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The effect of rapid rural industry changes on the development of a decision support system for dairy farmers in Australia

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Abstract

This paper outlines the factors that affected the development of a knowledge based decision support system (KBDSS) during a period of rapid industry change. The development process was led by a steering committee consisting of farmers, extension officers and milk processor representatives. The committee requested that changes be made to the KBDSS as a response to different circumstances in the Australian dairy industry due to the deregulation of the milk market. These changes were implemented using the services of a software development, marketing and product placement company. The research indicates that the use of the recommended approaches to the development of a KBDSS did not work well in the rapidly changing environment and that the interpretation that is necessary to determine the effect of deregulation on farmers added conflict and complexity to the development process. Moreover, it was found that approaches such as prototyping and stakeholder involvement that are advocated in situations involving requirements uncertainty do not necessarily provide an adequate solution.

Keywords: Knowledge based decision support system; Dairy industry; Industry deregulation

1. Introduction

A great number of expert systems and decision support systems have been developed for rural applications and McCown et al. (2002) outline many examples. Hayman and Easdown (2002) observe that decision support system (DSS) adoption is limited by poor engagement with end-users, and despite good practices in systems development and accessibility via farm-based computers, uptake remains low, at under 25%. Kuhlmann and Brodersen (2001) report similar results in Germany.

It is not news to state that DSS projects that involve end-users closely in development activity have greater uptake. For example, Kahai et al. (1998) found that increased involvement by end-users in DSS model building led to higher expectations of success, which was associated with higher satisfaction, and increased likelihood to refine a model prior to making a decision.

This paper refers to the development of a knowledge based decision support system (KBDSS) and some background to the KBDSS approach is shown below. The literature contains many definitions of expert systems (ES). Smith (1989, p. 2761) describes ES as '... computer programs containing a wide base of knowledge in a restricted subject area

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or domain. They use complex inferential reasoning algorithms to perform tasks done by human experts to solve real world problems'.

ES are based on the 'rules of thumb' obtained from expert knowledge. Knowledge is acquired for developing the rules within an expert system by various techniques including interviews, analysis of familiar tasks, observation and protocol analysis (McGraw and Westphal, 1990). ES are useful in collating knowledge that is difficult to quantify and/or which is based solely on experience. Bramer (1984) suggests that users of ES should treat them as aids to decision making and that they can be consulted in the same way as reading a textbook or consulting with a colleague. Schuwer and Kusters (1993) propose that an expert system can be considered a knowledge based system as both have the characteristic of a separation being made between the inference rules, or knowledge specific to the problem domain, and the programming code needed to run the application.

Decision support systems (DSS), on the other hand, are computer programs based on models developed from data. A DSS is described by Klien and Methlie (1990, p. 148) as '. . . a computer information system that provides information in a given domain of application by means of analytical decision models'. The DSS should be able to access databases in order to help managers make effective decisions. Klien and Methlie (1990) stress that the manager still makes the decision and solves the problem, while the DSS provides options to help the manager make the final decision.

The combination of ES with DSS is a logical extension of both technologies. Alter (1992) suggests that this combination of technologies happens naturally and any attempt to define differences between DSS and ES is a futile exercise, as they continually absorb new features from each other, becoming hybrids. There is, therefore, no reason why an ES cannot be a component of a DSS.

The combination of a knowledge based system and a DSS has been described as a knowledge based decision support system (KBDSS) (Klien and Methlie, 1990; Blair, 1994). This combination has the advantage of incorporating the knowledge of an expert with the objective output of models in a DSS.

This paper discusses the development approach that is based on the assumption that individual farmers will use a KBDSS on their own farm. This approach involves consulting end-users and other key stakeholders during all stages of development with the object being to create an environment where these people have some ownership over the product.

The end-user development approach described above was an integral part of a research project funded by the Australian Dairy Research and Development Corporation now called Dairy Australia. The initial research project was titled "DairyPro—the development of a knowledge based decision support system for the northern Australian dairy industry" it was scheduled to last 3 years (Kerr et al., 1999a,b). The development plan for DairyPro came initially from dairy farmers wanting a whole of farm approach to decision making. A prototype was developed out of that concept and this prototype lead to the funding of the DairyPro project. The project used an end-user participatory approach described in Kerr et al. (1999a). The project had the following aims:

1. To develop a knowledge based decision support system (KBDSS) based on the exploration of "what-if" scenarios, which will assist farmers to estimate the profitability of integrating new resources on their farm.
2. To develop a suite of expert systems that can assist dairy farm decision-makers to determine non-production and lifestyle effects of the purchase of new technology such as milk vats or feed mixing wagons. These non-production and lifestyle effects are meant to capture lifestyle factors such as the amount of time spent milking cows or cleaning milk vats. The intended expert systems were designed to allow the end-user to estimate the advantages of implementing new technologies in terms of personal lifestyle advantages rather than assessing it purely in financial terms.
3. To make these decision tools available to as many dairy farmers as possible through the sale of the software (or implementation on the World Wide Web), introduction of the software as part of farmer discussion groups and the production of booklets that allow manual calculations of the various scenarios.

As discussed earlier, rural DSS have a low adoption rate, however Turban and Aronson (2001) provide many examples of successful DSS designed for individual use in business sectors such as telecommunications, resources and manufacturing. Mallach (2000) also describe successful DSS applications for industries as diverse as finance, sport and engineering. Many of these individual DSS products were successful and did provide companies with significant cost savings. For example, Turban and Aronson (2001) describe situations such Littlewoods stores in Britain saving 1.2 million US$ by using a DSS to strategically price merchandise differently at different stores and further savings of 1.4 million US$ by reducing the need for stock liquidations.