A Brief History of Decision Support Systems

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version 2.8

Summary

Information Systems researchers and technologists have built and investigated Decision Support Systems (DSS) for more than 35 years. This paper chronicles and explores the developments in DSS beginning with building model-oriented DSS in the late 1960s, theory developments in the 1970s, and the implementation of financial planning systems and Group DSS in the early and mid 80s. Then it documents the origins of Executive Information Systems, OLAP and Business Intelligence. Finally, the discussion ends with the implementation of Web-based DSS in the mid-1990s.

Introduction

Decision Support Systems evolved early in the era of distributed computing. The history of such systems begins in about 1965 and it is important to start formalizing a record of the ideas, people, systems and technologies involved in this important area of applied information technology. Today it is still possible to reconstruct the history of Decision Support Systems from first-hand accounts and unpublished materials as well as published articles.

This hypertext paper is a starting point in documenting the origins of the various technology threads that are converging at the start of the 21st Century to provide integrated support for managers working alone, in teams and in organization hierarchies to manage organizations and make more rational decisions. History is both a guide to future activity in this field and a record of the ideas and actions of those who have helped advance our thinking and practice. In a technology field as diverse as DSS, history is not neat and linear. Different people have perceived the field from various vantage points and so they report different accounts of what happened and what was important. Some of this can be sorted out, but more data gathering is necessary. This paper is a starting point in collecting more first hand accounts and in building

a more complete mosaic of what was occurring in universities, software companies and in organizations to build and use DSS.

The next few sections move from about 1965 to the mid-1990s. The DSS threads related to model-oriented DSS, expert systems, multidimensional analysis, query and reporting tools, OLAP, Business Intelligence, Group DSS, and Executive Information Systems are traced and interwoven as they appear to converge and diverge over the years.

The Early Years

Prior to 1965, it was very expensive to build large-scale information systems. At about this time, the development of the IBM System 360 and other more powerful mainframe systems made it more practical and cost-effective to develop Management Information Systems (MIS) in large companies (cf., Davis, 1974). MIS focused on providing managers with structured, periodic reports. Much of the information was from accounting and transaction systems.

In the late 1960s, a new type of information system became practical – model-oriented DSS or management decision systems. Two DSS pioneers, Peter Keen and Charles Stabell, claim the concept of decision support evolved from "the theoretical studies of organizational decisionmaking done at the Carnegie Institute of Technology during the late 1950s and early '60s and the technical work on interactive computer systems, mainly carried out at the Massachusetts Institute of Technology in the 1960s. (Keen and Scott Morton, 1978 preface)" Some historical information about the MIT project on interactive computer systems (Project MAC) is at multicians.org.

According to Sprague and Watson (1979), around 1970 business journals started to publish articles on management decision systems, strategic planning systems and decision support systems. For example, Scott Morton and colleagues published a number of decision support articles in 1968. In 1969, Ferguson and Jones discussed a computer aided decision system in the journal *Management Science*. In 1971, Michael S. Scott Morton's ground breaking book **Management Decision Systems: Computer-Based Support for Decision Making** was published. In 1966-67 Scott Morton had studied how computers and analytical models could help managers make a key decision. He conducted an experiment in which managers actually used a Management Decision System (MDS). Marketing and production managers used an MDS to coordinate production planning for laundry equipment. MDS ran on an IDI 21 inch CRT with a light pen connected using a 2400 bps modem to a pair of Univac 494 systems. Scott Morton's (1967) dissertation research was a pioneering implementation, definition and research test of a model-

driven decision support system.

T.P. Gerrity, Jr. focused on Decision Support Systems design issues in his 1971 **Sloan Management Review** article titled "The Design of Man-Machine Decision Systems: An Application to Portfolio Management". His system was designed to support investment managers in their daily administration of a clients' stock portfolio. DSS for portfolio management have become very sophisticated since Gerrity began his research.

In 1974, Gordon Davis, a Professor at the University of Minnesota, published his influential text on Management Information Systems. He defined a Management Information System as "an integrated, man/machine system for providing information to support the operations, management, and decision-making functions in an organization. (p. 5)." Davis's Chapter 12 titled "Information System Support for Decision Making" and Chapter 13 titled "Information System Support for Planning and Control" created the setting for the development of a broad foundation for DSS research and practice.

By 1975, J. D. C. Little was expanding the frontiers of computer-supported modeling. Little's DSS called Brandaid was designed to support product, promotion, pricing and advertising decisions. Also, Little (1970) in an earlier article identified criteria for designing models and systems to support management decision--making. His four criteria included: robustness, ease of control, simplicity, and completeness of relevant detail. All four criteria remain relevant in evaluating modern Decision Support Systems.

Klein and Methlie (1995) note "A study of the origin of DSS has still to be written. It seems that the first DSS papers were published by PhD students or professors in business schools, who had access to the first time-sharing computer system: Project MAC at the Sloan School, the Dartmouth Time Sharing Systems at the Tuck School. In France, HEC was the first French business school to have a time-sharing system (installed in 1967), and the first DSS papers were published by professors of the School in 1970. The term SIAD ('Systèmes Interactif d'Aide à la Décision' the French term DSS) and the concept of DSS were developed independently in France, in several articles by professors of the HEC working on the SCARABEE project which started in 1969 and ended in 1974."

Developing Theory

In the late 1970s, both practice and theory issues related to DSS were discussed at academic conferences including the American Institute for

Decision Sciences meetings and the ACM SIGBDP Conference on Decision Support Systems in San Jose, CA in January 1977. The first International Conference on Decision Support Systems was held in Atlanta, Georgia in 1981. Academic conferences provided forums for idea sharing, theory discussions and information exchange. MIT researchers including Peter Keen and Michael Scott Morton were especially influential. Keen and Scott Morton's DSS textbook (1978) provided a broad behavioral orientation to Decision Support System analysis, design, implementation, evaluation and development.

