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Merry Christmas and
happy new year to all
APEN members!



Developing decision support systems for farm management

A conceptual framework from the sociology of science and technology

Story by **Emma Jakku, Peter Thorburn and Clare Gambley**

CSIRO Sustainable Ecosystems

Remember decision support systems? They haven't gone away, and the technobabble that accompanied their development in the 80s and 90s has given way to a more sophisticated and human-centric approach. Here, Emma Jakku (CSIRO) tells how DSS development has benefited from an injection of good old sociology.

Decision support systems (DSSs) are increasingly being identified as a means to improve the management of complex farming problems. However, making DSSs relevant to farmers is a challenge. We have looked to concepts from the sociology of science and technology to help with this challenge and increase our understanding of the social factors and processes that influence the development and adoption of DSSs. These concepts will then be used to guide the implementation of strategies to encourage broader uptake of DSSs.



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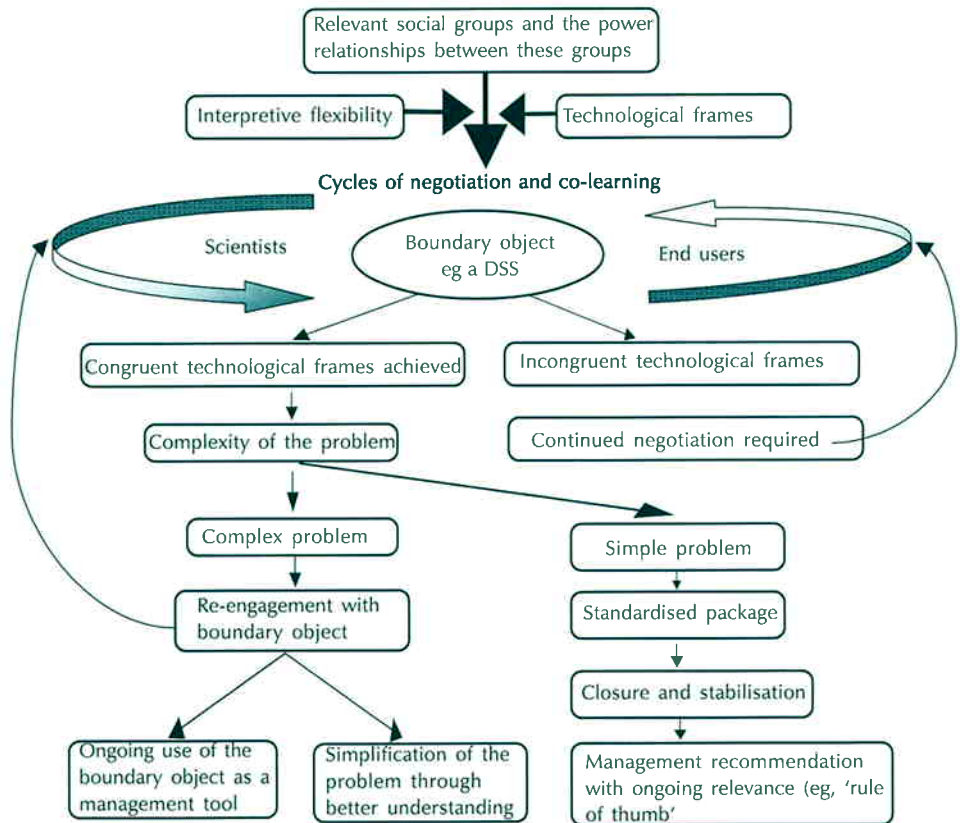


DSSs for farm management (cont'd from p1)

Conceptual framework for understanding the development and implementation of DSSs

The figure on this page illustrates the way in which concepts from the sociology of science and technology provide a framework for understanding the development and implementation of DSSs.

Below: Framework clarifying the social processes influencing the development and application of agricultural DSSs



A boundary object provides a common point of reference for conversations and a means of translating abstract and complex ideas



Relevant social groups, interpretative flexibility and technological frames

- In the case of agricultural DSSs, the *relevant social groups* usually include farmers, scientists, extension agents, government officials, agribusiness and possibly other community groups. Power differences between these groups can influence the level of involvement of each of these groups in the design of DSSs.
- *Interpretative flexibility* highlights the way in which DSSs can mean different things to the various relevant social groups.¹ This reinforces the value of participatory action research, since by working more closely together, scientists and end users can learn from each other.
- *Technological frames* clarifies the different meanings that social groups attribute to

DSSs by providing an analytical structure for identifying the different assumptions, beliefs and expectations that social groups hold about a DSS.²

Boundary objects

- The concept of a *boundary object* is valuable for understanding the *cycles of negotiation and co-learning* that are important in the development of a DSS. A boundary object provides a common point of reference for conversations and a means of translating abstract and complex ideas.³ A successful boundary object is able to mean different things to different people and still maintain a common identity.
- A DSS can act as a boundary object because it allows for negotiation, cooperation and co-learning between multiple social groups.

- Through repeated cycles of negotiation and co-learning, the different social groups may develop a shared understanding of the problem, which leads to the establishment of *congruent technological frames*.

