<tr>
<td>Strategy making assesses and generates change;</td>
<td></td>
</tr>
<tr>
<td>The language used in strategy making is non-technical, non-scientific;</td>
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<tr>
<td>Strategy making seeks cohesive action;</td>
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</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>Strategy making is directed to the future.</td>
<td></td>
</tr>
</tbody>
</table>

Evered further found that different user types (he specifically referred to corporate, military and futures research types) have additional meanings attached to strategy, which reflect the nature of strategy in their specific domains. For example, whereas the military field tend to be concerned with destruction, futures research is more concerned with ensuring destruction is prevented.

These characteristics of strategy making make strong statements about the nature of OSMSS. For example, because strategy making is action oriented and asks what needs to be done and why, it can be argued that Management Information Systems (MIS), which provide passive reports of existing data, can be of assistance, but MIS can not be the basis on which OSMSS is developed. Most of the "strategy support systems" discussed in the literature are nothing more than MIS type systems, which fall far short of the requirements of OSMSS. Executive Information Systems (EIS) address strategic issues in a more direct and useful way, but EIS it is still passive, and although EIS could be very useful in OSMSS, is cannot be the basis on which OSMSS is developed. Arguments such as these demonstrate the importance of getting a stable and valid understanding of what strategy and strategy making is.

2.2 In search of correlation between strategy making and performance

When solutions are suggested to produce better OSMSS, then it must eventually be demonstrated that these solutions will improve organizational performance.

If this can be demonstrated, then the suggested measures can serve as requirements of OSMSS, otherwise they should be discarded.

Investigations into the correlation between strategy making and organizational performance can be made in two directions: Firstly, does it promote successful performance, and secondly, does it counter failures?

An investigation by Makridakis [18] into 16 prominent corporate failures in USA goes in the direction of how strategies can counter failure, although it does not go far enough for our purposes. Additional investigations need to found or made in this respect, to identify the link between failures and specific strategies more explicitly. Makridakis suggested main causes of these 16 corporate failures as shown in Table 2.

<table>
<thead>
<tr>
<th>Failure as a natural process</th>
<th>Organizational arteriosclerosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overreacting</td>
<td>Overdazzle by new technologies</td>
</tr>
<tr>
<td>Taking risks</td>
<td>Being overoptimistic</td>
</tr>
<tr>
<td>Overextending resources and capabilities</td>
<td>Ignoring or underestimating competition</td>
</tr>
<tr>
<td>Being overoptimistic</td>
<td>Belief in quick fixes</td>
</tr>
<tr>
<td>Overextending resources and capabilities</td>
<td>Relying on barriers of entry</td>
</tr>
<tr>
<td>Overreacting</td>
<td>The personality and ability of the CEO</td>
</tr>
<tr>
<td>Incompatibility with the domain of operation</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 Main contributing factors to corporate failure (based on [18])

There is no doubt that these causes must be addressed in organizations, and it seems logical that strategy making is the appropriate place to incorporate preventive measures. Deliberate and improved strategy making can countered most of these causes, and may enable prevention of unnecessary corporate failures. This alone should make research and development of OSMSS feasible.

It is more difficult to demonstrate or prove a positive correlation between strategy making and organizational success, since success is expected to depend on particular variables of strategy making, that is on the quality of the strategy making, rather than on the mere fact that strategies are made. Studies of Eisenhardt and Bourgeois [9] and Eisenhardt [8] are inspirational for further research into the correlation between strategy making and organizational performance. For example, Eisenhardt [8] demonstrated that it is important in high-velocity business environments, to have actual data about the business and environment readily available, more so than planning data. This shows that a better understanding of the strategy making task may produce unexpected results (the
greater importance of actual data). In this case the recognition also indicated that linking to actual data is a very important requirement of OSMSS, in some cases more so than linking to planning data, and OSMSS must be developed to provide the ability to be strongly linked to actual data.

The studies by Eisenhardt and Bourgeois were deliberate attempts of scientific research in the strategy making domain. Unfortunately there are only few such attempts to rely on in research and development of OSMSS. In such circumstances the pilot study had to rely on the judgment of people who have special training, expertise, or credentials in the area investigated. Experts may be wrong at times, but based on the approach discussed in section 3.1, until expert views can be proven or rejected through higher constraint research, their views may often represent the best basis for OSMSS definition.

