Journal of Information Technology Management

ISSN #1042-1319

A Publication of the Association of Management

OUTRUNNING A SPEEDING ENVIRONMENT: DEVELOPING "HIGH-VELOCITY" STRATEGIC DSS EVALUATION CRITERIA

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ABSTRACT

This research develops a theoretical "fit" framework for evaluating "High-velocity" (H-v) strategic Decision Support Systems (DSS). This theoretical framework is then used to derive 45 H-v strategic DSS requirements. Finally, it uses these 45 requirements to evaluate 16 popular commercial DSS tools for their "out of the box" ability to support high-velocity strategic decision-making. Results illustrate the usefulness of a fit-based theoretical framework in performing systems analysis. Results also illustrate the assertion that few currently-available DSS tools support H-v strategic decision requirements, and that configuration may be difficult or impossible. Based on the findings, the authors underline the importance of building native configuration features into future DSSs in order to increase the flexibility of a DSS tool to adapt to fit a rapidly changing environment.

Keywords: Decision support systems, strategic decisions, strategic use of IT, information systems evaluation.

[1] *Opinions, conclusions, and recommendations expressed or implied within are solely those of the authors and do not necessarily represent the views of the United States Air Force, the Department of Defense, or any other US government agency.*

INTRODUCTION

In business, a "high-velocity" (or "H-v") environment is one "in which there is rapid and discontinuous change in demand, competitors, technology and/or regulation, such that information is often inaccurate, unavailable, or obsolete" [1]. While previous evidence suggests that H-v strategic decision-making environments are industry-specific—[1] lists, for example: computing, banking, airlines—recent events in the mortgage, financial, and automobile industries [2] suggest that: 1) H-v *environments* can arise in *any* industry, and 2) the domains of strategic planning [3] and real-time decision-making [4] are beginning to merge. In such environments, the ability to decrease decision cycles, or to make better decisions themselves when confronted with time and market pressures, may represent sources of competitive advantage [5, 6].

Considering the strengths of computer-based decision support systems (DSS)[2] in augmenting human reasoning capabilities and supplementing human weaknesses, one might imagine that the use of such tools would be pervasive amongst strategic decision-makers. Unfortunately, recent evidence points to a lack of serious use of DSS among strategic decision-makers; instead, they often voice a strong preference for making decisions "using the gut" [9]. Further evidence points to inconsistent results of DSS tool usage on decision quality [10–12]. Is this because DSSs are incompatible with strategic decisions [13], because they are too "brittle" to adapt to changing environments [13, 14, 15, 16–18], or simply that it is difficult to find the right fit between DSS, user, and decision task in a non-recursive environment, thus defeating the ability to adapt described by [19]?

These considerations are of great importance to an organization considering evaluation of a current or proposed DSS, because preparation for H-v decision-making simply cannot occur after the fact. Further, as shown in this paper, previous academic analysis of business strategy appears to ignore H-v strategy concerns—even as practitioner outlets continue to point to H-v strategy issues. Therefore, this research develops balanced (between academic and practitioner) H-v strategic DSS requirements. If, as some argue [7], good decisions result from the ability of a DSS to achieve fit between a user, his/her decisions, and an environment of interest (see Figure 1), then DSS criteria must be developed that integrates each of these items—not separately, but rather, as they *interact*.

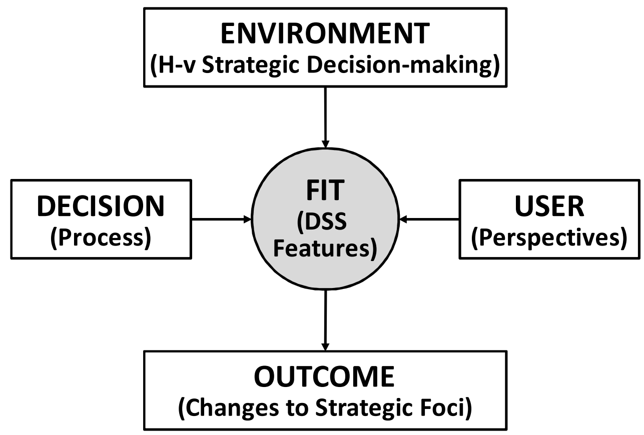

Figure 1: Framework Used to Derive H-v DSS Requirements

This research considers how DSS features can be used to build or configure a DSS to match requirements arising from *decisions*, nested within *users*, and further nested within an *environment* of interest, to best address the *strategic foci* of senior decision-makers. In the first section, we develop this "fit" framework, considering both academic and practitioner perspectives. In the second section, this theoretical "fit" framework is used to derive 45 H-v strategic DSS requirements. In the third section, the list of 45 H-v strategic DSS requirements is used to evaluate 16 existing commercial DSS tools for their "out-of-the-box" ability to support H-v strategic decision-making.

Silver [7] anticipated and informed the model used to guide this research (as we will describe later in detail); however, his model—especially the concept of use of *configurable features* to increase fit—has yet to be used to develop DSS evaluation criteria. We further note that research has yet to consider how DSSs could be designed to fit the decision types unique to an H-v strategic environment. It is in these two areas that we hope this research is most useful.

[2] The DSS definition assumed in this paper is that offered by Silver [7]: ". . . a computer-based information system that affects or is intended to affect *how* people make decisions" [emphasis added]. Power [8] expands this definition by creating a taxonomy (adapted in Appendix A, and used to group DSSs in Appendix C) to describe the types of systems available to support various decision processes.

A THEORETICAL FRAMEWORK TO DERIVE H-V STRATEGIC DSS REQUIREMENTS

Gorry and Scott Morton [20] acknowledge that the boundaries between Anthony’s three organizational activity categories of *operational control*, *management control*, and *strategic control* are not always clear. On one extreme, operational control (also called “tactical”) concerns day-to-day operations, and requires *well-defined*, *narrowly scoped* information, usually fed frequently from internal sources. Management control (also called “operational”) falls between the extremes, concerning itself with relatively routine problems in support of either operations or strategy, fed primarily through personal interaction. Strategic control, (also called strategic decision-making) differs in terms of both scope (larger) and complexity (higher). Adding the constraint of an H-v environment not only reduces decision cycle times, but interacts with scope and complexity in ways that may fundamentally alter decision criteria, causing significant overlap between the formerly delimited tactical, operational, and strategic decisions.

Shown in Figure 2, DSSs are typically developed to support each of these three areas *in isolation* (the areas shown in gray). But as asserted above, the H-v strategic environment pushes DSS users (and designers) into uncharted territory, as strategic decisions must now be made on tactical timelines, and both short-term tactical and operational decisions may be required to support strategic goals that cannot wait for the normal process to percolate from top-to-bottom, and vice-versa. In other words, H-v environments may cause two complications to the Gorry and Scott-Morton model: 1) those of velocity, and 2) those of scope. We assert that both of these items are of critical importance to DSS designers in building H-v decision support features. To further understand H-v strategic decision-making, we undertook a comprehensive literature search to derive the essence of decisions required in an H-v environment, as described below.