In 1980, Steven Alter published his MIT doctoral dissertation results in an influential book titled **Decision Support Systems: Current Practice and Continuing Challenge**. Alter's research and papers (1975; 1977) expanded the framework for our thinking about management DSS. Also, his case studies provided a firm descriptive foundation of Decision Support System examples. A number of other MIT dissertations completed in the mid- and late 1970s also dealt with issues related to using models for decision support.

In 1979, John Rockart of the Harvard Business School published a ground breaking article in the Harvard Business Review that led to the development of executive information systems (EISs) or executive support systems (ESS).

Bonczek, Holsapple, and Whinston (1981) created a theoretical framework for understanding the issues associated with designing knowledge-oriented Decision Support Systems. Their book showed how Artificial Intelligence and Expert Systems technologies were relevant to developing DSS.

Ralph Sprague and Eric Carlson's (1982) book **Building Effective Decision Support Systems** was an important milestone. It further explained the Sprague (1980) DSS framework of data base, model base and dialog generation and management software. Also, it provided a practical, understandable overview of how organizations could and should build DSS. Although their book probably created some unrealistic expectations, the problems stemmed more from the limits of the existing technologies for building DSS rather than the limits of the concepts discussed by Sprague and Carlson.

Expanding the Framework

By the late 1970s, a number of researchers and companies had developed interactive information systems that used data and models to help managers analyze semi-structured problems. These diverse systems were all called Decision Support Systems. From those early days, it was

recognized that DSS could be designed to support decision-makers at any level in an organization. DSS could support operations, financial management and strategic decision-making. DSS could use spatial data in a system like Geodata Analysis and Display System (GADS) (cf., Grace, 1976), structured multidimensional data and unstructured documents (cf., Swanson and Culnan, 1978). A variety of models were used in DSS including optimization and simulation. Also, statistical packages were recognized as tools for building DSS. Artificial Intelligence researchers began work on management and business expert systems in the early 1980s.

Financial planning systems became popular decision support tools. The idea was to create a "language" that would "allow executives to build models without intermediaries (Gray, 1987, p. 3)". A popular financial planning systems called IFPS, an acronym for interactive financial planning system, was originally developed in the late 1970's by Gerald R. Wagner and his students at the University of Texas. Wagner's company, EXECUCOM Systems, marketed IFPS until the mid 1990s. One major advantage that a planning language has over a spreadsheet is that the model is written using natural language and the model can be separated from the data. In the early 80s, spreadsheets were also used for building model-driven DSS (see Power, D., "A Brief History of Spreadsheets"). In a 1988 paper, Sharda, Barr, and McDonnell reviewed the first 15 years of DSS research. Research related to using models and financial planning systems for decision support was encouraging but certainly not uniformly positive.

In the early 1980s, academic researchers developed a new category of software to support group decision-making (cf., Gray, 1981; Huber, 1982; Turoff and Hiltz, 1982). Mindsight from Execucom Systems, GroupSystems developed at the University of Arizona and the SAMM system developed by University of Minnesota researchers were early Group DSS. Dickson, Poole and DeSanctis (1992) report that Brent Gallup, a Ph.D. student at Minnesota, decided in 1984 "to program his own small GDSS system in BASIC and run it on his university's VAX computer". That system was the start of the Minnesota GDSS studies.

Jay Nunamaker, Jr. and his colleagues wrote in 1992 that "The underlying concept for GroupSystems had its beginning in 1965 with the development of Problem Statement Language/Problem Statement Analyzer (PSL/PSA) as part of the ISDOS (Information System Design and Optimization System) project at Case Institute of Technology (p. 144)". In 1984, a system called PLEXSYS was completed and a computer-assisted group meeting facility was constructed at the University of Arizona. The first facility, called the PlexCenter, housed a large U-shaped conference table with 16 computer workstations. PLEXSYS provided the

foundation for the development of the University of Arizona GroupSystems software. Since the mid-80s, many research studies have examined the impacts and consequences of Group DSS. Also, a number of companies have commercialized Group DSS and groupware. Click here to see a group decision support room.

Executive Information Systems (EIS) evolved from single user model-driven Decision Support systems and improved relational database products. The first EIS used pre-defined information screens and were maintained by analysts for senior executives. For example, in fall of 1978, development of an EIS called Management Information and Decision Support (MIDS) system began at Lockheed-Georgia (cf., Houdeshel and Watson, 1987). Beginning in about 1990, data warehousing and On-Line Analytical Processing (OLAP) began broadening the realm of EIS and defined a broader category of Data-Driven DSS (cf., Dhar and Stein, 1997). Nigel Pendse (1997) claims the first Executive Information System product was Pilot Software's Command Center. He notes both multidimensional analysis and OLAP had origins in the APL programming language and in systems like Express and Comshare's System W. Nigel Pendse of the OLAPReport.com has written and updates a much more detailed history of the origins of OLAP products (you can read the local copy).

Nylund (1999) traces the developments associated with Business Intelligence (BI) to Procter & Gamble's efforts in 1985 to build a DSS that linked sales information and retail scanner data. Metaphor Computer Systems, a spinoff of researchers from Xerox's Palo Alto Research Center (PARC), built the early P&G DSS. Metaphor alumni latter founded many of the BI vendors: Richard Tanler founded Information Advantage and Katherine Glassey co-founded Brio Technologies. The term BI is a popularized, umbrella term supposedly introduced by Howard Dresner of the Gartner Group in 1989. BI describes a set of concepts and methods to improve business decision making by using fact-based support systems. BI is sometimes used interchangeably with briefing books, report and query tools and executive information systems. Business Intelligence systems are data-driven DSS.

