



Use of Decision Support Systems in Small Businesses

Yanqing Duan, Russell Kinman, Mark Xu

Luton Business School, University of Luton, Park Square, Bedfordshire, UK LU1 3JU

Tel: +44 (0) 1582 743134., Fax: +44 (0)1582 743926, Email: yanqing.duan@luton.ac.uk.

ABSTRACT

The study of recent literature available suggests that current use of computer-based information systems in small businesses is often limited, and geared to operational support rather than managerial decision-making. Little research in the UK has attempted to examine the current level of DSS usage in small businesses, and to investigate the managers' needs and how their needs could be met by greater, or more appropriate use of Decision Support Systems (DSS). The research reported in this paper investigated the current practice of using DSS in small manufacturing firms in Bedfordshire, UK. It reports the current level of DSS implementation; users' satisfaction of DSS; the DSS development methods utilised for different decision-making activities in different firms; and gaps between current DSS utilisation and managers' desired levels of DSS support.

INTRODUCTION

The success and continued growth of small businesses in most countries are critically important to local and national prosperity, but their problems are not always accorded the same importance as those of larger organisations. Small business has been described as a neglected research domain (Raymond, 1985; Bayraktar and Gozlu, 1994). In particular, the use of information technology (IT) in small business has not received adequate research attention in the UK. Very few studies have addressed decision support needs of managers in the context of the use of information technology.

Research into the IT application in business organisations indicates that computer use is still confined to operational activities (Khan and Khan, 1992; Cragg and King, 1993; Lai, 1994). However, Naylor and Williams (1994) found that a third of their respondents realised the value of their information systems as decision support tools and had begun to use them for analysis, forecasting, and planning. Other researchers suggest there be many areas in which DSS can be better developed and utilised to help managers in critical decision-making processes such as marketing, sales promotion, cash-flow management and customer services (Heikkila, *et al.*, 1991; Khan and Khan, 1992; Lai, 1994). There are arguments that small businesses can improve their organisational performance and increase their competitiveness with appropriate information systems (Chau 1994; Freeman, 1996). These promises cannot be realised, however, without an adequate understanding of current practice in DSS use, and better identification of users' needs.

The need for his research is also triggered by the extensive growth in the DSS market as reported by a survey of large UK companies (Business Objects UK, 1997). The survey shows that on average, 11% of the corporate information technology budget is spent on DSS (ranging from minimum 2% to maximum 55%), and some major UK companies are "placing enormous importance on establishing a DSS strategy". However, the situation in small firms is not clear and could be different. It is probable that small business will represent a productive domain for attempts to introduce greater levels of computer-based decision support. This is derived from Ray *et al.*'s (1994) work that small business managers and their staff have positive attitudes towards the use of computers in business. Other surveys show that many have plans to increase their

use of computer applications (Cragg and King, 1993). The wish for better information was identified as the motivating force in all case studies conducted by Cragg and King (1993). In the majority of the firms studied by Khan and Khan (1992) managers believed that a computerised system improved their performance in selected areas, but that there is still room for significant further development.

Gordon and Key (1987) argues that if small business managers' problem-solving skills are deficient in any of the critical areas of management decision-making, then small business managers must improve those skills through the use of appropriate educational programmes, consultants, decision support tools, or some combination of these. Unfortunately, the owner-manager, because of

Table 1 Profile of the participant firms and respondents

	Number	Percentage
1. Number of employees		
10-19	35	27%
20-49	56	43%
50-99	18	13%
100-249	22	17%
2. Annual turnover		
< 1 million	30	24%
1 - 2 million	27	22%
2 - 5 millions	35	29%
5 - 10 millions	17	14%
>10 millions	14	11%
3. Job title		
MD/GM/Owner	80	62%
Finance/Accounts Manager	15	12%
IT/IS Manager	4	3%
Marketing/Sales Manager	6	5%
Production/Operation Manager	5	4%
Works/Quality Manager	8	6%
Administration Clerk	6	5%
Others	4	3%
4. General knowledge of IT		
1 - none	2	1%
2 - little	17	13%
3 - some	64	49%
4 - good	38	29%
5 - extensive	10	8%
5. Level of satisfaction with computer systems used in the firm		
1 - very dissatisfied	3	2%
2 - dissatisfied	15	12%
3 - moderate satisfied	43	34%
4 - satisfied	54	43%
5 - very satisfied	13	10%
6. General level of computer literacy of most managers in the firm		
1 - no literacy	7	5%
2 - little literacy	44	34%
3 - some literacy	54	42%
4 - good literacy	22	17%
5 - high literacy	3	2%

involvement in the day-to-day operation of the firm, has not the time, resource or expertise needed to evolve an appropriately analytical approach (Naylor and Williams, 1994). There would seem to be as strong a case for the potential benefits of DSS to the smaller business as for its larger counterpart, provided suitable software is available, and effectively used by the managers concerned.