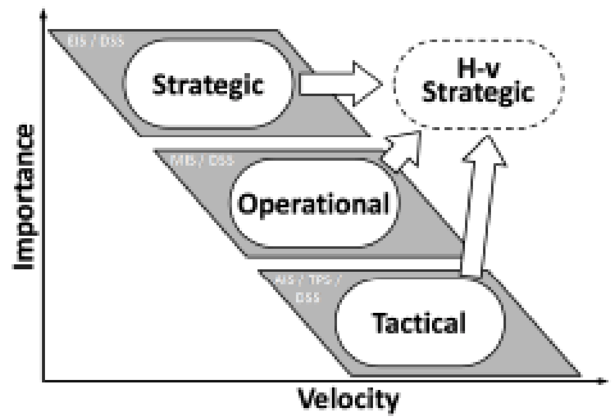

Figure 2: Research Context

The Outcome Variable: Strategic Foci

The purpose of this research was to develop the fit model in Figure 1 for use as a theoretical framework to derive H-v DSS requirements; therefore, we considered how each piece informed the velocity/scope challenges inherent to H-v strategic DSS fit. First, we considered the outcome variable, changes to strategic foci, supported with a literature review. The purpose of this step was to determine if there was any reason to restrict one’s consideration strategic decisions temporally; therefore, the search criteria was left broad, e.g., “Strategy.”

To provide structure to the inductive coding process, the authors searched through major strategic management journals for seminal strategy articles over the past 30 years, 1980-2010. Since the determination of a seminal article takes a number of years, no attempt was made to make this list perfectly current. The method used to code and group these articles was the inductive coding method outlined by Dubé and Pare [21]. The resultant items discovered are listed in Table 1, enabling the below discussion.

Table 1: Strategic Foci

Focus	Element
Internal	- Scope/Market Entry & Exit - Competition/Competitive Advantage - Alliances, Acquisitions & Mergers - Industry Environment/Macro - Regulation
Boundary	- Turnaround/Restructuring - Corporate Govern. & Ownership Structure - Investment - Strategy Formulation/Business Definition
Internal	- Structure - Corporate Culture - (Strategic) Innovation - Corporate Performance - Corporate Learning - Integration of Sub-activities - Diversification/Integration/Restructuring

Note: Search criteria was "Strategy" in the following journals (number of references obtained in parentheses): *Strategic Management Journal* (68), *Academy of Management Journal* (19), *Academy of Management Review* (15), *Journal of Management* (7), *Organization* Science (2), *Management Science* (2), *Administrative Science Quarterly* (2).

Our analysis of the academic literature tended to confirm a strong bias in strategic management literature to discuss strategic decisions in their long-term context, i.e., five-year strategic plans; however, we also noted that it was difficult to draw the conclusion from these articles that strategic foci were *necessarily* built/executed over a long period of time. Therefore, the second step was to compare the academic assumptions to a cursory examination of recent practitioner literature with respect to a single H-v event. Investigation of the 2009 automotive "bailout" of General Motors and Chrysler, readily showed that questions of market entry/exit, alliances, acquisitions and mergers, turnaround and restructuring, industry environment and regulation (to name a few) all merged to drive *immediate* changes in automakers' strategies [22]—even though the automotive industry is not typically considered an H-v industry/environment. During this event, strategic foci were apparently addressed both quickly and simultaneously as the H-v environment dictated. The existence of this apparent gap in the academic and practitioner treatments of strategy raises two concerns: first, if DSS designers are following the lead of academics in developing H-v DSS solutions, those solutions may be incomplete; second, there appears to be no *a priori* reason to exclude any of the strategic foci from consideration in an H-v environment for reasons of either velocity or scope.

Further, this search confirmed that an understanding of the *foci* of strategic decisions does not answer the DSS designer's question of what type of H-v decision *actions* are required during an H-v event. In other words, during an H-v strategic event, the focus of strategy (outputs) may not change, but the *actions* required to make those decisions (processes) may. These actions will be driven primarily by the *environment*, so we next consider key H-v environmental variables, and how they interact with strategic decisions.

The Input Variables: H-v Strategic Environment and Decisions

A second way to investigate strategic decisions is to describe how key environmental attributes of the foci mentioned above interact with the decision-making process from a DSS design perspective; therefore, the authors next literature search included both practitioner and academic DSS literature (shown in Table 2) focusing on how decisions themselves are affected by key environmental variables. We restricted consideration of "users" to user perspectives (academic and practitioner, designers and end users) of the other variables. It was not possible to include an in-depth treatment of specific individual user considerations, i.e., human-computer interaction factors, although we briefly address the nested relationship between decisions, users, and environments in the next section. Whereas the initial literature search considered DSS customers, this search considered opinions of both DSS designers and customers. Of over 500 articles returned using the search terms, 49 (25 practitioner and 24 academic) were directly applicable to the search for H-v strategic decision key components. Again, the method used was the inductive coding methodology described by Dubé and Paré [21].

The results of this literature search identified six components (shown in Table 3)—five scope/complexity components, and one velocity component, with three to five attributes that were unique to an H-v environment—and thus applicable to developing configurable items to achieve fit. Because of the central nature of these items in developing evaluation criteria, they are defined in more detail below.

Table 2: Periodicals/journals searched 1990-2009

Academic	Practitioner
ACM SIGMIS Database	Air and Space Power Journal
Decision Science	Business Week
Decision Support Systems (DSS)	Chief Executive
European Journal of Operations Research	Chief Information Officer (CIO)
Group Decision/Negotiation	Communications of the ACM
IEEE Transactions on Professional Communication	Computer World
IEEE Transactions on Systems, Man and Cybernetics (Part A)	e-week
	Government Executive
	IEEE Control Systems Magazine
	IEEE Professional
	Information Week
	KM World
	Wired
Note: Search criteria was "Decision Support," AND "Strategic"	

Table 3: H-v strategic decision-making key components

H-v Component	H-v Unique Decision Attributes/Constraints	Source
Numerous Stakeholders	- Unique mixture of internal, external and boundary issues	A
	- Requires unique information (aggregate information from external sources)	AP
	- Proliferation of (divergent) process stakeholders and issues	AP
High-impact	- Decisions far-reaching/high-risk	AP
	- Concerning firm survival/prosperity	AP
	- Desire optimal first-pass decision quality	P
High-uncertainty	- Large number of variables creates uncertainty	AP
	- Decision outcomes are not observable until much later time	AP
	- Lag effects/mistakes make optimal strategy costly to learn	P
	- Initial cues may be overlooked/misinterpreted	P
High-complexity	- Nonprogrammed, unstructured, nonroutine, infrequent	A
	- Requires support for entirely different cognitive processes	A
	- Requires different managerial skills	AP
	- No existing precedent for problem search, design, or choice	P
	- Require different managerial heuristics to frame/solve	P
Resource-limited	- Unique size and scope of the decision (i.e., resource-intensive)	AP
	- Not enough resources to test/implement multiple alternative strategies	AP
	- Implementation must be carefully planned/deconflicted	P
	- Time and cognitive limitations may reduce perceived courses of action	AP
High-velocity	- Likely infrequent (but less so in current/future business context)	P
	- Devastating effect of failure to adequately recognize/respond	AP
	- Strategy made piecemeal/adaptively	AP
	- Action may be constrained	P
Note: A = academic, P = practitioner		

Numerous Stakeholders Strategic control is inherently unique in its scope, concerned with broad policies and goals for an organization [23], but also with strategic orientation to a firm's industry and environment [24]. The unique mixture of internal, external and boundary issues covered by strategic control implies a large number of process stakeholders—each with goals and requirements that tend to diverge. Because of this large scope, strategic control may require unique information—particularly aggregate information from external sources—to feed its decision-making processes. As some note, high-velocity environments may tend to *increase* both the number of stakeholders and critical issues [25].

High-impact Because the scope of strategic decisions is often so far-reaching, i.e., concerning survival and prosperity of the firm and its employees, the results of any mistakes are potentially devastating. For this reason, high first-pass decision quality is desirable. Resources are often not available to pursue more than one strategy, although in proper long-term planning, it may be possible to hedge a strategy with multiple options, expounded in recent literature [26]. So, even in low-velocity environments, the interaction between the consequences of strategic decisions and the resources required to implement them creates large inherent risk in the strategic decision-making process.