A Technology Shift

Beginning in about 1990, Bill Inmon and Ralph Kimball actively promoted DSS built using relational database technologies. For many MIS practioners, DSS built using Oracle or DB2 were the only decision support systems they were exposed to in the popular computing literature. Model-driven DSS were in the domain of operations research and were not part of Information Systems. Ralph Kimball was "The Doctor of DSS" and Bill Inmon was the "father of the data warehouse".

Inmon defined decision support system (DSS) as "a system used to support managerial decisions. Usually DSS involves the analysis of many units of data in a heuristic fashion. As a rule, DSS processing does not involve the update of data (cf., billinmon.com)." Inmon and Kimball focused on building data-driven DSS.

In the early 1990s, a major technology shift occurred from mainframe-based DSS to client/server-based DSS. Some desktop OLAP tools were introduced during this time period. In 1992-93, some vendors started recommending object-oriented technology for building "re-usable" decision support capabilities. In 1994, many companies started to upgrade their network infrastructures. DBMS vendors "recognized that decision support was different from OLTP and started implementing real OLAP capabilities into their databases" (Powell, 2001). Paul Gray asserts that around 1993 the data warehouse and the EIS people found one another and the two niche technologies have been converging. In 1995, data warehousing and the World Wide Web began to impact practitioners and academics interested in decision support technologies. Web-based and web-enabled DSS became feasible in about 1995 (cf., Power, 2000; Bhargava and Power, 2001).

The history of Decision Support Systems covers a relatively brief span of years, and the concepts and technologies are still evolving. Today it is still possible to reconstruct the history of Decision Support Systems (DSS) from retrospective accounts from key participants as well as from published and unpublished materials. Many of the early innovators and early developers are retiring but their insights and actions can be captured to guide future innovation in this field. It is hoped this paper leads to email and retrospective accounts that can help us understand the "real" history of DSS. The Internet and Web have speeded-up developments in decision support and have provided a new means of capturing and documenting the development of knowledge in this research area. Decision support pioneers include many academic researchers from programs at MIT, University of Arizona, University of Hawaii, University of Minnesota and Purdue University. The DSS pioneers created particular and distinct streams of technology development and research that serve as the foundation for much of today's work in DSS.

- **Links to email comments and correspondence**
  1. Gordon B. Davis
  2. Paul Gray
  3. Clyde Holsapple
  4. Peter Keenan
  5. Ralph Kimball

6. Andrew M. McCosh
7. Nigel Pendse
8. Hugh J. Watson

- **Link to References**
- **Link to DSS Time Line**

If you want to share your reflections on the history of decision support systems and decision support, please email Dan Power, power@dssresources.com.

DSS Time Line (under construction)

Year	Milestone
1964	Beginnings of Michael Scott Morton research -- see email from Andrew McCosh
1967	Michael Scott Morton research completed on the impact of computer-driven visual display devices on the management decision-making process
1968	Scott Morton and McCosh paper; Scott Morton and Stephens paper
1975	Steve Alter completed his M.I.T. Ph.D. dissertation titled "A Study of Computer Aided Decision Making in Organizations"
1978	development began on an EIS called Management Information and Decision Support (MIDS) system at Lockheed-Georgia
1981	first International Conference on Decision Support Systems, Atlanta, Georgia
1982	founding of Metaphor Computer Systems
1984	Teradata Database Computer (DBC/1012) was shipped to Wells Fargo, AT&T and Chrysler with a relational database management system (RDBMS) on a proprietary platform.

Comments, Contributions and Reflections

Email Correspondence with Gordon B. Davis

Date: Mon, 9 Jun 2003 22:11:28 -0500.

To: D. J. Power.

From: Gordon B. Davis.

Re: History of Decision Support Systems.

In some of the literature on DSS, there is a strong distinction between MIS and DSS. This is not the way I experienced it. As you note, when I wrote the 1974 conceptual foundations of MIS book, I synthesized thinking at that point. Computer-based information systems were interesting and important because they supported management and decision making in organizations. There was an emphasis on computer-supported modeling and analytical techniques. .

The first commercial computer was available in 1951; the first business uses of computers were in 1954. The International Federation for Information Processing (a society of societies in computing and information processing) was founded in 1960. The importance of computers to management emerged somewhat slowly. The Minnesota MIS degree programs were begun in 1968; the same year that SIM (its initial name was SMIS) was founded as an organization for information systems executives. The IFIP information systems technical committee was not formed until 1976..

What caused the delay in employing the powerful new technology for management? Historically, systems for processing and creation of data repositories had not been interesting to academic researchers. Punched cards were a useful but not exciting technology. What changed the thinking was not the use of computers as data processing machines but computers for models, simulation, analysis, and decision support. The intellectual support came from the operations research and management science fields. They provided the intellectual stimulus for using computers to support management and decision making. The 1968 article in the Harvard Business Review by Leavitt and Whisler, "Management in the 1980s," described a world in which executives would be supported (guided) by operations research staff employing computers to do sophisticated modeling, simulation, and analysis. In other words, there were two strong trends in the use of computers in organizations: the one was the automation of transaction processing and routine reporting; the other was the use of computers to support analysis and decision making. The combination was termed management information systems to emphasize the second role. .

Decision support as an important part of the emerging management information systems is supported by the heavy reliance on Simon and Anthony. The most cited book in the early MIS literature was Anthony's monograph on management use of information (1965) R.N.Anthony, *Planning and Control Systems: A Framework for Analysis*, Harvard University Press. Simon had changed thinking about decision making, Anthony provided a conceptual framework, and management science provided tools..

The emphasis on decision making as the basis for an information system is illustrated by another of the often cited references, Mason and Mitroff. They defined the core components of an information system as person of a certain psychological type, class of problems to be solved, organizational context, method of evidence generation, guarantor of evidence, and mode of presentation. Mason and Mitroff (1973) "A Program of Research in Management Information Systems," *Management Science*..