This research sets out to investigate the current practice in relation to decision support systems in small manufacturing businesses, to clarify managers' needs for computer-based support, and to explore if and how computer-based DSS could be better developed and utilised to meet these needs. Within this research, DSS is broadly defined to encompass any decision-making activity that is supported by computers.

RESEARCH METHOD

The research was conducted in the manufacturing sector in the county of Bedfordshire, UK. The target population was small and medium manufacturing companies with employee number between 10 and 250. It is arguable that company with employee number between 50 - 249 may be classified as medium sized company (10-49, small company; less than 10, very small company and sole entrepreneurs), according to OECD's definition (1995). In this study, the term "small business" is used to include all the companies defined by OECD as SMEs. Freeman (1996) suggests that small manufacturing companies can make particularly beneficial use of information technology to turn out products in smaller, faster, more customised runs.

Of all the Bedfordshire companies, the manufacturing companies account for 17%, within the Bedfordshire manufacturing industry, 96% are small firms, according to the definition used. All 592 manufacturing firms falling within this definition in Bedfordshire were surveyed. Business contact addresses were obtained from Business Link Bedfordshire (a business service centre run by the county council) which has a large, regularly updated database containing information on virtually all firms in the county. To ensure a reasonable response rate, a follow-up mailing was carried out. A further psychological boost to responses was provided by the use of stamped, addressed return envelopes. The localised nature of the survey was also expected to help increase the response rate.

The questionnaire was constructed in three parts: a. General information on the respondents; b. General information on the firm; c. Current use of DSS, their development methods, managers' satisfaction with the current DSS, and managers' desired levels of future DSS support. The questionnaires were sent to the firm's

Table 2 *The extent of the use of DSS applications and managers' satisfaction*

Decision-making Activity	Extent of DSS use (1-none, 5-extensive)		Manager's satisfaction with DSS (1-very dissatisfied, 5-very satisfied)	
	Mean	Std. Dev.	Mean	Std. Dev.
Inventory/stock control	3.27	1.51	3.20	1.13
Budget preparation	3.23	1.46	3.51	1.00
Job costing/cost analysis	2.90	1.53	3.14	1.09
Cash management	2.90	1.62	3.53	1.00
Job estimating/quoting	2.70	1.60	3.24	1.11
Material requirements planning	2.42	1.62	3.47	1.01
Production control	2.39	1.49	3.18	1.09
Production scheduling	2.37	1.47	3.24	1.04
Long range profit forecasting	2.32	1.42	3.18	0.97
Short term sales forecasting	2.28	1.29	3.36	0.87
Capacity planning	2.24	1.41	3.30	0.94
Project management	2.16	1.37	2.96	1.00
Capital budgeting	2.15	1.41	3.29	0.86
Long range sales forecasting	2.14	1.43	3.17	0.97
Sales market analysis	2.06	1.27	3.33	0.99
Labour productivity analysis	2.05	1.40	3.18	1.11
R & D of new products	1.78	1.28	3.00	0.94
Personnel planning	1.62	1.13	3.20	0.95

Table 3 *Factors holding a company back from adopting or making further use of DSS*

Factors	Percentage
Lack of staff time to analyse needs and identify solutions	60%
Lack of finance for systems purchase or development	44%
Lack of experience of systems development	34%
Lack of information on available DSS packages	20%
Appropriate software is not available	8%
Others	9%

Table 4 *DSS development methods at different decision-making levels*

Decision-making Levels	Off-the-peg	User	In-house	Bespoke
Operational	60%	13%	11%	16%
Tactical	51%	18%	20%	11%
Strategic	51%	25%	13%	11%
Overall	56%	17%	14%	13%

general manager or managing director, but 38% of the returned questionnaires were completed by other managers, such as financial managers.