High-velocity environments further restrict this process both by restricting the time available to properly investigate alternatives, as well as resource availability. Notwithstanding this fact, it is likely that the *types* of decisions, e.g., investment, alliances, market entry/exit and structure, will remain the same—evidenced by sweeping (yet strikingly different, given the limited options available) responses of General Motors, Chrysler, and Ford to 2008's credit crisis preceding the automotive bailout. So, as noted above, high-velocity does not change the problem type, but it may reduce the resources available to solve these inherently risky problems.

High-uncertainty Unfortunately, also because of their scope—and hence uncertainty due to the large number of variables and long time-horizons—high-quality strategic decisions are difficult to achieve. As summarized by Kottemann et al. [14], "Because decision outcomes are not observable until the adjustment is made and the resulting effects are manifest, the manager may learn appropriate strategies over time but at the price of costly lag effects and mistakes."

Adding a high-velocity environment to this equation only compounds the difficulty of making good environmental predictions, as the nature of the environment may be fundamentally shifting during the process of decision-making to one that is unpredictable at the outset. Evidence indicates that initial cues of impending H-v strategic challenges might be easily overlooked or misunderstood [27]. Failure to properly interpret these cues, or failure to orient to them in a timely manner, may lead to inefficient or improper solutions.

High-complexity Strategic decisions are unique when compared to the types of decisions made at the operational and management levels in that they are more often *nonprogrammed, unstructured, nonroutine,* and *infrequent* by comparison. Simon [28] and March and Simon [23] describe a continuum of executive decisions that range from *programmed* decisions, i.e., *routine*, to *nonprogrammed* decisions, i.e., *novel*, *unstructured*, and *consequential*. Gorry and Scott Morton [20] use the terms *structured* and *unstructured* in place of Simon's terminology, and add that a fully structured decision is one that is structured throughout all phases of the decision making process, whereas a fully unstructured decision is one that is unstructured throughout all phases of the decision making process.[3] Unstructured decisions may require different managerial skills, for example *analytical* and *reflective*, versus *communicative* and *procedural*. Likewise, strategic decisions are often *nonroutine* or *infrequent*, with no existing precedent for problem search, design, or choice. Nonroutine decisions may therefore require different managerial heuristics to frame and solve them. In other words, because of the *nonprogrammed*, *unstructured*, *nonroutine*, and *infrequent* nature of strategic decisions, it is possible that they may require support for entirely different cognitive processes—certainly a primary concern of strategic DSS designers.

As noted above, in a high-velocity environment, decision types may remain constant; however, different sub-routines may be required, and different cognitive process support required [29]. Also noted earlier, as stakeholders and uncertainty proliferate, complexity tends to increase. Indeed, if there is a specific cognitive ingredient to high-velocity decision-making, it might best be termed *flexibility*—the ability to learn and unlearn useful heuristics as conditions change.

Resource-limited As mentioned above, the strategic environment is inherently resource-constrained. The unique size and scope of strategic decision-making, coupled with the resources available, limit a firm to testing/implementing a specific subset of acceptable strategies—often within the paradigm set by an industry's structure [30, 31]. Having said this, normal, low-velocity conditions do not normally increase cognitive load such

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[3] Simon [28] identifies three phases of problem solving, i.e., decision making: *intelligence gathering* ("searching the environment for conditions calling for a decision"), *design* ("analyzing possible courses of action"), and *choice* ("selecting a course of action from those available").

that individuals cannot react in accordance with their training and strategic intent. Careful planning is both possible and advisable, carefully maneuvering resources to maximize benefits and minimize waste.

In a high-velocity environment, though, the effects of bounded rationality and satisficing behavior [32] may be increased, encouraging use of pre-set routines of behavior, such as: searching fully developed solutions, adopting practices of others, and identifying alternatives (and courses of action) from available ideas, versus devising custom-made alternatives [33, 29, 34]. In other words, both time and cognitive resources are limited in an H-v environment.

High-velocity Although strategic decisions are well-researched in management literature, strategic decisions are rarely studied in H-v environments. Noted in the introduction, H-v environments seem endemic to some industries, yet they may arise in any industry. As suggested by Schumpeter [35, 36], while discontinuous change may not occur often, it is nonetheless devastating in the short-run to firms that fail to recognize it—or fail to appropriately respond to it. As evidenced by recent events in the housing, banking, and automobile markets, discontinuous change in one environment can spill-over into another, normally cyclical, environment; in fact, the effects of globalization seem to increase this probability.

Bourgeois and Eisenhardt [1] suggest that in H-v environments, "strategy is made piecemeal, adaptively, and in small increments, rather than comprehensively and in large, purposeful chunks," because time horizons, and therefore information search functions, are compressed. Uncertainty is increased, and action may be constrained. The *wait and see* approach, as well as the *me too* approach, do not effectively address these environments; therefore, it is imperative to make strategic decisions "carefully, but quickly" [1].

The Fit Variable: Configuration to Match Decisions/Users/Environment

In order to understand how H-v strategic decision-making key components translate into H-v strategic DSS requirements, it is useful to understand why these requirements are as much a function of elements of configuration as they are of discrete operators. Because a DSS can both support and restrict the decision-making process, depending on the environment, *configurable* elements are necessary to adapt to those environments. From the user's perspective, there are four DSS configuration elements: operators, navigational aids, adaptors, and sequencing rules [7]:

> *Operators perform the system's basic information-processing activities, navigational aids help users choose operators, adaptors allow users to create or modify operators and navigational aids, and sequencing rules control when each of the other components can be invoked by the user.*

While the underlying functionality and elementary information processes that reside at the layer below the user view are likely to remain relatively constant over time [37, 7], configuration of the user level through the use of these four basic elements provides a certain amount of restrictiveness that can either enhance or inhibit system use [7]. For example, navigational aids may be optimized for decision speed over thoroughness—making it more difficult to use in-depth functionality. Therefore, from the user's perspective, configuration is a primary consideration—and configuration items exist to adapt a DSS to fit a given decision/user/environment.

Another important point to make is that configuration is nested, or hierarchical. Operators themselves support decisions, but they may be hidden or presented through using navigational aids. Both navigational aids and operators may be sequenced to support a user or task. Finally, adaptors, navigational aids, and sequences may be modified through the use of adaptors. As shown in Figure 3, the problem is primarily one of fit between a DSS configuration and a H-v strategic decision requirement (shown by the two arrows), with the decision-user-environment decision requirement driving the configuration support requested, and existing configuration restricting the decision types that can be supported.

In the inner rings, atomistic operators (e.g., retrieve, compile, compare, etc.) support atomistic decisions (e.g., higher/lower, buy/sell, etc.). In the second set of rings, users utilize navigational aids to find the atomistic operators to support an individual decision. Navigational aids support individual user requirements, and they can be sequenced in the third ring to better support user style or environmental necessity. Finally, the environment may change such that the entire DSS must be re-configured, either through changing the sequence of navigational aids or atomistic operators to support a new task, or by creating new sequences, navigational aids, or atomistic operators to support new decision-types.