For example, in consideration of Mintzberg's views (reported in [17]) the pilot study concluded the following:

In an OSMSS strategies must not be created in a formal process; OSMSS must be development based on the recognition that strategies are made in people's heads, not in the computer; OSMSS must be developed to link the big issues with actual operations; OSMSS must support people to gain and maintain a sophisticated understanding of what is going on in strategic context.

Apart from the difficulty to validate expert opinion it also opens up a host of questions regarding recognition, intellectual property and responsibilities on the part of the OSMSS developer and on the part of the expert, which needs further investigation.

2.3 Strategy making processes

Another issue investigated was to find out how strategy making processes in organizations works, and how it effects OSMSS. Basically these processes can be viewed in two ways: as normative models or as results of empirical observations.

Textbooks often present the strategy making process as normative models. For example, Glueck and Jauch [13] suggest that strategies typically start with enterprise objectives and/or strategies. The strategic management process then involves taking account of the environment in order to select or develop the best possible strategies to mobilize resources, in order to work towards a desired result. With such descriptive normative models it is unfortunately the rule that links between individual model elements are poorly described, often not at all. Nonetheless textbook descriptions express scholarly views of what is involved in strategy making, and therefore it can be used as indications of the kinds of functions that OSMSS should provide. or at least the kinds of functions that can be investigated. For example, from [13] we identified the requirement that OSMSS may be used to monitor environmental threats and opportunities in order to counter advert changes in the environment, that OSMSS may also be used to consider and choose alternative strategies to achieve better performance, and that OSMSS may be used to assist in directing organizational resources in line with strategies.

Empirical research of the strategy making process brings realism to the normative view. The well-known study of Mintzberg, Raisighani and Theoret [19] concluded for example that the strategic decision process is not linear, but that it is very much a system with continuous circulation of ideas and effort until a condition is reached which is perceived to satisfy existing requirements. Although this does not directly indicate what OSMSS should do or should provide, it does suggest what an OSMSS should not be, for example that an OSMSS should certainly not be based on a linear approach to strategy making. The model of Mintzberg, Raisighani and Theoret also suggests that the strategy making process goes through phases of identification, development and selection, in a this looping fashion.

The question is, how can this knowledge be used in OSMSS development? It will be difficult to determine at what point practical strategy making processes are at a particular point at a particular time, and what the course will be from that point onward. Therefore the wisdom of trying to develop OSMSS to control the strategy making process can be questioned on several counts. However, the users of OSMSS will probably know what phase they are interested in at different points in time. Therefore an OSMSS could make tools available, to support individual phases, and leave the choice of phases and tools to the user. Applegate, Konsynski and Nunamaker [2] also argued along this line, that sets of tools and techniques can be used in specific phases of the strategy making process.

2.4 Influence of strategy making styles

The issue of style was another area investigated. The study of Evered's [11], which was discussed in section 2.1, suggested that different meanings are attached to strategy making, depending on field involved. On similar lines Taylor [23] identified (in the corporate environment alone) five different styles: central control systems; framework for innovation; strategic management; political planning; and futures research. Taylor concluded that each of these styles has their own focus, ideas, elements and techniques of strategy making. Comparison of such papers about style showed there is often a mix-up, even contradiction in terms used, which highlights the need for careful definition of terms used in OSMSS.

Such comparisons can also lead to additional research issues, such as the following: It must be borne in...
mind statements about strategy making are often made from the perspective of one particular style of strategy making; the effectiveness of different styles should be investigated; it should be investigated if generic OSMSS could be developed for all styles, or if OSMSS should be developed for particular styles.

2.5 Tools, techniques, methodologies and processes

Another issue investigated was the range of tools, techniques and methodologies used by different strategists, and by the different styles. It was also suggested in section 2.3 that specific tools may be used in specific phases of strategy making. Applegate et al. [2] pointed to specific tools that could be used in specific phases. Arguments were given in section 2.3, and Mintzberg advises, that strategy making should not be formalized [17]. OSMSS should avoid forcing specific tools, techniques or methodologies onto the user, and rather offer such facilities as options that the user may use. OSMSS researchers and developers should analyze which tools, techniques and methodologies are used in practice and why, and use that information to determine the priorities of providing tools and techniques to the user.

The pilot study did not attempt to investigate specific tools and techniques, that task was left to the main body of research. It is expected that further research into these issues will lead to additional understanding and further requirements of OSMSS.

2.6 Scenarios and strategic alternatives

General agreement seems to exist in that strategy making is oriented towards changes in the situation and in consciously generating change. In this context scenarios and strategic alternatives are important. In general scenarios can be associated with changes in the organizational environment, and strategic alternatives can be associated with changes that are under control of the organization.