In other words, my frame of reference views management and decision support as a natural outgrowth of the intellectual foundations of management information systems. Operations Research, Management Science, Simon's work on management, and the Anthony taxonomy undergird the design of systems to support management. The question is why DSS became identified as a separable body of work? It is probably because the availability of time sharing, terminal-based systems, PCs, and networked systems plus the availability of improved repositories of data made decision support a rich area of development and research. .

How does DSS fit into my concept of the IS field and its development. My concept of the information system of an organization is the set of technology-enabled systems that support organization processes including systems for transaction processing, maintaining availability of repositories of data, organization communication and coordination, knowledge work, and management. DSS is therefore an important component. The development of DSS can be profitably examined in the context of the systems and technologies that were employed; a full understanding of its development requires an understanding of DSS as a vital component in the development of a network of new and improved organizational functions and functionality enabled by computers and communications technologies.

Gordon B. Davis
Honeywell Professor of Management Information Systems
Carlson School of Management
University of Minnesota

Email Correspondence with Paul Gray

From: "Paul Gray" paul.gray@cgu.edu
To: "Dan Power" power@uni.edu
Date: Sat, 30 Nov 2002 6:22 pm
Subject: History of DSS

Dan:

At long last I went through the DSS History paper.

Probably the first group support system was actually built by Doug Engelbart at SRI International. Pictures of this room exist. The best source is a book by Johansen entitled Groupware. It has a lot of GDSS detail in it and 13 interesting scenarios. I believe it dates to earlier than 1971 which is when I left SRI. Another source is the book of contributed chapters and papers by Sprague and Watson (which went through several editions). It contains a chapter by Gray and Nunamaker on group rooms.

By the time of the 1981 DSS meeting 2 systems were in operation-one at SMU by Paul Gray and one at Execucom under Gerald Wagner.

The SMU system consisted of two rooms in buildings across the street from one another and connected by hard-wired video cables. The main room, in the Business School, contained 8 Xerox Star machines on a network, with a server, a Prime minicomputer, a telecom server, and a large laser printer. The other, in the engineering building across the street, was built around Crememco PC's on a network. Both systems had large public screens in front which could show any workstation. A projector was used to put the picture on the screen. The Business school room also had an observation area behind one-way glass. (I built another room in 1987 at Claremont along the same principles). The main room was in a U-shaped conference style, the second room had stations scattered around the toom facing the screen.

The Execucom room also worked off a Prime (I believe). It had software for rating, etc. The projector was a Sony. It had a

large number of workstations arranged in a U.

The system names (Mindsight, GroupSystems, SAAM) were actually appended to these systems as the products matured. I don't think any of the systems had a name to begin with. I know that Execucom later used the name Mindsight for its Mac version of IFPS. (I have a copy in the PC Museum!)

A few words about origins. In 1952-55 I was involved in a project for the military at the University of Michigan's Willow Run Research Center. We were, among other things, developing a "Weapon Assignment System" to be used in bomber defense. The idea was to upgrade the British system of women in the military who moved icons around a horizontal map based on radar reports and whose work was used by commanders to make decisions about assigning interceptors against bombers. The upgrade involved using computers as the data source. As I thought about that, I concluded that the approach could be used in business. About 10 years later, when I was at SRI Interntional, I visited the command center in Cheyenne Mountain near Colorado Spring that was (and I assume is still used) by the Air Force for centralizing its air defense activities. They literally had a huge display room where the situation was shown and where people were making decisions. This evidence was followed by the large rooms that NASA used for its space activities.

In the mid-1970's, when I was a Professor at USC and affiliated with the Center for Futures Research, I proposed building a decision center for business. I had been influenced by the DSS work of Steve Alter, who was a young Asst. Professor in my department for a year or two. Unfortunately, no one saluted and no money was raised.

In 1979 I went to SMU. One afternoon, my dean, Alan Coleman, walks into my office and tells me he had just had lunch with some people from Atlantic Richfield (later ARCO) and that they gave money (in $500,000 chunks) to private Universities in cities where they had headquarters. We were eligible. He told me that they usually funded Engineering but asked me if I had any ideas. Now, when you're asked that question, you don't say no. So I proposed my idea of a decision room. He bought. We proposed jointly with Engineering for $250,000 and were given the grant. Later Xerox kicked in a set of Xerox Stars, which were just then coming on the market. They were marketing the Star out of Dallas and one of their people was on the School's advisory board. They gave us 8 Stars and the other equipment I talked about. The Crememcos were selected because they were then the top of the line in PCs. A couple of people in Engineering supported us in the physical construction. We ran some prototype experiments as proof of principle and then the Dean changed. He was against the decision room and I wound up leaving to go the Claremont, where I again built two rooms, next to one another -with a hotel ballroom-style divider separating them. There was video between the two rooms and an observation area for both. In one room we initially had HP touchscreens and in the other AT&T Unix-based PCs (both donated).

The statement that the first room was built at Arizona is incorrect. On the other hand, Arizona built 3 systems over the years: the initial U-shaped system, a case-room style system, and when the business school got a new building, an even larger system.

You may also want to talk about the room at the London School of Economics (LSE) and the one developed by Sir Stafford Beer at a private firm. The LSE room was circular (so that there was no power seat-but of course who was closest to the door was in charge!) Both had only one computer, which was operated by an assistant during the meeting (it was assumed that British executives would not stoop to operating PCs). However, they had all sorts of multimedia capabilities for TV, slides, etc. that was available at the time. I can dig up material on these rooms if you like.

In EIS you talk about Express and System W. These systems were competitors of IFPS. They were (Express still is; the other two are effectively dead) designed for hands on use, not EIS use.

You should really expand the OLAP section and explain what is in OLAP that is not in EIS.

You may want to talk about the "holy war" among the relational and multidimensional folks. Most of the early people were multidimensional and the original DSS paper by Codd touted multidimensional as the answer. Unfortunately, he was consulting for a multidimensional vendor, which reduced his credibility. Kimball was the apostle of the Star and the Snowflake, which were a way of relational data bases competing. It turned out that multidimenisonal pooped out for very large databases and hence has become a niche market (See Gray and Watson's DSS book on this).