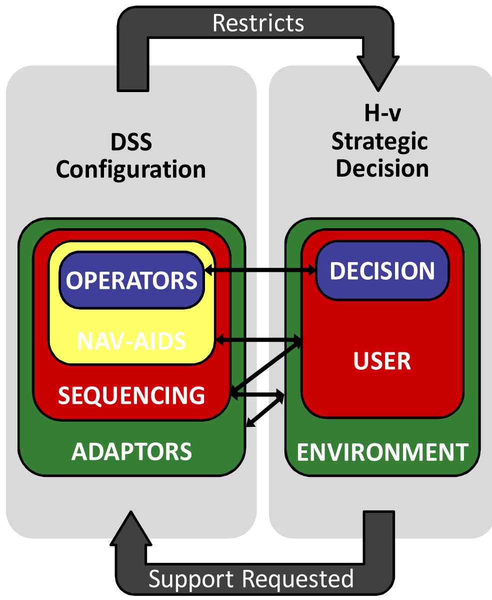

Figure 3: Dimensions of Fit Between DSS and H-v Decisions; Adapted from [adapted from 7]

In a H-v strategic decision, it is likely that the sequencing and adaptors are of primary concern, because they give a DSS its ability to change to support user requirements, as well as new situations that might not have been considered by designers. Finally, a DSS with a fixed set of operators, navigational-aids, and sequences can only support a finite number of possible decisions, users, and environments. So, the degree of adaptability of a system is the primary driver of fit between DSS configuration and decision requirements.

Figure 4 summarizes the above discussion, adding detail to figure 1. The main point of the discussion thus far is that, in order to derive H-v strategic DSS requirements, one must consider designing DSS features that fit the unique and changing combination of decisions, users, and environments to best inform real-time changes in strategic foci.

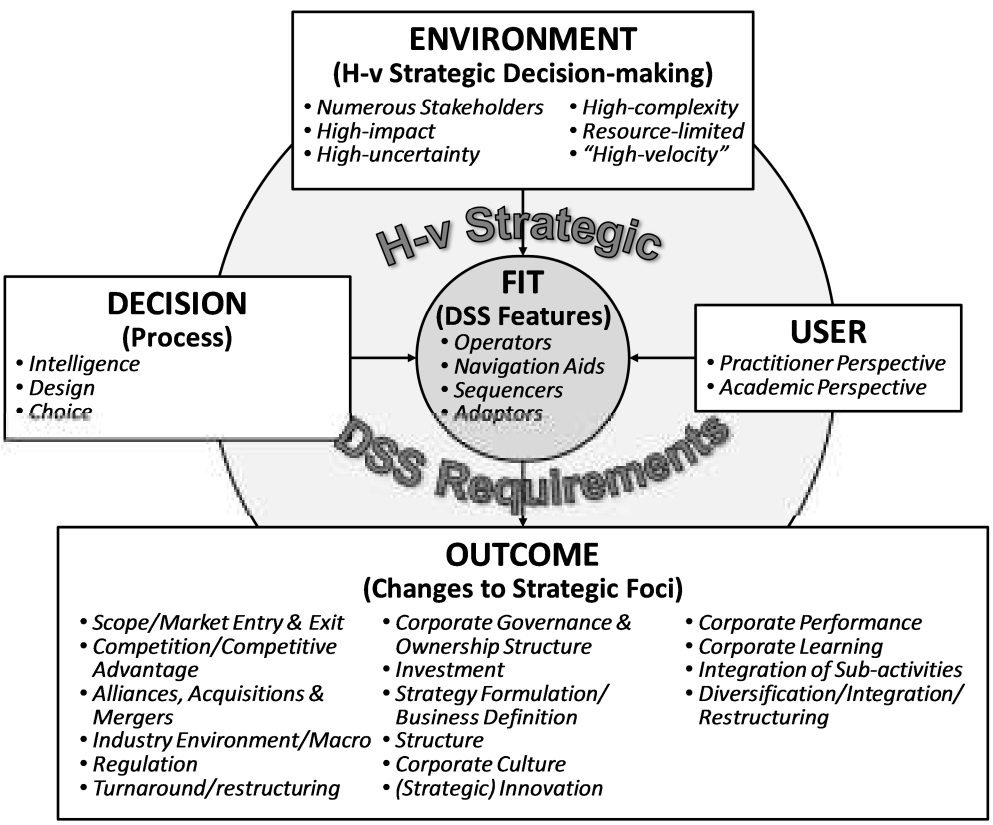

Figure 4: Complete Framework Used to Derive H-v DSS Requirements

USING THE “FIT” MODEL TO DERIVE H-V STRATEGIC DSS REQUIREMENTS

As Beroggi and Wallace [4] put it, “when assessing reasoning logics embedded into DSSs, one must be careful to separate the effects of the reasoning logics from those of the DSS.” If the four elements of configuration regulate the use of relatively stable *DSS logics*, then it is important to explore the *reasoning logics* required by an H-v strategic DSS. The intent of the final literature search was to define H-v *reasoning logics* supporting the previous analyses.

Methodology

Table 4 shows the results of an extensive literature search balanced between practitioner and academic literature, with results grouped by decision, user, and environmental components. Upon reviewing the 49 articles mentioned previously to identify the H-v strategic decision-making key components (there were six), the authors revisited the same documents from a DSS feature design perspective to determine the essential elements of an H-v DSS. Where applicable, the paradigm of DSS configuration was applied to the elements discovered, resulting in the final list of 45 essential requirements of an H-v DSS. Two raters, selected for their familiarity with the subject matter, independently mapped these DSS requirements to their decision requirements (shown in Appendix B, with the 45 requirements ordered by their count frequency in the literature in the column labeled “#”). Because there were six H-v Strategic decision-making key components (with 2^6, or 64, possible combinations of “Yes” or “No” thereof), the most restrictive possible definition of inter-rater reliability was used, calculated by assigning 100% agreement a “1,” and any disagreement a “0.” In 270 coding cases, the Cohen’s Kappa calculated between the two authors was .944—normally considered exceptional [38]. After this coding exercise, the two authors met and resolved any discrepancies to produce the table provided.

Analysis

At first, many of the decision requirements appearing in Table 4 do not appear unique *until* one considers H-v strategic user and environmental factors, i.e., Table 3. For example, in an H-v strategic decision, it seems likely that configuration requirements will change based on the cognitive capabilities and user experience. Second, as affirmed by [13], range (short-term) and criticality (impact on organization) are primary environmental concerns characterizing the H-v strategic environment. Much as in developing common systems, different configurations may be required to support a decision depending on the range and criticality of that decision, [39]. Finally, it appears that H-v strategic decisions are also nested, or hierarchical: decisions within individual users, and users within a decision environment. Therefore, one may assert that it is not the elementary information processes that are of primary concern in a H-v strategic decision, but rather the interaction between DSS configuration and decision requirements [40, 17, 41]. There are hundreds—or thousands—of possible combinations of configurations for a given decision, but one conclusion is inescapable, optimal decision outputs may be made *more likely* the *higher the degree of fit* between DSS configuration and the decision supported.