Pilot study investigations showed that the issues surrounding scenarios and strategic alternatives are mostly of technical nature. Not least for that reason it is beyond the scope of this paper to discuss different approaches to scenario and alternative building. However, it was concluded that scenarios and alternatives are integral parts of strategy making, and an OSMSS must provide the means to deal with these approaches.

3 Analysis and discussion of task requirements

Section 2 gave an overview of the main issues involved in the strategy making task. This section firstly introduces a philosophy of phased research that was used in the pilot study. Thereafter this section discusses how results from investigations into the strategy making task were analyzed and converted into logical OSMSS characteristics.

3.1 Philosophy of phased research

The overall aim is to develop computer systems that will support a specific task, strategy making in organisations. With reasons discussed before the task had to be investigated first. However, which of the other domains, builder, user, system and other factors, should be investigated thereafter? How deep should investigation into other actors be? Because strategy making touches all functions of the organization, and because the different actors involves totally different disciplines, the problem exists that the research could quite easily grow out of practical proportions. Therefore it was considered necessary that a research method had to be designed that ensures the research becomes more focused as it progresses. The approach developed is shown in Figure 1.

In phase 1 of the research (represented by section 2 of this paper) a low constraint field research of the strategy making task was carried out in order to identify physical requirements of the strategy making task, using the language of the task. Thirty-seven such physical requirements and recommendations were identified.

The approach developed is shown in Figure 1. In phase 1 of the research (represented by section 2 of this paper) a low constraint field research of the strategy making task was carried out in order to identify physical requirements of the strategy making task, using the language of the task. Thirty-seven such physical requirements and recommendations were identified.

The task investigated also determines the extent to which we are interested in issues in the builder, user, systems and other domains. Phase 1 therefore narrows down the scope of the remaining research.

Since the eventual aim of the research is to develop effective OSMSS, the eventually result we are looking for
is a definition of an OSMSS, in "systems builder language". In the pilot study the OSMSS was eventually defined in terms of a set of logical characteristics in software terms. The approach to convert from current physical requirements to new logical requirements is a well-known technique used in software systems analysis. This conversion process represents phase 2 of the research. In this case the current physical system is represented by the characteristics identified during research of the strategy making task. These characteristics were converted to current logical suggestions, as discussed in section 3.2 hereafter. The current logical suggestions were processed to suggest a new logical system, which is the definition of OSMSS in logical terms. This step is discussed in section 3.3. Finally an interpretation of the results is provided in section 3.4.

In the pilot study the logical requirements of OSMSS discussed above were then used as basis for further research, which represents phase 3. It is beyond the scope and purpose of this paper to discuss phase 3 issues in detail. Instead this paper addresses the final objective of this paper, and demonstrates that the system proposed in phase 2 is completely possible with technology of today.

3.2 Conversion from task requirements to logical development suggestions

During phase 1 of the research the characteristics of the strategy making task considered important to OSMSS were recorded as task requirements. The requirements were highlighted during discussion of the issues investigated, and were also added to an overall list. However, they were only added if, in our judgment, they appeared to be strong support for the requirement, either in number of subjects mentioning it, in the credibility of the source, or in published research results. An example of such a requirement is:

An OSMSS must support detection, and formulation of strategies, to counter the aging process of markets, organizations and products.

These task requirements were then translated to logical development suggestions. The criterion applied to this conversion was that it must be backward compatible, in the sense that the logical suggestion must apply when compared with all task requirements, not only the task requirement from which it is derived. This criterion applies because the final OSMSS must satisfy all task requirements, and therefore every characteristic of that OSMSS must satisfy all task requirements, or at least not conflict where no direct connection exists.

As a consequence, we argue, if the numbers of task requirements are increased, then the logical view of the OSMSS should stabilize at the same time. It is therefore not important to exhaust every task requirement in terms of the logical suggestions that can be extracted from it.

Each requirement was processed on its own merit, with understanding of the context from which it was derived. Due to space limitations it is not possible to show details here. An abbreviated presentation of the conversion list is provided in Table 3. Note that it is more important to have logical suggestions that match all requirements rather than to have suggestions that match requirement exactly, and that it is not important to have a logical suggestion for each requirement. One of the main task of OSMSS developers will be to maintain such lists.