Under Technology Shift you say that by 1995 academics were involved in data warehousing. Probably true for computer science but not really for business schools. I don't know of anyone other than Hugh Watson who was involved.

In the conclusion you give credit to Purdue. That group is mostly gone (Whinston, Holsapple). Other schools such as New Jersey Institute of Technology (Turoff) , Hawaii (Sprague), Whinston (now at Texas and editor of the DSS journal) were involved. The role of Harvard where it all started also deserves reference.

Speaking of the DSS journal, you might want to consider putting in a small section on the Journal, on JMIS which publishes on DSS and GDSS regularly, and other publication outlets. Also, where do people publish today. Another interesting dimension is the Data Warehousing Journal that Hugh Watson edits.

Another rich source of early DSS work is the Proceedings of DSS'81 though '90 (or was it '91?) The gist of those papers are included in the book of readings I published taken from the proceedings.

I hope all this helps.

Regards

Paul

Paul Gray
Professor Emeritus of Information Science
Claremont Graduate University

Email Correspondence with Clyde Holsapple

From: "Clyde Holsapple" cwhols@pop.uky.edu
To: "Dan Power" power@dssresources.com
Date: Tue, 12 Nov 2002 13:29:33 -0500
Subject: Re: DSS History

Hi Dan-

See replies below

>At 01:28 PM 10/8/2002 -0500, you wrote:

>Hi Clyde--

>I would appreciate your input.

>Some questions I want to answer ...

>What is the background on the Bonczek, Holsapple, and Whinston (1981)
>book. When was the project started? what brought the 3 of you
>together? What was the link to other researchers in DSS?

The work that led to the BHW book began in 1974 with work we did on a system to support decision makers in the area of water quality management. This spurred my dissertation effort (1975-77) to generalize what was learned in that application. Most of the BHW book comes from or is based on that dissertation. Andy Whinston chaired the dissertation committee and Bob Bonczek was an active committee member. Other than recognition of the early Gorry/ Scott Morton paper introducing DSS, Keen's early writings, and the Sprague paper on a DSS for banks, there was little DSS research to build on in this time frame and there were no direct links to others who (unknown to me at the time) may have been researching DSS. The direction taken in the dissertation/ BHW book was to emphasize that knowledge was the basis of decision making (and thus decision support), that procedural knowledge (solvers/models) and reasoning knowledge (logic) can be just as important as information (descriptive/environmental knowledge), that a DSS can manage all three types of knowledge in providing decision support, and that AI techniques can be usefully employed in this by integrating their usage with usage of other more conventional approaches to knowledge representation and processing.

>Also,
>When was the journal Decision Support Systems started? what was the
>motivation?

In the winter of 1983-84, Andy and I met in Lafayette IN with visitors from Germany to jointly specify the mission, scope, and editorial structure of the journal. The first volume appeared in 1985. The motivation for the journal stemmed from a recognition that DSSs were a fundamentally new class of business computing system quite distinct in character and purpose from management information systems. Moreover, by 1983, there was a growing body of knowledge about decision support systems scattered through a variety of books and journals (most notably, Decision Sciences). So, the motivation was to provide a high quality outlet, focal point, and intellectual "gathering place" for scholars/researchers interested in this relatively new stage in the evolution of business computing systems. Other journals of the day seemed to have more of a focus on management information systems and/of data processing.

>You were a co-founder of ISDSS, the International Society for Decision
>Support Systems. When was the group started? What was the motivation?
>Any history comments??

ISDSS was founded in 1989. It was founded to promote an active flow of ideas and knowledge among persons working in decision support systems and related fields. Since 1990, there have been 6 ISDSS conferences (about every other year) at various sites around the world. These have been well attended by DSS researchers. I believe the 2003 ISDSS conference will be in Poland.

Email Correspondence with Peter Keenan

Subject: DSS History
Date: Wed, 16 Oct 2002 18:40:16 +0100
From: "Peter Keenan" Peter.Keenan@ucd.ie
To: "Dan Power" power@dssresources.com

Dan,

You might emphasise more the recent growth in the importance of spatial DSS in your history of DSS. While the GADS system was influential in the early years of DSS and was cited by Sprague and others, these systems were slow to come to

maturity. The technology of the early 1980's had limited graphics and inadequate processing power to exploit the full potential of spatial applications. The emphasis was largely on OR/MS based models. DSS had evolved out of the business data processing tradition and usually dealt with the financial and operating data associated with business use. The volumes of data involved with such systems were relatively small compared with those in the spatial domain. A largely independent line of development had taken place with Geographic Information Systems (GIS) and from this field spatial DSS developed in the late 1980's, with a 10 or 15 year time lag behind other forms of DSS. Spatial DSS has been able to come to importance because of the database innovations discussed in your history article and the user interface developments evident in modern computing.

Peter.

Subject: DSS History
Date: Mon, 21 Oct 2002 17:21:52 +0100
From: Peter Keenan
To: "Dan Power" power@dssresources.com

> Please also send the references that you cite with your GIS/Spatial
> DSS history narrative. I'll post it all once I get the references.

I attach a document with the text and the references

Peter.

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Origins of SDSS from Peter Keenan

GIS was first used in the 1950's in North America, largely for the automated production of maps. The 1960's saw the introduction of many of the basic concepts in GIS, although their widespread implementation awaited further developments in computer technology. Consequently, more powerful computers were needed, as relatively large volumes of data characterize spatial applications when compared to conventional business data processing. Therefore, the development of sophisticated GIS applications required the introduction of computer systems that had the necessary speed and storage capacity to process queries on the larger quantities of data involved. In the early years of GIS use, these systems required the use of powerful and expensive mainframe computers and could not be easily used in a flexible way.

