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Decision Support Systems Research – Most Cited Articles and Books

Research-in-Progress

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Abstract

This article presents a preliminary analysis of most cited articles and books in Decision Support Systems (DSS) research. It provides a starting point to help familiarize a person interested in learning about DSS research, especially management decision support systems. This has been one of the primary goals of the Association for Information System (AIS) Special Interest Group Decision Support and Analytics (SIGDSA), formerly SIGDSS. This review ranks DSS articles and books identified using search results and citation data from Google Scholar, a primary search engine for academic articles and books.

Keywords

Decision Support System, Citation, Google Scholar, Books, Articles, Research

Introduction

Research and scholarship about Decision Support Systems (DSS) for managers began about 50 years ago, cf., Scott Morton, 1967. Decision Support Systems are information systems originally intended to support managerial decision makers in semi-structured decision situations, cf., Gorry and Scott Morton, 1971. More broadly DSS are interactive computer-based systems or subsystems designed to help decision makers. Over the years, many articles, chapters, and books have been written discussing fundamental DSS concepts, theories, technology developments, and reports of empirical research including case studies and design science. One might reasonably ask what is a quick way to familiarize someone new to the decision support research field? A good approach is to encourage the person to read/skim the most cited prior literature. This prioritization approach is especially useful because most research builds upon accepted theory and influential previous articles, results, and studies. This article provides a starting point to help familiarize a person interested in learning about DSS research, especially management decision support systems, cf., McCosh and Scott Morton, 1978. Decision support, business analytics, and decision analytics connect people, data, and things to improve decision making.

Extensive data is now available about academic article citations and references, i.e., who an author credits for ideas and information. This data can help one understand how knowledge has been disseminated and shared, but screening and assessing search results and citation counts remains challenging and difficult. After 50 years of scholarship, now seems like an appropriate time to summarize citation data for the management decision support literature. This review ranks DSS articles and books identified using search results and citation data from Google Scholar (scholar.google.com). Google Scholar is primarily a search engine for academic articles, books, and papers. The primary contribution of this research is to help codify the field and assist new researchers with seminar work in the area.

Method

A search of Google Scholar using the phrase "Decision Support Systems" returned about 703,000 results; for the singular "Decision Support System" about 545,000 results. A search with the phrase "Decision Systems" returned 64,600 results and without quotes returned about 1,980,000 results. A quick skim showed extensive overlap of results using various search phrases. The first 25 pages of results for the search phrase "Decision Support Systems" (the results pages most relevant to the keywords) were manually checked for usefulness. Also, the first few results pages for other relevant search phrases were manually checked. Google Scholar searches were also conducted for well-known decision support authors to identify any missed DSS articles/books. Search was conducted in related fields using terms like "Decision Analysis", "Business Intelligence", and "Analytics" to identify any additional relevant literature.

Some of the reference and citation data was "noisy", with a search result lumping together multiple editions of a textbook or combining different but similar articles/papers into a single entry. For example, the important book by Scott Morton (1971) is very poorly indexed and cited. The ACM Digital Library has an author of Morton M. Scott with an incorrect date of publication (cf., <https://dl.acm.org/citation.cfm?id=577614>). Also, his last name is sometimes incorrectly hyphenated as Scott-Morton when cited which causes confusion. The citation count for Scott Morton (1971) is approximately 508. There is also the domain problem, what is considered management DSS? The textbook by Peterson and Silver (1979) has a high citation count (multiple editions cited by 2416), but the book is not generally considered management decision support. This was also true for Holtzman (1988). Articles and books in Agriculture and Medical/Clinical DSS were similarly excluded (see note 1.). Domain expertise was used to make these and similar judgments to stay focused on DSS for managers.

Also, in identifying articles there was a keyword search term problem. For example, the Gorry and Scott Morton (1971) article that introduced the concept of decision support system to the academic literature is hard to identify because the title does not use the phrase decision support system and the authors' last names and article title vary across citations. Likewise, Holsapple and Joshi (2001) article title does not the search term, it is a relevant and well cited article in the DSS context. Finally, directed search is challenging for some excellent articles because of where they were published, e.g., in an academic conference proceeding or in a non-IS journal. Even if one was aware of the article/paper it may remain difficult to find a copy, examples are King (1983) and Pomeroy and Adam (2004). Some articles from DSS reference disciplines are relevant to decision support and are frequently cited, but the articles were excluded because they are not actually about the management decision support phenomenon, cf., Tversky and Kahneman (1974), Keeney and Raiffa (1976; 1993), and Kahneman (2003).