<table>
<thead>
<tr>
<th>Task requirement</th>
<th>Logical suggestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counter factors contributing to failure</td>
<td>(Deliberately blank)</td>
</tr>
<tr>
<td>Picture of effects of ventures on environment</td>
<td>At the top level it is a model</td>
</tr>
<tr>
<td>Management of critical risk factors</td>
<td>(Deliberately blank)</td>
</tr>
<tr>
<td>Match plans with resources, capabilities, growth</td>
<td>Models and values relate</td>
</tr>
<tr>
<td>Monitoring of competition</td>
<td>Monitoring tool</td>
</tr>
<tr>
<td>Reflect time taken to implement solutions</td>
<td>Shows dynamics with time</td>
</tr>
<tr>
<td>Strategies are not created in a formal process</td>
<td>Is a creativity tool</td>
</tr>
<tr>
<td>Strategies are in peoples' heads</td>
<td>Decision Support Systems</td>
</tr>
<tr>
<td>Link big issues with actual operations</td>
<td>Network model, abstraction &amp; nesting</td>
</tr>
<tr>
<td>Gives sophisticated understanding of what is going on</td>
<td>Picture for human understanding</td>
</tr>
<tr>
<td>Ideas bubbles up, champions, etc</td>
<td>Supports multiple users</td>
</tr>
<tr>
<td>Consider of simultaneous alternatives</td>
<td>Is multi-layered (alternatives)</td>
</tr>
<tr>
<td>Support conflict resolution</td>
<td>Allows comparisons</td>
</tr>
<tr>
<td>Integrate strategies with another and tactical plans</td>
<td>Links strategies and operations</td>
</tr>
<tr>
<td>Is a kind of decision support system</td>
<td>Is a Decision Support Systems</td>
</tr>
<tr>
<td>Mostly used in development phase of strategies</td>
<td>Emphasizes decision support</td>
</tr>
<tr>
<td>Do not use decision process framework</td>
<td>Not a model of the decision process</td>
</tr>
<tr>
<td>Minimum scope is to counter failures</td>
<td>Maps strategic decision</td>
</tr>
<tr>
<td>Desirable to link strategies and operations</td>
<td>Supports abstraction</td>
</tr>
<tr>
<td>Interfacing with company databases</td>
<td>Links to actuals</td>
</tr>
<tr>
<td>Support evolution/change of environment learning</td>
<td>Is flexible to change</td>
</tr>
<tr>
<td>Research excluded effect of politics</td>
<td>(Deliberately blank)</td>
</tr>
<tr>
<td>Supporting scenarios and alternative plans</td>
<td>Supports alternatives and scenarios</td>
</tr>
<tr>
<td>Types of decision processes does not influence general development requirements</td>
<td>Tools are approach independent</td>
</tr>
<tr>
<td>Classify tools/techniques for ease of use (optional)</td>
<td>Models are classified in categories</td>
</tr>
<tr>
<td>Routines may have unique set of supporting models</td>
<td>Multiple sets of models</td>
</tr>
</tbody>
</table>
very limited number of logical solutions, all of them being
details not.

case, only to determine what kind of software system a
purpose of the logical characteristics column is, in this
OSMSS will be, the directions pointed to are important,
contained in the first column of that table were obtained
logically valid.

was that the logical characteristic must be stated for soft-
was applied for both conversions, the only added criterion
would best fit the logical suggestions identified before.

It is conceivable that different people will derive
different logical OSMSS results, but as is the case with
the conversation discussed before, because of the complexity
and large number of issues involved in strategy making,
we argue that advanced research may well point to a
very limited number of logical solutions, all of them being
logically valid.

The pilot study results of this second conversion are
shown in Table 4. Please note that the logical suggestions
contained in the first column of that table were obtained
from the conversion process discussed in section 3.2. The
purpose of the logical characteristics column is, in this
case, only to determine what kind of software system a
OSMSS will be, the directions pointed to are important,
details not.