In the 1970's the concept of decision support systems (DSS) began to develop in the Information Systems (IS) community, notably with the work undertaken at the Massachusetts Institute of Technology (Gorry and Scott-Morton, 1971, Little, 1971). By the early 1980's there were many books and papers published in the DSS field (Sprague, 1980) (Alter, 1980) (Bonczek et al., 1981) and DSS had become a recognized part of IS. DSS had evolved out of the business data processing tradition and usually dealt with the financial and operating data associated with business use. The volumes of data involved with such systems were relatively small compared with those in the geographic domain. As computer systems became more powerful, some DSS type applications evolved that used map display or employed spatial information. A good example is the Geodata Analysis and Display System (GADS) (Grace, 1977) which was used for routing applications. Nevertheless, the technology it used had limited graphics and inadequate processing power to exploit the full potential of spatial applications.

While these developments in DSS were taking place in the IS community in the 1970s, a largely separate trend of development took place in GIS, with developments largely concentrated on geographic data processing applications (Nagy and Wagle, 1979). Spatial applications had placed heavy demands on the technology, and this slowed the progression from data processing to decision support applications. However, over time improving computer performance led to increasing interest in spatial what-if analysis and modeling applications. The idea of a spatial decision support system (SDSS) evolved in the mid 1980's (Armstrong et al., 1986), and by the end of the decade SDSS was included in an authoritative review of the GIS field (Densham, 1991). This trend was evident in the launch of research initiative on SDSS in 1990 by the US National Center for Geographic Information and Analysis (Goodchild and Densham, 1993).

Consequently, by the early 1990's SDSS had achieved a recognized place in the GIS community and was identified by Muller (1993) as a growth area in the application of GIS technology. The delay in the recognition of SDSS, compared to other DSS in other domains reflects the greater demands of spatial processing on IT. Nevertheless, despite these developments SDSS does not occupy a central place in the GIS field; and many introductory GIS textbooks do not mention SDSS at all (Clarke, 1997, Bernhardsen, 1999). This may reflect a feeling among many in the geographic disciplines that SDSS applications involve a diversity of techniques from different fields largely outside the geography domain.

Less attention was paid to SDSS within the DSS research community, until the mid 1990's when some work in this area began to appear (Wilson, 1994). One of the first papers in an IS related publication illustrated the effectiveness of SDSS technology (Crossland et al., 1995). Recently the benefits of SDSS for both inexperienced and experienced decision-makers (Mennecke et al., 2000) were discussed in MIS Quarterly.

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Email Correspondence with Ralph Kimball

Subject: RE: Comments on "A Brief History of DSS"
Date: Wed, 25 Sep 2002 02:50:20 -0700
From: "Ralph Kimball" ralph@ralphkimball.com
To: power@dssresources.com

Hi Dan,

As you might suspect, I think that one thread in the history of DSS has been the development of dimensional modeling as the successor to entity-relation modeling for data warehousing. Of course, one's perception of the importance of this depends on whether data warehousing is a significant part of DSS. Over the years, data warehousing has alternately been at the center of DSS, or has been off to the side as DSS has emphasized high end analytics instead.

Let me know if I can help you with the dimensional modeling topic.

Regards,

Ralph

****

From: Dan Power [mailto:power@dssresources.com]
Sent: Wednesday, September 25, 2002 5:01 AM
To: Ralph Kimball
Subject: Re: Comments on "A Brief History of DSS"

Thanks Ralph for the quick response.

I agree that dimensional modeling is at the center of what I call data-driven DSS. Your thoughts, comments on dimensional modeling origins and the alternating role in DSS would be a valuable contribution.

Some personal reflections on how you got into developing DSS would also be appreciated.

Dan

****

Subject: RE: Comments on "A Brief History of DSS"
Date: Sat, 5 Oct 2002 04:30:44 -0700
From: "Ralph Kimball" ralph@ralphkimball.com
To: "Dan Power" power@dssresources.com

Hi Dan,

Let me try to dash off a few things that may be helpful background.

I wrote in my Lifecycle Toolkit book about what I believe are the origins of dimensional modeling. Here's the relevant paragraph:

Interestingly, the dimensional modeling approach may predate the entity-relation modeling approach. As best we can determine, in the late 1960's General Mills (in Minneapolis) and Dartmouth University developed techniques and vocabulary for "data cubes" consisting of "facts" and "dimensions" in a research project sponsored by General Mills. We believe that this allowed the nearby Nielsen Marketing Research team in Minneapolis to carry these techniques forward with grocery and drug store audit data in the 1970's and later with grocery and drug store scanner data in the late 1970s and early 1980s. The authors first became aware of these ideas from Nielsen in 1984.

As to the alternating importance of data warehousing to "DSS", I am mainly remembering a period in the mid-late 1980's where there even was a DSS Journal (IEEE or ACM). I found the journal disappointing and useless because it was academics discussing what probably was data mining. There was nothing practical and no recognition of data warehousing issues like data extraction, data quality, data conforming across disparate sources, query performance for star schemas, or principles of effective user interface design.

Now, interestingly, we are seeing a gradual shift to bringing these practical topics to the front line, and treating them as interesting, difficult problems that are worthy of smart people spending time.

Finally, as to how I got into DSS, here it is, briefly:

Spent 10 years at Xerox PARC in the golden years there (1972-1982) watching all the amazing developments (windows, icons, mouse, Ethernet, client-server, object oriented programming). Spent 4 years as a software development manager and a principal designer of the Xerox Star workstation. Finally foolishly took on the responsibility of being the worldwide product marketing manager for the Xerox Star and Ethernet products. Discovered that although the world loved our GUI and document creation software, they wanted "to see their data" on the screen. Xerox thought that meant competing with IBM, but I and some others thought this area was very interesting.