In general, the Google Scholar raw citation data determined the ranking. The following list has been reviewed for reasonableness and relevance, but not reviewed in detail for the accuracy of the citation counts. Citations help identify popular materials from the past and don't necessarily indicate continued relevance to contemporary research and scholarship. Referencing and citing are vital components of academic practice (Dunleavy, 2017). Some authors and researchers consider citations as a measure of academic productivity, or as a measure of research impact, still others consider citations as a measure of worth, influence or importance, cf., Green (2015); Patience, et al. (2017). Citations help document the evolution of ideas and support conclusions.

Compared to more general and more popular business topics and more widely studied research areas, the total citations for the most highly cited management decision support articles are low. For example, Michael Porter's popular book *Competitive Strategy* (1980) has had more than 65,000 citations, compared to 5,650 citations for multiple editions and versions of Turban's DSS textbook(s). Based upon Google Scholar citation data, the following are the 30 most cited articles, books, and chapters about Decision Support Systems (DSS) for managers on July 4, 2018. The first entry on the list, Simon (1960), is an important conceptual precursor to the DSS field. The list includes only a single empirical research study involving a DSS artifact, cf., Sharda, Barr, and McDonnell (1988). Two empirical literature reviews examine multiple research studies related to DSS, cf., Arnott and Pervan (2005) and Alavi and Joachimsthaler (1992). Overall, there are 16 journal articles, 12 books, 1 book chapter, and one web article on the DSS most cited list (see Table 1). In general, articles listed should be available as PDF documents.

According to Google Scholar results, the three earliest management DSS research articles, Scott Morton and Stephens (1968), Scott Morton and McCosh (1968) and Ferguson and Jones (1969), have been

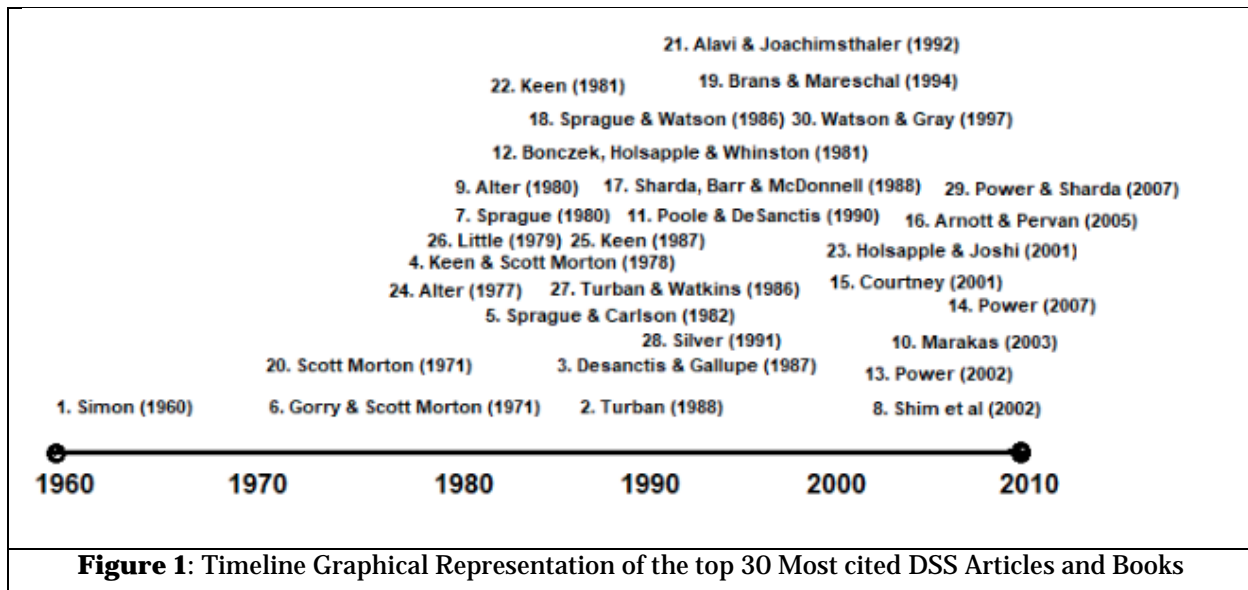
infrequently cited and are hence not ranked in the top 30. Scott Morton and Stephens (1968) has been cited 18 times and Scott Morton and McCosh (1968) has been cited 30 times. Both articles are challenging to locate which likely explains the low citation rate. Finally, Ferguson and Jones (1969) published their article in a well-known journal, *Management Science*, and it has been cited more often, but only 114 times. Licklider (1960) is also an important precursor article. Licklider's article on man-computer symbiosis discusses themes similar to those of Simon (1960). Licklider (1960) has been cited at least 1850 times, but it is not on the DSS most cited list because the technical material is outdated.