Table 4: H-v Strategic DSS Requirements

Component	H-v Strategic DSS Requirement	Source
Decision - Intelligence	- Data Management/Support	A
	- Efficient access/exploration of wide knowledge spectrum	A
	- Data must contain meta-information/searchable	A
	- Qualitative/quantitative data mixture	A
	- Thought support to augment search/identification functions	A
	- Triggers (pre-set conditions generating decision request)	P
	- Low system latency	P
	- Automated reports generation	P
	- External-internal/balanced focus	P
	- Balanced information (detail)	P
	- Drill-down capabilities/depth	P
Decision - Design	- Interactive/Flexible Modeling/Simulation	A
	- Capture/recall past decision processes for reference (includes cognitive maps)	A
	- Trend analysis	A
	- Experimentation with variables (sensitivity analysis)	A
	- Compare alternate models/courses of action (e.g., linear programs/stochastic)	A
	- Decomposition into sub-problems	P
	- "Single source of truth" (vice "many opposing views")	P
	- Web content management systems	P
	- Predefined/adaptable alternatives (previously identified)	P
Decision - Choice	- Decisional Guidance	A
	- Informative/Suggestive	A
	- Predefined/adaptable heuristics (previously identified)	A
	- Artificial Intelligence (AI)	A
	- Idea generation support	A
	- Justification of solutions	A
	- "What-if?" predictive modeling capabilities	P
	- Future-oriented	P
	- Qualitative/quantitative synthesis	P
User Concerns	- Dialogue & Collaboration Capabilities/Support	A
	- Distributed/web-based support	A
	- Easy to Use	A
	- Personalized/matches individual (e.g., experience, org. level, decision scope)	A
	- Ability to shift representations (example: meta-templates)	A
	- Ability to change view of operators	A
	- Visualization/"Graphic Dashboards"	P
	- Seamless integration (with other tools)	P
	- Scalability/personalizability/customizability	P
	- "Fit" between task and tools	P
Environ-mental Concerns	- Support for changing environments	A
	- Ability to adapt/create operators	A
	- Ability to adapt/create navigational aids/menus	A
	- Ability to adapt/create sequences	A
	- Ability to re-sequence operators	A
	- Ability to re-sequence navigational aids/menus	A
Note: Search criteria were "Decision Support," AND "Strategic"; A = academic, P = practitioner		

OUT-OF-THE-BOX VENDOR SUPPORT FOR H-V STRATEGIC DECISION-MAKING

Realizing that fit as described above is inherently situational, we next addressed a broader, more basic question: do the current tools provided by vendors fit—provide the functionality required by—an H-v strategic DSS? The “fit” used in this context is “profile deviation” [42], with the 45-item list representing the ideal “profile.” The basis for this discussion is Appendix C, created by comparing the respective vendor literature with the 45 H-v strategic DSS requirements in Table 4. This table explored 16 popular products in the market today, chosen for their representativeness of their taxonomical category described by Powers [8, 43].

Methodology

For each of the 45 DSS requirements, “fit” is coded by either “Y” for yes, “N” for no, and “C” for configurable. Each of these items was assigned by one of the authors, and then the second author coded reviewed the codes assigned, with each item of disagreement discussed and resolved between the two authors. In the case of a “yes,” the authors agreed that the tool provided native support for the requirement, and in the case of a “configurable,” the authors determined that the tool provided the ability to configure the tool to support the requirement—though it was not possible to determine the level of difficulty to do so.

Analysis

First, results seem to indicate that no single tool currently provides support for all the H-v strategic DSS requirements—in fact no single tool even comes close. In 720 cells, 431 (60%) indicate “no fit,” 159 (22%) indicate “fit” and 130 (18%) indicate “configurable.” This observation is important because it implies that current DSSs are not a “one-stop shop,” nor are they the only tool used to support current business decisions. Second, tools seem to specialize on one aspect of the process, e.g., communication, data mining, or simulation. Tools that are strong in one area are often only strong in that area. Third, six H-v strategic DSS requirements are not supported by any tool—and 16 requirements are supported by fewer than three tools. Of these 16 poorly-supported requirements, nearly all of them are critical components of the H-v and resource-limited aspects of H-v strategic decision making—especially those that provide cognitive support to augment users’ deficiencies in these environments.

RECOMMENDATIONS

Based on the above analysis, it appears that current DSS tools struggle to support H-v strategic decision-making environments. Therefore, the following recommendations are offered to guide future DSS research and development:

- *Recommendation 1: Build a more comprehensive understanding of the current state of fit between DSS products and H-v strategic decision-making requirements.*

If current DSS technologies do not adequately support the requirements of strategic decision makers, then the obvious question this poses is *why*? There are two main reasons this might be so. First, it is possible that current technologies are not capable of modeling the complexities of the decisions made by strategic decision makers; in other words, the problem is a technology problem. Second, it is possible that users are not able to adequately configure the systems they are provided with—a training problem. Finally, it is possible that system designers do not understand the requirements of strategic decision makers; in other words, the problem is one of knowledge. For analysts and strategic decision makers alike, it is important to understand the problem and its sources in order to address it. Although significant research exists investigating the fit between information systems and firm strategy [44], research has yet to consider how to design DSSs to fit the individual decisions unique to an H-v strategic environment. Using our theoretical model, it might be possible to devise a protocol to study DSS tool use in H-v strategic environments; however, we admit that the result will necessarily be mixed methods—combining design science, human-computer interaction, and phenomenological techniques to account for the fact that H-v environments resist study by their nature.

- *Recommendation 2: Concentrate future research efforts on the concept of DSS configuration, and its fit with different decisions, users, and environments.*

Any lack of system flexibility inadvertently restricts the applicability of a DSS to a given decision task, and may result in inadvertent guidance that reduces decision quality. Silver [7] states that “if DSS designers understand how and when such [inadvertent] guidance can occur, they can take steps to avoid the unintended consequences, perhaps by offsetting them with deliberate guidance.” For researchers—especially human-computer interaction researchers—this type of research might be performed in a laboratory setting with existing systems, or by design science researchers using systems analysis techniques to determine where design funds are best spent in search of configuration. For practitioners—especially industry practitioners—this research presents some ideas, as well as a generic heuristic, to determine where configuration items might be added.

- *Recommendation 3: Build future DSS systems that consider, and account for, the numerous changing environmental factors that may influence DSS configuration.*

Whether or not current DSS technologies support the requirements of strategic decision makers, it is important for systems analysts to understand their customers' requirements. In the case of H-v strategic decision-makers, changing environmental factors lead to the requirement that DSSs remain powerful, yet flexible, with two closely related implications. First, and most importantly, Keen [45] notes:

> *Users' concepts of the task or decision situation will be shaped by the DSS. The system stimulates learning and new insights, which in turn stimulate new uses and the need for new functions in the system. The unpredictability of DSS usage surely reflects this learning, which can be exploited only if the DSS evolves in response to it.*

In other words, if DSSs augment human reasoning capabilities and supplementing human weaknesses, then only configurable systems will result in better decisions in H-v environments. This should give DSS designers pause to consider "fit"-based systems analysis tools such as the one developed in this paper.

Second, we found that vendors currently appear to target a particular tool specific niches in the DSS marketplace, i.e., communication, implying that a customer must not only purchase multiple systems, but also that the customer is on the hook for a significant bill to configure and maintain its suite of systems. Although one might argue that the resulting escalation of commitment is desirable from a vendor's perspective, as it raises switching costs, Mata, Fuerst, and Barney [46] note that switching costs do not tie customers inextricably with suppliers. Indeed, vendors acquiring a reputation for selling non-configurable systems risk losing repeat and referral business.

LIMITATIONS

As this research is preliminary, its findings are limited. Although the theoretical model we built represents the confluence of both academic and practitioner publications, it did not fully consider technical design occurring outside these publications. Further technical research is required, i.e. design science and human-computer interaction research, to verify the model's usefulness in actual analysis and design of systems.

Second, we applied our efforts to a limited number of existing DSSs—some of whom are only loosely termed DSSs according to the criteria developed herein. Following our logic of the importance of configuration at the level of the atomistic decision element, one might argue that true DSSs are only those installed and configured in organizations. We agree, although we temper this with our assertion below that there is value in taking an outsider's view of a DSS.