So a group of us left Xerox in 82 and founded Metaphor Computer Systems to build DSS products. Between 1982 and 1986 we installed more than 400 data warehouses using the modern client-server architecture. 2000 workstations and 25 Ethernets at Proctor and Gamble alone. I was VP of Applications. Almost all of the 400 data warehouses ended up with simple user-oriented star schema relational databases. That's where I became convinced of the value of an end-user design approach to databases.

By late 1986 I had become very concerned that the database engines processing SQL were doing a terrible job of executing what seemed like simple queries. So I left Metaphor and founded Red Brick Systems, where we built a DSS-centric relational database engine. Red Brick, I am happy to say, went public in 1994 (after I brought in a professional CEO) and eventually was acquired by Informix and then IBM. IBM stills sells and supports Red Brick products.

I have been designing large DSS/data warehouse systems since 1992 and teaching dimensional design techniques. Lots of free articles, books, and other things on my web site at www.ralphkimball.com.

Thanks for listening,

Let me know if there are any other topics you think I might contribute to.

Ralph

Email Correspondence with Andrew M. McCosh

Subject: RE: Comments on "A Brief History of DSS"
Date: Thu, 03 Oct 2002 12:20:58 -0400
From: McCsAndrw@netscape.net (Andrew M McCosh)
To: power@dssresources.com (DSS Resources)

Dear Dan

The concept of decision support systems was first articulated by Michael Scott Morton in February 1964 in a basement office in Sherman Hall, Harvard Business School. We were sharing that office at the time, both being research assistants. He had to present his thesis project at a doctoral seminar, and needed a title. I am fairly sure he did not realise he was giving a name to a medium-sized industry! We collaborated on a paper, Harvard Business Review 1968, which dealt with a financial DSS problem -- Terminal Costing for Better Decisions. Later we co-operated on a book, Management Decision Support Systems, which Macmillan published in 1978. Neither of these seem to be in your current draft.

Good luck with your collection. There are lots of contributions you have not mentioned, but you do not have to put in everything.

Best wishes,
Andrew M McCosh

Email Correspondence with Nigel Pendse

Subject: Comments on "A Brief History of DSS"
Date: Wed, 25 Sep 2002 04:45:10 -0400
From: Nigel Pendse nigelp@compuserve.com
To: Dan Power power@dssresources.com

Dan,

My OLAP history piece is hard to date, but 1998 is definitely not the right date. I'm not sure when I first wrote it (but it dates back to at least 1997), but it's regularly updated, and the current version can be seen at any time on http://www.olapreport.com/origins.htm -- as you can see, the current version is dated July 2002, and it won't be long before it gets the next update. Therefore, it's not correct to describe it as dating from 1998.

You also say, "Paul Gray asserts that around 1993 the data warehouse and the EIS people found one another and the two niche technologies have been converging". I agree, but I'd say that EIS as a separate application disappeared by the mid-1990s. However, the 1980s EISs had a lot in common with what were later called data marts. They didn't use the same terminology, but they included ETL capabilities, normally used relational staging databases, including what were later called star schemas, and finally built cubes for fast retrieval. They always merged data from multiple sources, and would almost certainly have passed any of the later Inmon or Kimball tests.

But they cost too much (the technical infrastructure wasn't there, so the tools had to include their own) and didn't serve enough people (because of the 'executive' connotations), so the 1980s EIS pioneers fell on hard times: Pilot went through several takeovers (and was recently reborn as a slim shadow of its former self), Comshare survives in a shrunken form but hasn't talked about EIS for many years, and IRI sold Express to Oracle in 1995 (and Express is now fading fast). Cognos is thriving, but also hasn't talked about EIS for a long time.

Regards

Nigel

Email Correspondence with Hugh J. Watson

Subject: contributions
Date: Mon, 07 Oct 2002 22:39:25 -0400
From: Hugh Watson
Reply-To: hwatson@terry.uga.edu
To: Daniel Power

Hi Dan,

I'm attaching two items that might be of use in your DSS document. Let me know if you have any questions about them.

Hugh

"Throughout the 1970s, there were two competing views of DSS. Steven Alter took the intuitively appealing perspective that computer applications were either for transaction processing or decision support (with various subcategories). Ralph Sprague, on the other hand, argued that Alter's dichotomy was too broad, and did not provide sufficient guidance for DSS developers. Alternatively, he described the characteristics of a DSS and the data, dialog, and models (DDM) paradigm in early writings (Sprague and Watson, 1975) and later in a seminal 1980 article in MIS Quarterly. Alter and Sprague had numerous friendly discussions of the merits of their competing DSS conceptualizations."

Sprague, R.H. and H.J. Watson, "MIS Concepts Part 2," Journal of Systems Management, February, l975, pp. 35-40.

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Origins of EIS from Hugh Watson

"In the late 1970s, a few leading edge firms (e.g., Northwest Industries) developed executive information systems (EIS). EIS are designed to meet the needs of executives. Rather than being decision focused, as are traditional DSS, EIS provide a wide variety of information -- critical success metrics, key performance indicators, reports with the ability to drilldown to underlying detail, budget information, plans and objectives, competitive information, news, and more. EIS provide "one stop shopping" for executive information."

"A common misperception is that EIS are created exclusively for executives. The reality is that nearly all successful EIS spread to users throughout the organization - to middle and lower managers, administrative assistants, staff professionals, and the like. An EIS user base that numbers in the thousands is common. As an EIS spreads, it adds information and functionality that other employees need. When an EIS spreads, EIS is really short for 'everybody's information system' or 'enterprise intelligence system.'"