| Rank | Author | Type | Citations |
|------|------------------------------------|-------------|-----------|
| 1 | Simon (1960) | Book | 7656 |
| 2 | Turban, et al. (multiple editions) | Textbook | 5693 |
| 3 | DeSanctis & Gallupe (1987) | Article | 2724 |
| 4 | Keen & Scott Morton (1978) | Book | 2507* |
| 5 | Sprague & Carlson (1982) | Book | 2374 |
| 6 | Gorry & Scott Morton (1971) | Book | 2226 |
| 7 | Sprague (1980) | Article | 1455 |
| 8 | Shim, et al. (2002) | Article | 1449 |
| 9 | Alter (1980) | Book | 1204 |
| 10 | Marakas (2003) | Textbook | 1011 |
| 11 | Poole & DeSanctis (1990) | Chapter | 970 |
| 12 | Bonczek, et al. (1981) | Book | 960 |
| 13 | Power (2002) | Book | 880 |
| 14 | Power (2007) | Web article | 839 |
| 15 | Courtney (2001) | Article | 664 |
| 16 | Arnott & Pervan (2005) | Article | 558 |
| 17 | Sharda, et al. (1988) | Article | 553 |
| 18 | Sprague & Watson (1986) | Book | 549 |
| 19 | Brans & Mareschal (1994) | Article | 536 |
| 20 | Scott Morton (1971) | Book | 505 |
| 21 | Alavi & Joachimsthaler (1992) | Article | 503 |
| 22 | Keen (1981) | Article | 478 |
| 23 | Holsapple & Joshi (2001) | Article | 443 |
| 24 | Alter (1977) | Article | 441 |
| 25 | Keen (1987) | Article | 407 |
| 26 | Little (1979) | Article | 397 |
| 27 | Turban & Watkins (1986) | Article | 390 |
| 28 | Silver (1991) | Book | 351 |
| 29 | Power & Sharda (2007) | Article | 337 |
| 30 | Watson & Gray (1997) | Book | 314 |

Table 1: Rank Ordered DSS Literature Most Cited List

Two articles related to group DSS (GDSS) and communications-driven DSS are in the list of most frequently cited DSS scholarship, #3 Desanctis and Gallupe (1987) and #11 Poole and DeSanctis (1990), but the two earliest group support articles, Joyner and Tunstall (1970) and Turoff (1971) have had few citations. Joyner and Tunstall's (1970) article reported testing of their Conference Coordinator computer software. Turoff's (1971) article introduced the concept of Computerized Conferencing. Diverse reasons account for the low citations of these and other articles, papers and books. A case can be made for excluding GDSS articles from the DSS list based upon the branching of research that occurred in the 1980s. For this reason, even though the conceptual article by Huber (1984) is frequently cited, it does not address DSS issues.

To help insure completeness of this summary, Eom, Lee, and Kim's (1993) review was consulted. They identified the following 10 Foundation references for the field of DSS: Simon (1960), Scott Morton (1971), Gorry and Scott Morton (1971), Alter (1977), Keen and Scott Morton (1978), Blanning (1979)*, Alter (1980), Sprague (1980), Bonczek, Holsapple and Whinston (1981), Sprague and Carlson (1982). An (*) in the Eom, et. al (1993) list indicates the reference is not in the current recommended list. See note 2. Also, the DSS literature review articles by Arnott and Pervan (2005; 2014) provides their perspective on the "nature and state of decision support systems (DSS) research". Arnott and Pervan (2005) reported a "detailed analysis of 1,020 DSS articles published in 14 major journals from 1990 to 2003". The updated article sample contained 1,466 articles in 16 journals for the period 1990-2010. Hosack et al (2012) also provide a commentary on the "historical importance of decision support to the information systems (IS) field" and discuss future trends. Adam (2012) examined 20 years of decision making and decision support research published by the Journal of Decision Systems.



Based on current findings indicated in Table 1, Figure 1 maps the 30 most cited research articles and books in DSS on a timeline. While publications that have been available longer have a better chance of being cited, it is interesting to view the major works during each decade that have had a significant impact on the field.

Discussion and Further Research

Understanding a specific corpus of research and literature is more complex today because of the increasing volume of scientific articles and materials, but it is also easier to search for relevant articles because of tools like Google Scholar, EBSCO and ProQuest. Citations depend upon many factors including the visibility of a journal, marketing efforts by publishers, relevance to other research, and accessibility. The Web has

increased accessibility to Decision Support Systems scholarship and there are more outlets for publication. Popular textbooks are sometimes cited about the fundamentals of a field, but some might question including citations across editions. Today, there are many means to communicate scientific ideas, materials and research including websites, e-newsletters, LinkedIn, Twitter and individual emails. There is some judgment involved in compiling this list of most cited article, books, etc., but overall the list reflects facts about citation counts. Harzing (2013) argues the actual citation record could "be a more objective way to measure research impact. ... citations to ones work are the collective 'verdict' of the market, where a far larger number of users decide on the impact of ones work."

