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Defining a Fit-based Strategic DSS Evaluation Method

Darin Alan Ladd
US Air Force Institute of Technology, darin.ladd@afit.edu

Avimanyu Datta
Illinois State University, adatta@ilstu.edu

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US Air Force Institute of Technology
darin.ladd@afit.edu

Avimanyu Datta
Illinois State University
adatta@ilstu.edu

ABSTRACT

This research used academic and practitioner literature to inductively derive a strategic DSS evaluation framework considering how fit between environment, decision, and user results in strategic outcomes. Once derived, this framework was used to derive a number of high-velocity strategic DSS attributes that may be used to evaluate candidate systems.

Keywords

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

INTRODUCTION

Although various "Design School" authors from Ansoff (1991) to Porter (1980) emphasize the importance of environmental factors in business strategy formulation, they seem to treat strategy formulation as an orderly, long-term endeavor. Critics, while stressing the iterative nature of strategy, remain quiet on the increasingly short nature of strategic cycles (Mintzberg 1990). Once considered to be the domain of specific industries, such as banking and information technology (Bourgeois and Eisenhardt 1988), the "high-velocity" (H-v) strategic environment, defined as 1) rapid, discontinuous change and 2) information-poor, appears more widespread (Beroggi and Wallace 1997; Gjerstad and Smith 2009).

Of what use are computer-based decision support systems (DSS)[1] in H-v environments? While DSSs supplement human weaknesses, they are designed and built by humans with long lead-times and are inherently "brittle" (Smith et al. 1997) because they lack configurable feature sets (Ladd et al. 2010). Though DSS usage may adapt (Fuller and Dennis 2009), this takes time. Recent practitioner literature documented numerous examples of "brittleness" in entire industries, such as housing and automobiles during the 2008 US financial crisis. Noting this apparent disconnect between academic and practitioner views, this research developed a model to derive balanced H-v strategic DSS requirements.

If, as some argue (Silver 1991), good decisions result from the ability of a DSS to achieve *fit* between a user, his/her decisions, and an environment of interest, then DSS criteria must be developed that integrates each of these items—not separately, but rather, as they *interact*. 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 (see Figure 1). Silver (1991) anticipated and informed the model used to guide this research; 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.

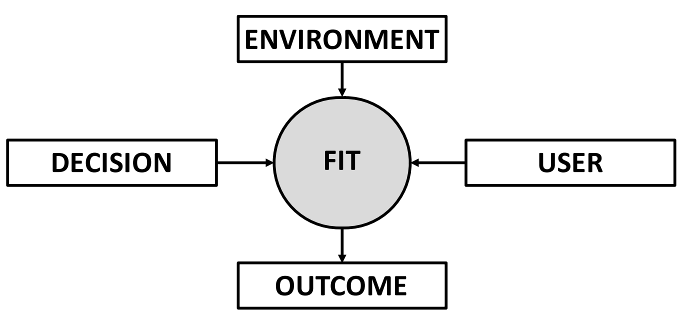

Figure 1. Framework Used to Derive H-v DSS Requirements

[1] Silver defines a DSS as ". . . a computer-based information system that affects or is intended to affect *how* people make decisions" (Silver 1991 p. 19, emphasis added).

A THEORETICAL FRAMEWORK TO DERIVE H-V STRATEGIC DSS REQUIREMENTS

DSSs typically support each of Gorry and Scott Morton's (1971) organizational activities *in isolation* (the areas shown in gray in Figure 2). An H-v strategic environment forces DSS designers and users to consider strategic decisions made on tactical timelines, with both short-term tactical and operational decisions required to support strategic goals that are changing in real-time. Hence, H-v environments cause two complications to the Gorry and Scott-Morton model: 1) increased velocity, and 2) increased scope. DSS designers must consider both of these complications in building configurable H-v DSS features.

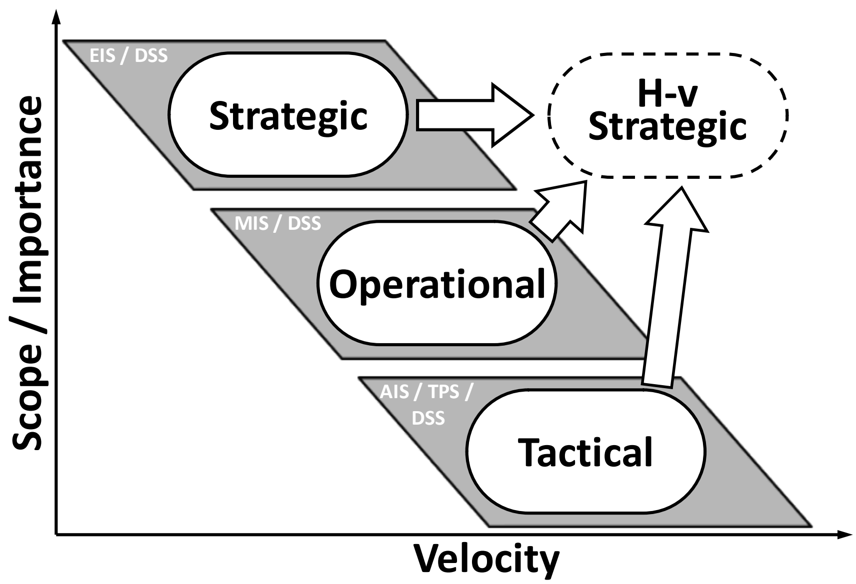

Figure 2. Research Context

The Outcome Variables: Strategic Foci

Considering Figure 1 as a broad theoretical framework to derive H-v DSS requirements, the authors considered both the essence of strategic decisions, and also considered how increased velocity and scope changed this essence. First, we considered the outcome variable, changes to strategic foci, supported with a literature review, to determine if there was any reason to expand consideration of 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 (presumably the determination of a seminal article takes a number of years, so this list cannot be perfectly current). The method used to code and group these articles was the inductive coding method outlined by Dubé and Pare (2003). The resultant items discovered are listed in Table 1.