<table>
<thead>
<tr>
<th>OSMSS characteristics</th>
<th>Logical suggestions</th>
<th>Logical OSMSS characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Options: Advise users about methodologies, techniques</td>
<td>Inbuilt advice (optional)</td>
<td>OSMSS strategies are represented by models</td>
</tr>
<tr>
<td>For user to develop models for specific purposes</td>
<td>(Deliberately blank)</td>
<td></td>
</tr>
<tr>
<td>Models can be user or builder generated.</td>
<td>Models are user or builder generated</td>
<td>OSMSS models can be embedded in other models. Models may have multiple versions for use in the same position of a larger model.</td>
</tr>
<tr>
<td>Emphasize reuse of models.</td>
<td>Models are reusable</td>
<td></td>
</tr>
<tr>
<td>Allows for alternative strategic plans.</td>
<td>(As above)</td>
<td></td>
</tr>
<tr>
<td>For prediction of future values...</td>
<td>Multiple input values, probabilities</td>
<td></td>
</tr>
<tr>
<td>Prioritising, filtering out of scenarios...</td>
<td>Filtering/sorting of models using results</td>
<td></td>
</tr>
<tr>
<td>Scenario have sets of environmental parameter values...</td>
<td>Model scenarios have constant interfaces</td>
<td></td>
</tr>
<tr>
<td>Multiple inputs for scenarios or sensitivity analysis...</td>
<td>(Deliberately blank)</td>
<td></td>
</tr>
<tr>
<td>Alternative strategy substitution...</td>
<td>(Deliberately blank)</td>
<td></td>
</tr>
</tbody>
</table>

Table 3 Conversion from task to logical suggestions

3.3 Converting from logical suggestions to
OSMSS characteristics

The starting point of this second conversion step
was the resulting list of logical suggestions in the prior
step. In the second conversion step the purpose was to
suggest the logical characteristics of an OSMSS that
would best fit the logical suggestions identified before.
Apart from the criterion of backward compatibility that
was applied for both conversions, the only added criterion
was that the logical characteristic must be stated for soft-
ware development purposes, with other words, it must be
expressed in software or builder language.

It is conceivable that different people will derive
different logical OSMSS results, but as is the case with
the conversation discussed before, because of the complexity
and large number of issues involved in strategy making,
we argue that advanced research may well point to a
very limited number of logical solutions, all of them being
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case, only to determine what kind of software system a
OSMSS will be, the directions pointed to are important,
details not.

Table 4 Conversion from logical suggestions to
OSMSS characteristics
3.4 Interpretation of results

From the resulting logical OSMSS characteristics, and from the context from which they were derived (that is, knowledge of the task), the following picture of an OSMSS is suggested as a possible logical solution:

- An OSMSS is an extended model management system that allows for the management of models by allowing models to be created, modified, presented and stored.
- In respect to the models used in OSMSS, there will always be some kind of top level model. That model is constructed by networking other models and more primitive elements, such as input values. Each model in the main model can in turn consist of models and primitives, and so on, theoretically ad infinitum.
- An OSMSS will provide facilities to cope with alternative strategies and scenarios.
- An OSMSS will be strong in the area of reflecting dynamics with time.

The indications that OSMSS is a model management system appeared to be particularly strong. This remained so if the model management solution was compared with the initial task requirements, and the context from which the task requirements were derived. For these reasons it was felt that the remainder of the research could safely assume that an OSMSS will be a model management system, a result that greatly reduces the amount of research required of remaining actors.

4 Implementation and other issues

After initial OSMSS characteristics have been suggested in the pilot study, research in other subject areas was conducted (a) if it promised to identify new requirements, or (b) if it appeared to prove or reject logical characteristics of the suggested OSMSS. A number of issues to investigate were identified, particularly implementation and user characteristics. The pilot study particularly investigated if it is practically possible to implement the OSMSS suggested above with model management knowledge and technology of today. Conclusions are briefly discussed hereafter.

4.1 Investigation into model management systems

It is beyond the scope of this paper to introduce model management as such. Good introduction are provided in [3] and [7]. The following discusses different levels of sophistication that MMS can have, and to what extent these levels of sophistication lend themselves to practical implementation of OSMSS.

Liang [16] suggested four generations of MMS. The first generation of MMS implement each models, together with the associated data, as separate application programs. The main problem with this approach is that programming skills are required to construct or change the models. However, this approach can produce very efficient models for narrow domains. Because of the great difficulties involved in modification, it may only be useful for stable environments.

Second generation MMS are like first generation MMS, except that a common set of tools is provided to support model processing. An example is typical use of spreadsheets, for example where the basic business strategy is provided on one or more spreadsheets, and the spreadsheet programs itself helps with the presentation and calculation. Most organizational strategic models of today are expected to fit in this category.

In third generation MMS the toolbase as well as the data are stored externally from the models. To have data externally from models assist in linking models to actual data, to what if analysis and different scenarios. It is expected that the more sophisticated in-house OSMSS of today are built along this line, and this kind of MMS is certainly an option for less sophisticated and generic commercial OSMSS.

