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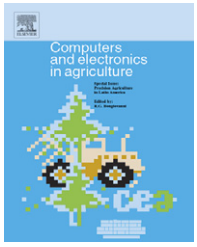

# Wither agricultural DSS?

*K.B. Matthews*, G. Schwarz, K. Buchan, M. Rivington, D. Miller*

*The Macaulay Institute, Craigiebuckler, Aberdeen AB15 8QH, UK*

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ABSTRACT

Computer-based agricultural decision support systems (aDSS) may be argued to have passed sequentially through phases of unbelief, euphoria and disappointment, and to be currently passing into either a phase of maturity with realistic expectations of the technology, or to abandonment. This paper appraises, in the context of the DSS development literature, our past and current efforts in decision support using simulation-models and farm-scale case-studies. The paper first reviews some of the explanations for the lack of success for aDSS including the identification of suitable roles and how best the tools may be deployed. The paper then outlines the authors' experiences during the euphoric period of aDSS development including the undertaking of market research on the nature of the aDSS desired and their potential for commercialisation. The positive outcome of the market research was that potential end-users recognised the range of functionality that an aDSS could offer. There was, however, significant scepticism on the balance of costs and benefits. The end-user preference for aDSS delivered as software products for use in-house, when combined with the limits on the price-per-unit that the market would bear, meant that there was little commercial potential. In the light of these findings the team re-evaluated the role and development strategy for their aDSS. The paper outlines this strategy in terms of both the technical developments of the aDSS and the approach to its use with stakeholders. The paper then discusses the legacy from the euphoric period highlighting a number of socio-political and institutional barriers to the use of aDSS which remain to be overcome. The paper concludes by arguing that there is a need to think beyond technocentric solutions to overcome the barriers to wider aDSS use and that there are a number of models of best-practice for aDSS development that can ensure their relevance.

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## 1. Introduction

### 1.1. Context

Agricultural systems remain the principal land-using sectors in terms of area for much of the EU and elsewhere in the world. The EU policy agenda has, however, moved support from solely encouraging increased agricultural production, to underpin food security and increase rural prosperity, towards *multi-functional* or *post-productivist* rural land use and sustainable development agendas (Scottish Executive, 2001, 2002, 2006a, b). Prosperity of the farming sector is thus increasingly to be balanced with food safety, environmental protection and sustainable development of the rural community as a whole. There is, however, disagreement on the extent to which EU agricultural systems are in reality post-productivist (Wilson, 2004), and particularly the extent to which the values and aspirations of farmers and other land managers have changed (Burton, 2005). It is possible to identify potential *win–win* improvements to resource management within farming sys-

* *Corresponding author*. Tel.: +44 1224498200; fax: +44 1224 311556.
E-mail address: k.matthews@macaulay.ac.uk (K.B. Matthews).
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tems, for example improved fertiliser management to reduce variable production costs and diffuse pollution (Bragg et al., 2005). In other cases, however, there is the need to make transparent and evidence-bounded land management decisions based on the trade-offs in outcomes between individuals or between individuals and the wider public-good (Verweij et al., 2006; Stilgoe et al., 2006). One approach to informing and/or influencing decision making within agricultural systems that has seen considerable investment of research funding is the development and use of agricultural decision support systems (aDSS).

### 1.2. *What are aDSS?*

For the purposes of this paper, the definition of DSS is restricted to computer-based tools, developed (generally by researchers, but not exclusively so) to provide analysis and advice to decision makers.[1] The "a", is added to DSS as a qualifier to distinguish a subset of DSS where decisions on patterns of land use and management are the central activity that the DSS developers are seeking to support. By restricting aDSS to computer-based tools the definition seeks to avoid the absurdities that can occur by including any information source as an aDSS (e.g. leaflets or other knowledge transfer media). For aDSS the emphasis is on *support*, since people make decisions and software at best only assists. aDSS is not about automated control. The *systems* element of aDSS (in contrast to the term *decision support tools*) recognises that aDSS is not only a stand alone software tool but also data, encapsulated knowledge and facilities to communicate or interpret the aDSS outputs. aDSS often have a counter-factual (what-if) analysis role, having the potential to both generate and assess alternative options. Such analysis is based on the use of simulation modelling or other forecasting methods, to support decision making where empirical evaluation of options via experimentation may be prohibitively expensive, too risky, or unethical.[2] The community of interest for aDSS starts with farmers and an organisational scale of individual enterprises (e.g. barley cropping or suckler cattle) or whole farm-business. In this regard, the decisions typically supported are tactical management (improving the sequencing or scheduling of resources to increase returns, reducing risk or limit damaging externalities such as pollution) or strategic management (deciding on the portfolio of enterprises undertaken) (Matthews et al., 1999a). Where trade-offs are being considered then the aDSS community of interest includes other direct and indirect stakeholders such as government, agencies, NGO's and the wider rural and urban publics (e.g. river basin and landscape scales for the EU Water Framework Directive (Blackstock and Richards, 2006) and UK bio-diversity action plans (Redpath et al., 2004)).

[1] In this context, the term decision makers encompass both practitioners who will implement the decisions and stakeholders, such as policy makers and the public, with legitimate interests in the outcomes of the decisions.

[2] The knowledge-based content of aDSS is often, however, based on empirical or experimental research.

### 1.3. *Objectives and structure*

There is a significant body of opinion holding the view that aDSS developed to date have failed to deliver tangible benefits, particularly since there are few examples of widespread or sustained use of aDSS by land managers. This is known as the *problem of implementation*. The objectives of this paper are, to critically reflect on the explanations for these failures available within the aDSS and related literatures, to assess how well these explain the authors' experiences in developing and deploying an aDSS, and to try and identify additional factors that may need to be considered. The paper first reviews a framework of phases within which the history of aDSS development (and current aDSS-like activities) can be understood, and assesses the implications of the four roles in which DSS have been seen to be effective. The paper then identifies key factors in the success of aDSS, arguing that there has been an excessive focus on technological factors rather that recognising the need to ensure that the tools developed are credible with decision makers and to integrate the software into a particular decision making milieu. Against this background the paper presents a retrospective analysis of the authors' experiences in developing an aDSS over the last 15 years. This is presented in three parts. The first part presents the previous research and model building efforts from which the authors' aDSS project was born and charts the initial phase of aDSS building. The second part presents the outcomes of a market research exercise carried out as part of a planned to commercialisation the aDSS in 1999. Some of the results of the market research are now dated (particularly those relating to the use of the Internet). The market research, however, remains compelling evidence for nature of the challenges faced by aDSS developers and supports theories within the aDSS literature. The third part outlines the research team's response to the market research, in particular the development of strategies for using the aDSS as part of a process of engagement between researchers and stakeholders (a knowledge transfer and exchange role) and facilitating interactions between stakeholders groups such as policy makers and land managers (a deliberation role). The paper then highlights significant legacy, socio-political and institutional factors that will, if not addressed, continue to have profound affects on which tools are developed, how they are developed and how effective they are. The paper argues that there is a continuing role of aDSS, that there needs to be realism in the expectations of the technology and that there are significant lessons from the history of aDSS development for other aDSS-like tools being developed in related fields of research.

## 2. Developing and deploying DSS

### 2.1. *DSS development phases*

Within literature assessing the use of new information technologies in management applications there is an increasingly well-developed understanding of the likely phases of development through which a particular technology will pass. Biethahn and Nissen (1995) presents a framework that is particularly useful in understanding the historical trajectory of

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