Questionnaires were sent to 592 firms in the first mailing, 97 replies were received, 85 of them were counted as valid. The follow-up mailing with a duplicated questionnaire and a modified covering letter was sent to the 482 companies that did not respond to the first mailing. This resulted in a further 48 valid responses from 55 firms. The overall response rate is 26% (total of 153 responses from 592 firms). The total usable questionnaires were 133. Additional evidence was collected from 40 respondents (about 30% of all the respondents) who gave their personal comments on different issues related to the survey. The comments cover issues such as: the problems experienced with DSS; factors effecting successful implementation of DSS; advice and help needed for running the DSS.

ANAYLSIS AND DISCUSSIONS

Profile of Participant Firms and Respondents

The profile of the participant companies and respondents is given in Table 1.

The data shows that 70% of the firms employed 10 to 49 people. 74% had been in existence for less than 25 years. Average annual turnover was £4.0 million, ranging from £0.2 million to just over £34 million. 62% of the respondents are general manager or managing director, and 38% are managers, such as financial managers, IT/IS managers, etc.. Those who reported using computers personally, had used them on average for ten years; 36% had had more than ten years' experience and 25% less than six years. Most managers expressed general satisfaction with the computer systems used in the firm, being either satisfied (43 per cent) or moderately satisfied (34 per cent); only 2% were very dissatisfied with their systems whilst 10% were very satisfied. This high level of managerial satisfaction with current computer systems may suggest that information technology is supporting these companies effectively, although the satisfaction may also act to prevent managers from seeking further improvement, as one of the managers noted: "*we feel we have the optimum*". The relatively low levels of computer literacy reported (less than 20% of managers indicating "good" or "high" levels) might also suggest that there is limited understanding of the potential benefits to be offered by computing systems, and DSS in particular.

The Use of DSS For Decision-Making Activities

The extent of use of DSS applications in participating firms, and the levels of managers' satisfaction with these systems are

Table 5 DSS in three decision-making levels

Decision-making Level	Level of Current DSS Use (1=no use, 5=extensive use)		Manager's satisfaction with Current DSS (1=very dissatisfied, 5=very satisfied)		Desired DSS support level (1=none, 5=extensive)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Operational	2.69	1.11	3.33	0.90	3.59	0.88
Tactical	2.49	1.20	3.40	0.88	3.05	1.13
Strategic	2.20	1.20	3.16	0.88	2.75	1.19
Overall	2.56	1.02	3.34	0.80	3.29	0.88

reported in Table 2. The data shows that the extent of DSS use is generally limited, ranging from 1.62 (little use) for personnel planning to 3.27 (moderate use) for inventory/stock control. High standard deviations for most applications suggest that the extent of DSS use varies considerably among the firms surveyed. However, even where there was a reported low level of DSS use, managers' satisfaction was relatively high. The applications with which managers were most satisfied were: cash management (3.53), budget preparation (3.51) and materials requirements planning (3.47).

Despite the relatively low usage of DSS generally, 79% of respondents indicated that they use computers personally to aid business decisions. This suggests that there is, at least, widespread use of desktop computing in managers' offices. It would be interesting to investigate this finding more deeply, to establish just what decision-making tasks are supported, and in what ways.

Table 3 presents the results of a question about inhibitors to the greater use of DSS. A lack of staff time to analyse needs and identify solutions is the most significant factor identified. Lack of finance for systems purchase or development, lack of experience of systems development and lack of information on available DSS packages were other factors commonly cited.

DSS Development Methods

DSS for small businesses can be developed and implemented in different ways. Four routes were identified for the purposes of the survey:

- *Off-the-peg* - purchase of a commercially developed package;
- *Bespoke* - designed by a software house for the specific application;
- *In-house* - developed by the firm's own specialist staff;
- *User* - developed by managers as users.

The data presented in Table 4 shows that the majority of DSS were purchased as commercially developed packages (56 percent); other systems were developed by managers as users (17 percent), developed by in-house specialists (14 percent) or developed as bespoke systems by software houses (13 percent). In view of the normally limited resource base for IT development (Heikkilä, *et al.*, 1991), it is not surprising that most small firms choose to purchase commercially developed, ready-to-use DSS software.