Third, this research applied criteria concerning configuration, but only accessed DSSs through vendor-provided literature. Vendors might argue that although their systems cannot support many of the H-v Strategic DSS requirements "out-of-the-box," they recommend customers retain their services to further tailor the product to. While we understand this position, it highlights our concern with a system that is not user-configurable. In other words, much like with financial software, the user will not know s/he has purchased an incompatible or inflexible system until so much effort has been placed in configuring the system that the sunk costs are considerable. Further, the implicit, but unstated assumption underlying most vendor literature is that any DSS purchase requires an indefinite service support contract with the vendor of choice—a problem which limits development of truly unique operators, sequencers, and (especially) adapters to the imagination, technical capability, and software environment of that vendor.

Having acknowledged the shortcomings of taking an outsider's view of DSSs in this paper, we maintain that, although it may not be apparent from current vendor literature the extent to which users may end up with a product that completely meets his/her business requirements, the usage of such a checklist in the vendor evaluation process may give a user some idea of the amount of time, energy, and vendor support required to support their business requirements. Clearly, there remains room for future research to evaluate the effort required to address each of the items included in the checklist. There also remains room for vendors to use the checklist to modify their off-the-shelf solutions to make them more configurable—essentially shifting the costs of producing a configurable system where it belongs: to the vendor. We assert that the use of this type of checklist to create configurable systems is one way for vendors to create product differentiation in a competitive market.

CONCLUSION

This research developed balanced evaluation criteria for H-v strategic DSS. First, it developed an H-v strategic DSS “fit” framework. Second, it used this framework to derive a list of H-v strategic DSS requirements. Third, it used the list of H-v strategic DSS requirements to evaluate existing DSS tools. It found that current DSS tools may not sufficiently fit many of the needs of H-v strategic decisions. Further, it proposed that the concept of fit should be a primary concern of DSS designers and evaluators, with the goal being decreased DSS brittleness. This concern is echoed by Owens and Philippakis [18] discussing Knowledge-based DSS (KBDSS):

> *However, as decision makers become dependent on KBDSS that integrate data and inductively derived rules, significant risks may occur if the system is unable to cope or adapt to new information. Specifically, the use of decision rules that are not adapted to new information may result in poor decisions. Over time, KBDSS must adapt to changes from the continuous environment. The lack of change processes may result in brittle systems. Within knowledge-based systems, brittleness has been defined as the inability to cope with unexpected problems.*

Indeed, we see this as the next frontier in DSS research: not necessarily the ability to predict all possible contingencies of usage, but rather the ability of a DSS to maintain flexibility in its configuration such that, as these contingencies arise, users can quickly adapt the system to match situational requirements.

REFERENCES

[1] Bourgeois, L. and Eisenhardt, K. "Strategic Decision Processes in High Velocity Environments: Four Cases in the Microcomputer Industry," *Management Science*, Volume 34, Number 7, 1988, pp. 816—835.

[2] Gjerstad, S. and Smith, V. "From Bubble to Depression?" *Wall Street Journal - Eastern Edition*, Volume 253, Number 79, 2009, p. A15.

[3] Farjoun, M. "Towards an Organic Perspective on Strategy," *Strategic Management Journal*, Volume 23, Number 7, 2002, pp. p561–594.

[4] Beroggi, G. and Wallace, W. "The effect of reasoning logics on real-time decision making," *Systems, Man and Cybernetics, Part A: Systems and Humans, IEEE Transactions on*, Volume 27, Number 6, 1997, pp. 743–749.

[5] Barney, J. "Firm Resources and Sustained Competitive Advantage," *Journal of Management*, Volume 17, Number 1, 1991, pp. 99–120.

[6] Reed, R. and DeFillippi, R. "Causal Ambiguity, Barriers to Imitation, and Sustainable Competitive Advantage," *The Academy of Management Review*, Volume 15, Number 1, 1990, pp. 88–102.

[7] Silver, M. *Systems that Support Decision Makers: Description and Analysis*, John Wiley & Sons, West Sussex, 1991.

[8] Power, DJ *Decision support systems: Concepts and resources for managers*, Greenwood, Westwood, CT, 2002.

[9] Wailgum, T. "To Hell with Business Intelligence: 40 Percent of Execs Trust Gut," *CIO*, 2009, January 12. http://advice.cio.com/thomas_wailgum/to_hell_with_business_intelligence_40_percent_of_execs_trust_gut

[10] Aldag, D. and Power, D. "An empirical assessment of computer-assisted decision analysis," *Decision Sciences*, Volume 17, Number 4, 1986, pp. 572–588.

[11] Dennis, A., Wixom, B. and Vandenberg, R. "Understanding Fit and Appropriation Effects in Group Support Systems via Meta-Analysis," *MIS Quarterly*, Volume 25, Number 2, 2001, pp. 167–193.

[12] Limayem, M., Banerjee, P. and Ma, L. "Impact of GDSS: Opening the black box," *Decision Support Systems*, Volume 42, Number 2, 2006, pp. 945–957.

[13] Mahmood, M., Courtney, J. and Burns, J. "Environmental factors affecting decision support system design," *SIGMIS Database*, Volume 14, Number 4, 1983, pp. 23–27.

[14] Kottemann, J., Boyer-Wright, K., Kincaid, J. and Davis, F. "Understanding Decision-Support Effectiveness: A Computer Simulation Approach," *Systems, Man and Cybernetics, Part A: Systems and Humans, IEEE Transactions on*, Volume 39, Number 1, 2009, pp. 57–65.

[15] Smith, P., McCoy, C. and Layton, C. "Brittleness in the design of cooperative problem-solving systems: the effects on user performance," *Systems, Man and Cybernetics, Part A: Systems and Humans, IEEE Transactions on*, Volume 27, Number 3, 1997, pp. 360–371.

[16] Mendonca, D. "Decision support for improvisation in response to extreme events: Learning from the response to the 2001 World Trade Center attack,"

Decision Support Systems, Volume 43, Number 3, 2007, pp. 952–967.

[17] Pearson, J. and Shim, J. "An empirical investigation into DSS structures and environments," *Decision Support Systems*, Volume 13, Number 2, 1995, pp. 141–158.

[18] Owens, H. and Philippakis, A. "Inductive Consistency in Knowledge-based Decision Support Systems," *Decision Support Systems*, Volume 13, Number 2, 1995, pp. 167–181.

[19] Fuller, R. and Dennis, A. "Does Fit Matter? The Impact of Task-Technology Fit and Appropriation on Team Performance in Repeated Tasks," *Information Systems Research*, Volume 20, Number 1, 2009, pp. 2–17.

[20] Gorry, G. and Scott Morton, M. "A Framework for Management Information Systems," *Sloan Management Review*, Volume 13, Number 1, 1971, pp. 55–70.

[21] Dubé, L. and Pare, G. "Rigor in Information Systems Positivist Case Research: Current Practices, Trends, and Recommendations," *MIS Quarterly*, Volume 27, Number 4, 2003, pp. 597.

[22] Klier, T. and Rubenstein, J. "What role did regional policy play in addressing the US auto industry crisis?" *International Journal of Automotive Technology and Management*, Volume 11, Number 2, 2011, pp. 189–204.

[23] March, J. and Simon, H. *Organizations*, (2nd ed.). Blackwell, Cambridge, MA, 1993.

[24] Porter, M. *Competitive Strategy*, Macmillan, New York, NY, 1980.

[25] Heifetz, R. *Leadership Without Easy Answers*, Harvard University Press, 1998.

[26] Bowman, E. and Moskowitz, G. "Real Options Analysis and Strategic Decision Making," *Organization Science*, Volume 12, Number 6, 2001, pp. 772–777.