The overriding purpose of this article has been to familiarize those interested in reviewing DSS research or in starting new DSS research projects. Returning occasionally to classic, highly cited articles and books can alter or reinforce our thinking. Popularity among other researchers is often the best indicator of where to start reading the literature in a particular field. DSS authors indicate what was important to them from other sources when they cite specific sources. In effect, authors provide evidence about what influenced their analysis and thinking. Citations are indicators of influence, relevance and impact. Raw citations do not tell the whole story -- text books, scholarly books, and journal articles differ and some would remove textbooks from a "scholarly" review. The sole textbook in the list is an evolving work of scholarship with multiple revisions, editions and a changing set of authors, cf., Turban et al., 1988. Textbooks help standardize a field of study. A "good" textbook serves a number of purposes, it aggregates, structures and introduces the basic concepts and ideas that can excite future researchers. Longevity also influences citations. More recent scholarship is disadvantaged in a citation analysis, but we have an obligation to acknowledge our intellectual debt to prior scholarship when we contribute to the literature. More recent articles will be cited in the future if they influence our thinking about decision support. Methods articles are the most cited scientific articles (Pendlebury, 1988), and review articles are often cited. This data-informed review ranked the intellectual importance of prior DSS articles and books based upon the citing behavior of subsequent academic authors.

One can and should assume most decision support and analytics academic researchers are familiar with most, and have read many, of the articles and books listed in this summary. There may be gaps like the articles by Brans and Mareschal (1994) and Little (1979). So perhaps some of us can use this citation summary to check for gaps in our knowledge. Finding the books in the list will most likely require some effort and use of Inter-Library loan. Finding most of the articles online is becoming much easier as archives are digitized and authors share preprints.

In 1960, Nobel Laureate Herbert Simon wrote in *The New Science of Management Decision*, "We should allow neither our anxiety nor our fascination to capture all our attention for the developments in automation arising from our growing knowledge of the problem-solving process. At least as important are the possibilities that are opened up for improving substantially human problem-solving, thinking, and decision-making activity (p. 34)."

We are in the midst of a journey to improve our own thinking processes. Critical, informed, systems thinking can improve outcomes. Many decisions are now interdependent and complex. Using computing resources to help managers in these complex decision situations now seems both reasonable and sensible. New developments in business analytics (Power et al, 2018) and business intelligence and analytics (Chen et al., 2012) will enrich decision support research.

This review article is more than a ranked list, it broadly summarizes 50 years of scholarship, and it showcases the articles and books that academic DSS authors have cited most frequently. The ranking is not the end of a journey, but rather a time to collect our thoughts and inform others of where we have been and with hope motivate new researchers to build on the cumulative decision support knowledge of the past 50 years. The intellectual foundation for future decision support and analytics research is sturdy and well-built. We can do so much more to improve our understanding and to build new capabilities to support decision making. Decision automation is an evolving topic that builds on many prior research streams.

As next steps, the current plan is to use other search engines like CiteSeerX, EBSCO and ProQuest to confirm Google Scholar results, then expand the search to include analytics including business analytics, create a more comprehensive digital summary of articles, books and resources related to decision support and analytics research to aid Information Systems, Decision Support, and Analytics scholars. Reviewing

and reading the most cited prior research is important to understanding and expanding decision support and analytics research. Decision support research over the past 50 years has created a foundation for an interconnected, technology supported decision environment.

Note 1: This citation review did not include the medical/clinical DSS or Agriculture DSS literature. For example, Bright, T.J., A. Wong, et al., "Effect of Clinical Decision-Support Systems: A Systematic Review," *Annals of Internal Medicine*, 157(1), 2012, pp. 29-43 DOI: 10.7326/0003-4819-157-1-201207030-00450 (Article Cited by 480). Also, Jones, J. W., Hoogenboom, G., Porter, C. H., Boote, K. J., Batchelor, W. D., Hunt, L., . . . Ritchie, J. T. (2003). The DSSAT cropping system model. *European Journal of Agronomy*, 18(3), 235-265 (Article Cited by 2420). The review/ranking does not include the literature of DSS/Data Warehouse practice, cf., Inmon, (1992) and Inmon and Hackathorn (1994). Inmon asserted the "data warehouse forms the foundation of all other forms of DSS processing."

Note 2: The exclusion of Blanning (1979) is based upon current citation data. He has published a number of interesting articles on model management, but none of his published work has been frequently cited.

Note 3: An earlier version of this article appeared as Power, D. J., "What are the most cited DSS articles and books?" *Decision Support News*, Volume 19, Number 14, July 8, 2018 at URL <http://dssresources.com/newsletters/475.php>.

Note 4: Thanks to Frada Burstein, Monash University, Peter Keenan, University College Dublin, and Niamh O Riodan, University College Dublin, for suggestions that improved this analysis and discussion.

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