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

Table 1. Strategic Foci

Our analysis of academic literature tended to confirm a bias in strategic management literature discussing 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, a confirmatory step was taken to compare academic assumptions to recent practitioner literature with respect to the 2009 automotive "bailout." In this context, 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 (Klier and Rubenstein 2011). Strategic foci were addressed both quickly and simultaneously as the H-v environment dictated. This apparent gap in the academic and practitioner treatment of strategy raises two concerns: first, if DSS designers follow the lead of academics in developing H-v DSSs, those solutions may be incomplete; second, each of the strategic foci remain relevant in an H-v environment. Finally, this search confirmed that an H-v strategic environment does not change the focus of strategy (outputs), but the *actions* and *thought processes* required to make those decisions, considered next.

Input Variable: H-v Strategic Environment

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 focusing on how decisions themselves are affected by the H-v environment. 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 over the period 1990-2009, 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 (2003), identifying six components (see Table 2).

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

Notes: (S) refers to scope concerns, and (V) refers to velocity concerns unique to an H-v environment.
Search criteria were "Decision Support," AND "Strategic" in the journals listed below.
Derived from academic (A) sources: *ACM SIGMIS Database, Decision Science, Decision Support Systems (DSS), European Journal of Operations Research, Group Decision/Negotiation, IEEE Trans. on Professional Communication, IEEE Trans. on Systems, Man and Cybernetics (Part A)*.
Derived from practitioner (P) sources: *Air and Space Power Journal, Business Week, Chief Executive, Chief Information Officer (CIO), Communications of the ACM, Computer World, e-week, Government Executive, IEEE Control Systems Magazine, IEEE Professional, Information Week, KM World, Wired*.

Table 2: H-v Strategic Decision-making Key Components

Input Variable: Decisions

As noted above, it is possible to frame decisions by their options or by their environmental constraints, the two items were mentioned previously. However, from a DSS perspective, it is also possible to conceive of decisions by their process components, defined by Simon (1947) as intelligence, design, and choice. Indeed, this is the framework used primarily in DSS research, e.g., group DSS research primarily focuses on support for idea generation—the intelligence phase (Wheeler and Valacich 1996). We note that this framework also links decisions to configuration items (mentioned below), because the configuration items support the processes required to support.

Input Variable: User

If Figure 2 shows the insufficiency of framing H-v strategic decisions in-line using traditional verbiage, it helps illustrate the point that users are generally confined to these levels of an organization, namely the tactical, operational, and strategic levels. In the systems analysis consulting experience of the authors, we have generally found that these levels of users affect the configuration items (mentioned below) required at a particular level. For example, a user at the tactical level generally requires configuration items that allow him/her to expand to the widest view of an organization—inspecting individual transactions, while a user at the strategic level generally requires configuration items that allow him/her to combine information gleaned from external sources with summary internal information—including drill-down capabilities.

The Fit Component: Configuration

At the core of our argument is our assertion that an H-v Strategic DSS should contain configurable features that support a user at a specific level of an organization with a specific decision process component, with respect to a specific environmental concern in order to make a specific strategic decision. While it might be possible to calculate all the permutations of these combinations and create individual tools to support each of these items, we point out that the nature of an H-v environment is that it requires a user to respond to a decision that he/she may have never seen before. Therefore, if one were to calculate the permutations, at the nexus of each of these items would be not be just a decision support feature, but rather, a *configurable* feature. Also, it would allow features to be decomposed and recombined. In addressing configurability, Silver (1991 p. 97) identifies four DSS configuration elements:

> ***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.*

Configuration elements can support the decision-user-environment framework in Figure 1. *Operator*s (e.g., access, combine, transform, etc.) support decisions (e.g., buy/sell, etc.), and users utilize *navigational aids* to find the operators to support a decision. Navigational aids and operators can be sequenced to better support user style or environmental necessity. Finally, *adaptors* allow a user to match operators, navigation aids and *sequencing rules* to match a changing environment. Therefore, our model suggests that an H-v Strategic DSS requires all four configuration elements, but especially adaptors.

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

This research concluded by applying the framework established above to identify H-v Strategic DSS requirements that could be compared to existing DSS systems. Table 3 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.

We note that this is merely a preliminary analysis made from a purely academic perspective. An organization wishing to apply these requirements to an actual DSS purchase decision would have to inspect and use the system to determine whether or not each of the items noted contain the correct configuration elements.

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		

Table 3. H-v Strategic DSS Requirements

CONCLUSION AND RECOMMENDATIONS

This research developed balanced evaluation criteria for H-v strategic DSS. First, it developed an H-v strategic DSS "fit" framework. Although significant research exists investigating the fit between information systems and firm strategy (McLaren et al. 2011), 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.

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. One example of configuration items used in the present researcher's consultancy is a system that generates multiple different views to personalize cyber situational awareness to the level of the user, with tactical users' views including more raw data, with the results of their analysis used to drive senior user views (and reciprocally, senior user questions/queries being used to drive tactical user builds—or even to build radio buttons or sliders for senior users to explore underlying data).

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.

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