By breaking down the development methods into three decision-making levels, it reveals that commercial packages are more used at the operational level (60 percent) than at strategic level (51 percent). In contrast, user-developed DSS are more used at the strategic level (25 percent) than at the operational level (13 percent).

The advantages and disadvantages of commercial packages and tailored software are discussed by Heikkilä, *et al.* (1991), but research on *in-house* and *user* development methods in small firms is scarce. The evidence from this survey suggests that small business managers are capable of developing their own DSS, and that a certain proportion does so. There is, of course no way of evaluating the quality of these systems from the survey results. Research in Canada by Raymond and Bergeron (1992) found that user-developed DSS in small businesses are more successful than any developed by other means. A study by Lai (1994) in the USA,

however, revealed no link between the method of system development and DSS success. This area might also prove productive for future enquiry.

The Extent of DSS Support Required By Managers

It is believed that no research has attempted to identify the gaps between the current provision of DSS and small business managers' desired levels of DSS support. Respondents were asked to indicate their current and desired level of DSS support for each decision-making activity listed in the survey. These activities were categorised into three decision-making levels in organisations - operational, tactical and strategic. Table 5 presents the analysis of the responses.

The findings reveal that:

- the current level of DSS usage is low;
- although DSS usage is limited, managers are generally satisfied with DSS they are using;
- the desired level of support is much higher than current provision;
- the high standard deviations for current DSS use and desired levels of support indicate high variations among responses. The standard deviation of levels of satisfaction is lower than the other two variables; this suggests that there is less disagreement on this issue.

Differences found between the three decision-making levels provide support for arguments in the literature that current DSS in small businesses are geared to operational rather than strategic decision-making (Khan and Khan, 1992; Lai, 1994). It is evident that the low level of DSS use found by Raymond (1982) has not changed significantly. The desired level of support at operational level is also much higher than that at the strategic level. Users appear to expect that DSS will provide most benefit for operational decisions. This is perhaps as well, given the nature of the decision-making tasks at strategic level, involving complex and changing environments, high levels of uncertainty and the need to include decision-makers' personal intuition and judgement. The lower level of DSS use and desired support for strategic decision-making does not mean that there is no space for further improvement, however. Indeed, the fact that many managers are "going it alone" could be seen to suggest that professional support would enhance strategic planning. Computer support for strategic decisions is a challenging area for future research and much effort is being expended to overcome the difficulties (Duan and Burrell, 1995), albeit, yet again, in the context of the larger business.

CONCLUSIONS

The research reveals that the extent of DSS implementation in small manufacturing business is still low in general, although there is significant variation between different firms. The literature review of previous studies indicated that the situation has not changed significantly since Raymond's investigation in 1982, and the present study confirms this. Lack of staff time to analyse needs and identify solutions is the most significant factor holding firms back from adopting, or making further use of DSS. Use of DSS at the operational decision-making level is higher than at the strategic level. Small business managers are satisfied with the DSS they are using and are hoping for much better DSS support in the future. DSS development, particularly DSS for strategic decisions in small business, still represents both a challenge and an opportunity for DSS professionals and researchers.

DSS are most commonly implemented by purchase of a commercial package, and only rarely by bespoke development. Most DSS are used for operational rather than strategic decision-making. A quarter of those firms that do use DSS to support strategic

decisions rely upon user-developed models.

Although DSS applications are still relatively few in number, most DSS users report satisfaction with their systems. To reduce the gaps between current DSS provision and the managers' indicated needs, a greater focus on small business by DSS researchers and practitioners is indicated. Systems most likely to appeal to small business managers will have to be appropriate to their sector's needs, and capable of implementation with minimal user training.

Further investigation is indicated by the present study in a range of areas affecting DSS usage in small business: the effectiveness of different DSS development methods; factors affecting the success of commercially provided DSS packages; the quality of user-developed DSS in meeting business needs; aspects of strategic planning in small business amenable to DSS support; the relationship between the extent of DSS utilisation and business performance. Moreover, with the rapid growth of the Internet, issues associated with web-based decision support systems and its applications in small businesses also deserve more attention.

Finally, it should point out the limitation of the research. Because the survey was conducted with Bedfordshire, UK, some of the results may not represent the status of other regions, sectors and countries. Therefore, cautions should be paid when interpreting these results.