[27] Reger, R. and Palmer, T. "Managerial Categorization of Competitors: Using Old Maps to Navigate New Environments," *Organization Science*, Volume 7, Number 1, 1996, pp. 22–39.

[28] Simon, H. *The Shape of Automation for Men and Management*, Harper & Row, New York, NY, 1965.

[29] Mintzberg, H., Raisinghani, D. and Theoret, A. "The Structure of "Unstructured" Decision Processes," *Administrative Science Quarterly*, Volume 21, Number 2, 1976, pp. 246–275.

[30] Caves, R. and Porter, M. "Barriers to Exit," In D. P. Qualls & R. T. Mason (Eds.), Ballinger, Cambridge, MA, 1976, pp. 39–70.

[31] McGahan, A. and Porter, M. "How Much Does Industry Matter, Really?," *Strategic Management Journal*, Volume 18, 1997, pp. p15–30.

[32] Simon, H. *Administrative Behavior*, Macmillan, New York, NY, 1947.

[33] Nutt, P. "A taxonomy of strategic decisions and tactics for uncovering alternatives," *European Journal of Operational Research*, Volume 132, Number 3, 2001, pp. 505–527.

[34] Nutt, P. "Types of Organizational Decision Processes," *Administrative Science Quarterly*, Volume 29, Number 3, 1984, pp. 414–450.

[35] Nelson, R. "Why Do Firms Differ, and How Does It Matter?," *Strategic Management Journal*, Volume 12, Number 8, 1991, pp. 61–74.

[36] Schumpeter, J. *The theory of economic development*, Harvard University Press, Cambridge, MA, 1934.

[37] Bettman, J., Johnson, E. and Payne, J. "A Componential Analysis of Cognitive Effort in Choice.," *Organizational Behavior & Human Decision Processes*, Volume 45, Number 1, 1990, pp. 111.

[38] Rosenthal, R. and Rosnow, R. *Essentials of Behavioral Research: Methods and Data Analysis*, (3rd ed.). McGraw-Hill, New York, 2008.

[39] Kirsch, L. and Haney, M. "Requirements determination for common systems: turning a global vision into a local reality," *The Journal of Strategic Information Systems*, Volume 15, Number 2, 2006, pp. 79–104.

[40] Eierman, M., Niederman, F. and Adams, C. "DSS theory: A model of constructs and relationships," *Decision Support Systems*, Volume 14, Number 1, 1995, pp. 1–26.

[41] Goodhue, D. and Thompson, R. "Task-Technology Fit and Individual Performance," *MIS Quarterly*, Volume 19, Number 2, 1995, pp. 213–236.

[42] Venkatraman, N. "The Concept of Fit in Strategy Research: Toward Verbal and Statistical Correspondence.," *Academy of Management Review*, Volume 14, Number 3, 1989, pp. 423–444.

[43] Power, D. "Ask Dan! about DSS - What vendors dominate the DSS product space?," 2012. http://dssresources.com/faq/index.php?action=artikel&id=81.

[44] McLaren, T., Head, M., Yuan, Y. and Chan, Y. "A Multilevel Model for Measuring Fit Between a Firm's Competitive Strategies and Information Systems Capabilities," *MIS Quarterly*. Volume 35, Number 4, 2011, pp. 909–930.

[45] Keen, P. "Adaptive Design for Decision Support Systems," *ACM SIGOA Newsletter*, Volume 1, Number 4-5, 1980, pp. 15–25.

[46] Mata, F., Fuerst, W. and Barney, J. "Information Technology and Sustained Competitive Advantage: A Resource-Based Analysis.," *MIS Quarterly*, Volume 19, Number 4, 1995, pp. 487–505.

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APPENDIX A: TYPE OF DSS, PURPOSE AND FEATURES

Type of DSS	Purpose	Example Features
Communications-Driven DSS	Used internally, or within teams across organizations to help conduct a meeting, or for users to collaborate.	Agenda creation, Annotation, Application and document sharing, Bulletin boards or forums, Chat or text interaction, Meeting scheduling and management, Polls, Record meetings, Slide presentations, Video interaction, Voice interaction, Web joint browsing, Whiteboard
Data-Driven	Used mostly by managers/staff to query a database/warehouse to seek specific answers for specific purposes. Deployed via a main frame system, client/server link, or via web.	Ad hoc data filtering and retrieval, Alerts and triggers, Create data displays, Data management, Data summarization, Excel integration, Metadata creation and retrieval, Report design, generation and storage, Statistical analysis, View predefined data displays, View production report
Document-Driven	Used by broad user sets to DSS is to search web pages and find documents on a specific set of keywords or search terms.	Ad hoc search and retrieval, Alerts and triggers, Append notes to a document, Browsing and document navigation, Document translation/multilingual interface, Document management, Hyperlinks, Indexes (both human and machine generated), Metadata retrieval, Relevancy ranking, Record search history/save/publish for other users, Show decision process flowchart, Summarization (provides extracts text using statistical cues to form summaries), Text mining/analysis, User action recording
Knowledge-Driven	Used by multiple groups to provide management advice using algorithms programmed by experts (or learned by system over time).	Asks questions, Backtrack capability, Display confidence or certainty information, Explain HOW, Explain WHY, Initiate actions, Output selection, Resume analysis, Retrieve data about a specific case or instance, Store inputs, results and user actions, Train users
Model-Driven	Used by management/staff to analyze decisions and present/select options. May allow analysis of more options, give process insights, or enable more efficient decisions.	Change a model parameter or classic "what if" analysis , Context specific help and model definitions, Create and manage scenarios, Extract specific historical data values from an external database, Generate a sensitivity analysis, Output selection, Specify and seek goals, Store inputs/results/user actions, Value elicitation and data input
Note: Adapted from Powers, 2009		

APPENDIX B: DERIVATION OF BALANCED H-V STRATEGIC DSS REQUIREMENTS

H-v Strategic DSS Requirements	#	H-v Strategic Decision-making Key Components					
		Stake-holders	Impact	Uncer-tainty	Com-plexity	Res.-limited	High-velocity
“What-if?” predictive modeling capabilities	12	X	X	X	X	X	X
Ability to adapt/create navigational aids/menus	12	X	X	X	X	X	X
Ability to adapt/create sequences	12	X	X	X	X	X	X
Ability to re-sequence navigational aids/menus	12	X	X	X	X	X	X
Balanced information (detail)	12	X	X	X	X	X	X
Capture past decision processes for ref. (e.g., cog. maps)	12	X	X	X	X	X	X
Decisional guidance	12	X	X	X	X	X	X
Drill-down capabilities/depth	12	X	X	X	X	X	X
Efficient access/exploration of wide knowl. spectrum	12	X	X	X	X	X	X
Future-oriented	12	X	X	X	X	X	X
Informative/suggestive	12	X	X	X	X	X	X
Justification of solutions	12	X	X	X	X	X	X
Predefined/adaptable alternatives (previously identified)	12	X	X	X	X	X	X
Predefined/adaptable heuristics (previously identified)	12	X	X	X	X	X	X
Qualitative/quantitative synthesis	12	X	X	X	X	X	X
Support for changing environments	12	X	X	X	X	X	X
Idea generation support	11	X	X	X	X	X	X
“Fit” between task and tools	10	X		X	X	X	X
Triggers (pre-set conditions generating dec. request)	10		X	X	X	X	X
“Single source of truth” (vice “many opposing views”)	9	X		X	X	X	X
Ability to change view of operators	9	X	X		X	X	X
Data must contain meta-information/searchable	9		X	X	X	X	X
Thought support to augment search/identification	9	X		X	X	X	X
Ability to re-sequence operators	8		X		X	X	X
Ability to shift representations (e.g., meta-templates)	8	X			X	X	X
Artificial intelligence (AI)	8	X		X	X	X	X
Compare alternatives (e.g., linear programs/stochastic)	8	X		X	X	X	
Dialogue and collaboration capabilities/support	8	X			X	X	X
Easy to use	8	X			X	X	X
Personalized (e.g., exper., org. level, decision scope)	8	X			X	X	X
Ability to adapt/create operators	7	X		X	X	X	
Automated reports generation	7	X		X	X		X
Experimentation with variables (sensitivity analysis)	7	X		X	X	X	
Distributed/web-based support	6					X	X
External-internal/balanced focus	6	X	X	X			
Interactive/flexible modeling/simulation	6	X		X	X		
Qualitative/quantitative data mixture	6	X		X	X		
Seamless integration (with other tools)	6	X			X	X	X
Trend analysis	5			X	X		X
Data management/support	4					X	X
Decomposition into sub-problems	4			X	X		
Low system latency	4					X	X
Scalability/personalizability/customizability	4	X		X	X		
Visualization/“graphic dashboards”	4						X
Web content management systems	4	X				X	