The fourth generation of MMS is similar to third generation MMS except that both models and data are stored centrally. A variation of the fourth generation approach was proposed in [22], where a central software system draws on a data base and a model base. Blanning [2] proposed one approach to implementations, by showing how models can be stored in databases.

MMS approaches which are investigated today are much more complex and sophisticated than the approaches discussed above. From the literature it appears that much of the research into MMS of today can be traced back to the framework of Breen, Holeapple and Whinston [4]. In that framework a knowledge system contains both data and models, as well as knowledge about how the system operates. Current research appears to be less concerned with the framework, and more with the operation of the language system, knowledge system and problem processing system. Of particular interest is the use of schema to represent models [12] and the use of artificial intelligence (AI) techniques for knowledge base representation [10] not only for model representation, but also for knowledge about interfacing with the user, driving the MMS, and even selecting models for given problems [7].

Considering findings such as the above, the pilot study found no reason why OSMSS based on model management systems principles cannot be implemented today. This conclusion, together with the insight and framework provided by the pilot study basically satisfied the overall objective of the pilot study, namely to act as forerunner for a main body of research. As a separate commercial project...
the author also implemented a OSMSS that satisfy many of the requirements discussed above, and which displays model management functionality.

4.2 The issue of expert systems

One question of fundamental importance that came up during the investigation of builder issues was how strategies are actually formulated, how they come to being. The question was highlighted when the pilot study indicated a difference, even conflict, between the apparent main body of MMS research of today, and the Mintzberg's opinion about what is required for strategy making. MMS research of today is particularly directed towards the use of artificial intelligence (AI) techniques to enhance MMS (for example [10]). There is no doubt that that research provides useful results and insight for many purposes, particularly in providing expertise in the use of the tools, not only in suggesting particular solutions. The question is, however, to what degree is the use of AI is appropriate for strategy making. Mintzberg [20] waves clear warning flags when he said, “...all the promises about artificial intelligence, expert systems, and the like improving if not replacing human intuition never materialized at the strategy level...[and that] ...real strategists get their hands dirty digging for ideas, and real strategies are built from the nuggets they uncover.” Mintzberg warns repeatedly against the use of formalisms, and in words and context it seems specifically against the kind of formalisms embedded in expert systems. Therefore the assumption that the use of AI is a good approach to model management systems must be questioned, particularly in the domain of OSMSS.

5 Conclusions

This paper argued and presented results of a pilot research conducted into the use of computers to support strategy making. Arguments were given as to why it is crucial that research into OSMSS must be based on a sound understanding of the characteristics of strategy making, and it was pointed out that very little evidence of research from this perspective exists. An approach was therefore designed, and a pilot research was conducted, in order to get an overview of the issues involved in strategy making. The main results were discussed in this paper. The findings appear to strongly suggest that OSMSS will be a kind of model management system, which seems totally within reach of technology available today.

At the offset of the paper we asked why so little evidence of research in this domain can be found. It remains difficult to understand, since it appears that: a need for OSMSS does exist; it certainly seems feasible to research and develop OSMSS; it seems possible to determine the requirements against which OSMSS should be developed; and technology seems to be at a state that makes OSMSS commercially possible. The only question not answered is if it makes sense to use computers to support strategy making, which, together with validation of findings of the pilot study, are subjects of our further research.

The study also concluded that it is important how OSMSS research and developed is approached. If the OSMSS is treated as a formalized system, then the outcome is unlikely to be of significant benefit to strategy makers, since what is needed is support to strategy making or formulation, much more than support to strategic planning in the sense of analysis and documentation. Research and development must be focused on strategy making as the driving force. Research that is driven by other perspectives, such as, “we have expert systems techniques, what can we do with it” are unlikely to lead to satisfactory results, particularly in the domain of strategy making support.

Strategy making is concerned with all of the functions (finance, human resources, marketing, manufacturing, etc.) in organizations as well as with external factors that may influence the organization (politics, natural resources, etc.). OSMSS research and development further require deep involvement with technology (how to develop OSMSS), psychology (how do people form ideas, etc.) and other issues, and it will therefore require contributions from many disciplines. However, this paper demonstrated, by example, an approach that continuously improves understanding of the characteristics of OSMSS, while the attention becomes more focused along the way.

As an overall conclusion we feel research and development of OSMSS is very much needed due to the importance of strategy making in organizations. It is difficult to understand why so little research was been done in this domain, and we hope to see an increase in research and communication in this domain in the years to come.

The author is currently involved in further research in computer support to strategy making in organisations.

6 References