* Author for correspondence.

REFERENCES

- Bayraktar, D. and Gozlu, S. (1994) A knowledge-based expert system for technology acquisition in small and medium scale manufacturing organisations, *Computers and Industrial Engineering*, 27(1-4), 285-288.
- Business Objects UK Ltd., (1997) Business plans to spend more on decision support, *Computer Personnel*, July.
- Chau, P. Y. C. (1994) Selection of Packaged Software in Small Business, *European Journal of Information Systems* 3(4), 292-302.
- Cragg, P. B. and King, M. (1992) Information system sophistication and financial performance of small engineering firms, *European Journal of Information Systems*, 1(6), 417-426.
- Cragg, P. B. and King, M. (1993) Small-Firm Computing: Motivators and Inhibitors, *MIS Quarterly*, 17(2), 47-59.
- Duan, Y. and Burrell, P. (1995) A Hybrid System for Strategic Marketing Planning, *Marketing Intelligence and Planning*, 13(11), 5-12.
- Freedman, D. H. (1996) Through the looking glass, *The State of Small Business*, 18(7), 48-54.
- Gordon, W. L. and Key, J. R. (1987) Artificial Intelligence in Support of Small Business Information Needs, *Journal of Systems Management*, 38(1), 24-28.
- Heikkila, J.; Saarinen, T and Saaksjarvi, M. (1991) Success of Software Packages in Small Business: An Exploratory Study, *European Journal of Information Systems*, 1(3), 159-169.
- Khan, E. H. and Khan, G. M. (1992) Microcomputers and Small Business in Bahrain, *Industrial Management & Data Systems*, 92(6), 24-28.
- Lai, V. S. (1994) A Survey of Rural Small Business Computer Use: Success Factors and Decision Support, *Information & Management*, 26(6), 297-304.
- Naylor, J. B. and Williams, J. (1994) The Successful Use of IT in SMEs on Merseyside, *European Journal of Information Systems*, 3(1), 48-56.
- OECD (1995) Information technology (IT) diffusion policies for small and medium-sized enterprises (SMEs) Paris, OECD
- Ray, C. M. (1994) Small Business Attitudes Toward Computers, *Journal of End User Computing*, 6(1), 16-25.
- Raymond, L. (1982) Information Systems in Small Business: Are they used in Managerial Decisions?, *American Journal of Small Business*, 5(4), 20-26.
- Raymond, L. (1985) MIS Success in Small Business, *MIS Quarterly*, 9(1), 37-52.
- Raymond, L. and Bergeron, F. (1992) Personal DSS Success in Small Enterprises, *Information & Management*, 22(5), 301-308.

0 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

www.igi-global.com/proceeding-paper/use-decision-support-systems-small/31619

Related Content

Variance-Based Structural Equation Modeling: Guidelines for Using Partial Least Squares in Information Systems Research

José L. Roldán and Manuel J. Sánchez-Franco (2012). *Research Methodologies, Innovations and Philosophies in Software Systems Engineering and Information Systems* (pp. 193-221).

www.irma-international.org/chapter/variance-based-structural-equation-modeling/63264

Indicators of Information and Communication Technology

Gulnara Abdrakhmanova, Leonid Gokhberg and Alexander Sokolov (2018). *Encyclopedia of Information Science and Technology, Fourth Edition* (pp. 4704-4714).

www.irma-international.org/chapter/indicators-of-information-and-communication-technology/184176

Bipolar Model in Collective Choice

Ayeley P. Tchangani (2018). *Encyclopedia of Information Science and Technology, Fourth Edition* (pp. 7282-7291).

www.irma-international.org/chapter/bipolar-model-in-collective-choice/184425

Dynamic Interaction and Visualization Design of Database Information Based on Artificial Intelligence

Ying Fan (2023). *International Journal of Information Technologies and Systems Approach* (pp. 1-13).

www.irma-international.org/article/dynamic-interaction-and-visualization-design-of-database-information-based-on-artificial-intelligence/324749

Classification Reasoning as a Basic Part of Machine Learning

Xenia Naidenova (2015). *Encyclopedia of Information Science and Technology, Third Edition* (pp. 114-121).

www.irma-international.org/chapter/classification-reasoning-as-a-basic-part-of-machine-learning/112321