Use of Decision Support Systems in Small Businesses

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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 trigged 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% |
| ITIS 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% |

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involvement in the day-to-day operation of the firm, has not the
time, resource or expertise needed to evolve an appropriately ana-
lytical 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 con-
cerned.

This research sets out to investigate the current practice in
relation to decision support systems in small manufacturing busi-
nesses, 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 be-
tween 10 and 250. It is arguable that company with employee
number between 50 - 249 may be classified as medium sized com-
pany (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 benefi-
cial use of information technology to turn out products in smaller,
faster, more customised runs.

Of all the Bedfordshire companies, the manufacturing com-
panies 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 con-
taining 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
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 fol-
low-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 suc-
cessful implementation of DSS; advice and help needed for running
the DSS.

ANALYSIS AND DISCUSSIONS

Profile of Participating 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 sys-
tems used in the firm, being either satisfied (43 per cent) or moder-
amately 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 sug-
gest that information technology is supporting these companies
effectively, although the satisfaction may also act to prevent man-
agers 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>
<thead>
<tr>
<th>Decision-making Activity</th>
<th>Extent of DSS use (1-none, 5-extreme)</th>
<th>Manager's satisfaction with DSS (1-very dissatisfied, 5-very satisfied)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Dev.</td>
</tr>
<tr>
<td>Inventory/stock control</td>
<td>3.27</td>
<td>1.51</td>
</tr>
<tr>
<td>Budget preparation</td>
<td>3.23</td>
<td>1.46</td>
</tr>
<tr>
<td>Job costing/cost analysis</td>
<td>2.90</td>
<td>1.33</td>
</tr>
<tr>
<td>Cash management</td>
<td>2.90</td>
<td>1.62</td>
</tr>
<tr>
<td>Job estimating/packing</td>
<td>2.70</td>
<td>1.60</td>
</tr>
<tr>
<td>Material requirements planning</td>
<td>2.42</td>
<td>1.62</td>
</tr>
<tr>
<td>Production control</td>
<td>2.30</td>
<td>1.49</td>
</tr>
<tr>
<td>Production scheduling</td>
<td>2.37</td>
<td>1.47</td>
</tr>
<tr>
<td>Long range profit forecasting</td>
<td>2.32</td>
<td>1.42</td>
</tr>
<tr>
<td>Short term sales forecasting</td>
<td>2.28</td>
<td>1.28</td>
</tr>
<tr>
<td>Capacity planning</td>
<td>2.24</td>
<td>1.41</td>
</tr>
<tr>
<td>Project management</td>
<td>2.16</td>
<td>1.37</td>
</tr>
<tr>
<td>Capital budgeting</td>
<td>2.15</td>
<td>1.41</td>
</tr>
<tr>
<td>Long range sales forecasting</td>
<td>2.14</td>
<td>1.43</td>
</tr>
<tr>
<td>Sales market analysis</td>
<td>2.06</td>
<td>1.27</td>
</tr>
<tr>
<td>Labour productivity analysis</td>
<td>2.05</td>
<td>1.40</td>
</tr>
<tr>
<td>R &amp; D of new products</td>
<td>1.78</td>
<td>1.28</td>
</tr>
<tr>
<td>Personnel planning</td>
<td>1.62</td>
<td>1.13</td>
</tr>
</tbody>
</table>
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 use 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 (Heikkila, 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 Heikkila, 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 inquiry.

### 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.

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 usage 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 decision-making found support from the software to be inadequate, suggesting a need for more research into the development of effective DSS systems in small businesses.
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.

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