APPENDIX C: EVALUATION OF 16 VENDOR PACKAGES SUPPORT FOR H-V STRATEGIC DSS REQUIREMENTS

	VENDOR - *Package*																		
Type:	**Comm**			**Data**					**Doc**	**Model**							**COUNTS**		
H-v Strategic DSS Requirements	**IBM** *Lotus Notes*	**MS** *Office Live Mtg.*	**MS** *Groove*	**NCR** *Teradata*	**SAP** *Business Objects*	**IBM** *Cognos*	**ORACLE** *Hyperion*	**MICROSTRATEGY** *MicroStrategy*	**EMC** *Documentum*	**ORACLE** *Crystal Ball*	CELEQUEST, INC. *Celequest 2.0*	**CYMFONY, INC.** *Dashboard*	**KHALIX** *Longview Solutions*	**NOETIX CORP.** *Enter. Tech. (NETS)*	**SAGE ANALYST** *Sage Metrics*	**ASCENTIAL** *Enterpr. Integr. Suite*	**Y**	**C**	**N**
"What-if?" predictive modeling capabilities	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	2	0	14
Ability to adapt/create navigational aids/menus	Y	N	Y	Y	Y	Y	N	Y	N	N	Y	N	N	Y	Y	Y	10	0	6
Ability to adapt/create sequences	N	N	N	Y	Y	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y	10	0	6
Ability to re-sequence navigational aids/menus	Y	N	N	Y	Y	Y	N	Y	N	N	Y	N	Y	Y	Y	Y	10	0	6
Balanced information (detail)	N	N	N	C	C	C	C	C	N	N	N	C	C	C	C	C	0	10	6
Capture past decision processes for ref. (e.g., cog. maps)	N	N	N	C	N	N	N	N	N	N	N	N	N	N	N	N	0	1	15
Decisional Guidance	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0	0	16
Drill-down capabilities/depth	N	N	N	C	N	C	N	C	N	N	N	C	C	C	C	N	0	7	9
Efficient access/exploration of wide knowl. spectrum	N	N	N	C	C	C	C	C	N	N	N	N	C	C	N	C	0	8	8
Future-oriented	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	2	0	14
Informative/Suggestive	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0	0	16
Justification of solutions	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	N	N	N	3	0	13
Predefined/adaptable alternatives (previously identified)	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	1	0	15
Predefined/adaptable heuristics (previously identified)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0	0	16
Qualitative/quantitative synthesis	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	1	0	15
Support for changing environments	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0	0	16
Idea generation support	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	2	0	14
"Fit" between task and tools	C	C	C	C	C	C	C	C	N	C	C	C	C	C	C	C	0	15	1
Triggers (pre-set conditions generating dec. request)	C	N	N	C	C	C	N	N	N	N	N	C	N	N	N	N	0	5	11
"Single source of truth" (vice "many opposing views")	N	N	N	N	C	C	N	C	N	N	N	N	C	N	N	C	0	5	11
Ability to change view of operators	N	N	N	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	N	N	8	0	8
Data must contain meta-information/searchable	N	N	N	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	10	0	6

	VENDOR - *Package*																**COUNTS**		
Type:	**Comm**			**Data**					**Doc**	**Model**									
H-v Strategic DSS Requirements	**IBM** *Lotus Notes*	**MS** *Office Live Mtg.*	**MS** *Groove*	**NCR** *Teradata*	**SAP** *Business Objects*	**IBM** *Cognos*	**ORACLE** *Hyperion*	**MICROSTRATEGY** *MicroStrategy*	**EMC** *Documentum*	**ORACLE** *Crystal Ball*	CELEQUEST, INC. *Celequest 2.0*	**CYMFONY, INC.** *Dashboard*	**KHALIX** *Longview Solutions*	**NOETIX CORP.** *Enter. Tech. (NETS)*	**SAGE ANALYST** *Sage Metrics*	**ASCENTIAL** *Enterpr. Integr. Suite*	**Y**	**C**	**N**
Thought support to augment search/identification	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0	0	16
Ability to re-sequence operators	N	N	N	Y	Y	Y	N	Y	N	Y	Y	N	Y	Y	N	N	8	0	8
Ability to shift representations (e.g., meta-templates)	Y	N	N	N	N	Y	N	N	N	N	Y	Y	Y	Y	Y	N	7	0	9
Artificial Intelligence (AI)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0	0	16
Compare alternatives (e.g., linear programs/stochastic)	N	N	N	N	Y	Y	N	Y	N	Y	Y	N	N	N	N	N	5	0	11
Dialogue and Collaboration Capabilities/Support	Y	Y	Y	N	N	N	N	N	Y	N	N	N	N	N	N	N	4	0	12
Easy to Use	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	0	16	0
Personalized (e.g., exper., org. level, decision scope)	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	0	16	0
Ability to adapt/create operators	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	2	0	14
Automated reports generation	N	N	N	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	9	0	7
Experimentation with variables (sensitivity analysis)	N	N	N	N	N	Y	N	Y	N	Y	Y	N	N	N	N	N	4	0	12
Distributed/web-based support	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	Y	N	11	0	5
External-internal/balanced focus	N	N	N	C	C	C	C	C	N	C	C	N	C	C	C	C	0	11	5
Interactive/Flexible Modeling/Simulation	N	N	N	N	N	Y	N	N	N	Y	Y	N	N	N	N	N	3	0	13
Qualitative/quantitative data mixture	N	C	C	N	N	N	N	N	N	N	N	Y	N	N	N	N	1	2	13
Seamless integration (with other tools)	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	0	16	0
Trend analysis	N	N	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N	9	0	7
Data Management/Support	Y	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	N	N	8	0	8
Decomposition into sub-problems	C	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0	1	15
Low system latency	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	0	16	0
Scalability/personalizability/customizability	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	14	0	2
Visualization/"Graphic Dashboards"	C	N	N	N	Y	Y	N	Y	N	N	Y	Y	N	N	N	N	5	1	10
Web content management systems	Y	Y	Y	Y	N	Y	Y	N	Y	N	N	Y	N	Y	Y	N	10	0	6
COUNTS (By Tool)	8	5	6	11	13	17	8	13	6	10	16	8	8	14	10	6			
	8	6	6	11	10	11	8	10	4	6	6	8	10	9	8	9			
	29	34	33	23	22	17	29	22	35	29	23	29	27	22	27	30			