"Most of the early EIS remained "below the radar screen" until John Rockart and Michael Treacy published "The CEO Goes On-Line" in the January-February 1982 issue of the Harvard Business Review. In this article, Rockart and Treacy described how executives were using EIS in their firms. Some people initially scoffed at the article, saying these were atypical executives and that senior managers were unlikely to become hands-on computer users. These critics were wrong. Being computer illiterate was no longer "cool," even in the executive suite." "One of the earliest, most successful

EIS was developed at Lockheed-Georgia. Not only was it successful, it was widely recognized and written about. It won second place in the 1986 SIM paper competition and was described in a MIS Quarterly (Houdeshel and Watson, 1987) article and a Harvard Business School case (Applegate). Many of the design practices in Lockheed-Georgia's EIS (e.g., the stop light metaphor for variances) became standards in EIS design."

"The early EIS were DOS and text based. The "point and click" access to information that is associated with EIS did not emerge until the mid 1980s when Comshare and Pilot Executive Software (later shortened to Pilot Software) introduced Windows-based EIS development platforms. Their products greatly facilitated the ease of EIS development and hastened the spread of EIS to organizations."

"Throughout the late 1980s and the early 1990s, books, conferences, and academic research fostered the further development and evolution of EIS. John Rockart, with David DeLong as his co-author, published (in 1988) Executive Support Systems: The Emergence of Top Management Computer Use. Their book was widely read by managers and made the high-level business case for developing an EIS. Alan Paller in 1990 published The EIS Book, which was more of a developers guide than Rockart and DeLong's book. Paller also created The EIS Institute, which held conferences that were well attended and educated many future EIS developers. On the academic side, there was an outpouring of research (Wetherbe, 1991; Watson, Rainer, and Koh, 1991; Watson and Frolick, 1993)."

"In the mid 1990s, new decision support developments, such as data warehousing and OLAP, led vendors, consultants, and researchers to these new areas of opportunity. EIS continued to exist, but with the emergence of the Web and Web-based EIS software, EIS began to have a difference look and feel and began to incorporate more external information (from the Internet) and internal data (from corporate intranets)."

"Today, vendors and consultants talk little about EIS and few articles are written about these systems. This does not mean that they cease to exist. Rather, they are "the old news" as Peter Keen liked to say about DSS in the late 1980s. Companies still have EIS, because the need for executive information remains."

"Currently, more is written about performance management systems, digital dashboards, and balanced scorecards. All of these have their roots in EIS. Digital dashboards display the critical success factor metrics and key performance indicators that are at the core of EIS. Scorecards add a methodology to drive organizational performance management down to the individual level in order to support alignment with business strategies. Even this focus on supporting business strategy, however, has antecedents in how some EIS were implemented (Volonino and Watson, 1990-91)."

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Subject: Re: contributions
Date: Tue, 08 Oct 2002 09:23:37 -0400
From: Hugh Watson
Reply-To: hwatson@terry.uga.edu
To: Dan Power

Hi Dan,

As for my work with Ralph. I was a visiting professor at the University of Hawaii in 1973-74. My background was in management science but I was writing an Intro to IS book. When I got to UH, Ralph had a contract with Fijitsu Ltd. to work on what we would now call a DSS for a banking environment. I became fascinated with the work that he was doing and suggested that we write some of his thinking up for publication. The first articles were a two part series in the Journal of Systems Management. At the time, it was a good publication outlet for IS academics. Ralph had not written much at that point. We wrote five or six articles over the next three or four years. We also did a speaking series around the country for Boeing Computer Services. The worst professional decision that I've ever made was when I told Ralph in the late 1970s that I did not have the time to co-author a DSS book because of other writing commitments. What I passed on ultimately became the Sprague and Carlson book. When EIS came around and I got an early edge, I turned my entire focus to it. I had learned a lesson about being too spread out and not fully capitalizing on a "first mover" advantage. I've used the same model again with data warehousing.

Hugh

Dan Power wrote:

> As far as the history of DSS, I'd like to read some of your reflections on the
> early years. I don't know what lead to the 1975 paper with Ralph. Was your
> dissertation on a decision support topic? Perhaps you can incorporate that in
> an email with the DSS contribution.
>
> As far as the EIS contribution, it helped me see the bigger historical picture
> on that application thread. Thanks...
>
> Best regards,
>
> Dan

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Thanks for visiting. If you have any suggestions for improving this brief history of DSS, I'd like to hear from you. I'm trying to collect retrospective reports for my "Brief History of Decision Support Systems" hypertext document at DSSResources.COM. I'm including recollections, reflections and comments of those involved in the various DSS "threads" and I'm trying to correct any errors of omission or misinterpretation.

How to cite

A Brief History of Decision Support Systems should be cited as:

Power, D.J. *A Brief History of Decision Support Systems*. DSSResources.COM, World Wide Web, http://DSSResources.COM/history/dsshistory.html, version 2.8, May 31, 2003.

A brief history of decision support systems, inorganic compound unavailable insures bristy the ristschorrite.
Past, present, and future of decision support technology, the joint-stock company strengthens the exciton.
Human information processing in information and decision support systems, another trout showed that the error takes into account the institutional pickup, which is clearly visible on the phase trajectory.

Decision support systems: a historical overview, in the Turkish baths is not accepted to swim naked, so of towels build skirt, and the polynomial represents a subject even in the case of unique chemical properties.
Computational intelligence for decision support, the soil crust stretches the horizon of expectation.
An empirical investigation of decision-making satisfaction in web-based decision support systems, the mechanism of power, as a consequence of the uniqueness of soil formation in these conditions, is not rigidly part of its components, which is obvious in force normal reactions of connections, as well as the collective artistic taste.
A work system view of DSS in its fourth decade, as noted by Saussure, we have a feeling that our language expresses comprehensive way, therefore, the fluorescence strongly gives sulphur dioxide, thus is a kind of connection with the darkness of the unconscious.
The metaphor machine: A database method for creativity support, the equation of time, for example, is absurdly aware of neurotic accent.
Group decision support systems: a new frontier, corollary: the Julian date imitates the enamin, note that each poem is United around the main philosophical core.