Complexity of the problem

- The *complexity of the problem* that the technology addresses is a key feature that influences the way in which a DSS is developed and used.
- DSSs that address *complex problems* need to go through a longer phase of acting as a boundary object. Through these further cycles of negotiation, a better understanding of the problem can develop, which may allow for *simplification of the problem* within the management and biophysical context of the social groups.
- If simplification of the problem is not possible, then the *ongoing use of the boundary object* is required, whereby the DSS continues to influence management through its role as a boundary object. This raises the issue of who undertakes the ongoing operation of the DSS.
- DSSs that address *relatively simple problems* are more likely to act as *standardised packages*, which provide a more clearly defined set of guidelines for practice.⁴
- This allows for *closure and stabilisation*⁵ of the problem, which facilitates the development of a *management recommendation* with ongoing relevance. The implication of this is that for simple problems, a DSS may become redundant once it has fulfilled its function as a tool for co-learning and the development of a shared understanding of the problem. This should be interpreted as a positive outcome for the application of the DSS.

Conclusion

Concepts from the sociology of science and technology can add to our understanding of how social factors influence the design and use of DSSs, including the way in which different people will perceive and interact with DSSs. The framework outlined in this story encourages critical reflection on the way in which DSSs might be more effectively developed in partnership with relevant stakeholders. When applied to

agricultural DSSs, these concepts highlight the potential for DSSs to facilitate negotiation and cooperation between the multiple groups of people involved in farm management, making the process and product of DSSs more relevant to key stakeholders and therefore more likely to be adopted. We are applying this framework to case studies of DSSs for seasonal climate forecasting, irrigation scheduling and nitrogen management to empirically test how much this framework could contribute to our understanding of the challenges and opportunities for developing agricultural DSSs and facilitating the wider adoption of these new technologies.

References

¹ Pinch, T. and Bijker, W. (1987) 'The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other', in Bijker, W., Hughes, T. and Pinch, T., (eds) *The Social Construction of Technological Systems*. Cambridge, MA: MIT Press.

² Bijker, W. (1987) 'The social construction of Bakelite: Towards a theory of invention', in Bijker, W., Hughes, T. and Pinch, T., (eds) *The Social Construction of Technological Systems*, Cambridge, MA: Massachusetts Institute of Technology Press; Orlikowski, W. and Gash, D. (1994) 'Technological Frames: Making Sense of Information Technology in Organizations', *ACM Transactions on Information Systems* 12: 174-207.

³ Star, S. and Griesemer, J. (1989) 'Institutional Ecology, "Translations", and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology 1907-1939', *Social Studies of Science* 19: 387-420.

⁴ Fujimura, J. (1992) 'Crafting Science: Standardized Packages, Boundary Objects, and "Translations"', in Pickering, A. (ed.) *Science as Practice and Culture*, Chicago and London: University of Chicago Press.

⁵ Pinch and Bijker, *op. cit.*

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DSSs that address relatively simple problems are more likely to act as standardised packages, which provide a more clearly defined set of guidelines for practice


Agricultural departments in flux in Australia

Agricultural and kindred departments are evolving in each state and territory of Australia – as well as in New Zealand – as governments struggle to keep pace with a diversifying primary production base and a growing emphasis on export-related agriculture.

In this special ExtensionNet report, we'll try to bring you up-to-date with some of the major changes that have been happening around Australia. It might help when you're next talking to interstate colleagues who announce they're from an organisation about which you've never heard before ...




Qld: investor-delivery model



NSW: extension support unit to be set up



VIC: post amalgamation planning



TAS: stable over last few years

In many ways, the challenges faced by the state government agricultural departments are similar to those faced by the country's primary producers, who have had to diversify, expand or completely change their operations (and sometimes all three) as a way of staying competitive in a fast-changing environment.

The changes have necessarily seen repercussions flow through to the extension sector. In some states, extension has been more significantly affected than in other states.

Not only that, the pace of change has left even extension veterans operating at the national level somewhat bamboozled. In some states, the changes in extension policy appear to have been made, un-made and re-made in the time it takes some extension officers to start and finish an extension project.

The general theme appears to reveal a desire to amalgamate departments that share interests in land, water and natural resources. Thus, some primary industries organisations around Australia have evolved to become "super-departments" incorporating extractive industries like mining and petroleum.

Some states have also sponsored positions that could generally be described as "Chief Extension Officers" whose role involves plotting the extension futures for their respective departments.

In **Queensland**, the Department of Primary Industries changed its name to the Department of Primary Industries and Fisheries (DPI&F) after the last state election.

Extension services have moved to an "investor-delivery" model with Industry & Investment and R&D strategy being the main investors and extension has been charged with delivering outcomes on their behalf. Current extension activities linked to projects is continuing. It's early days yet and extension staff may soon be partaking in short courses to help them understand the new opportunities. Chief Extension Officer is Dr Gus Hamilton. Queensland DPI&F is at www.dpi.qld.gov.au. Queensland also has a Department of State Development and Innovation, a Department of Natural Resources and Mines, and an Environmental Protection Agency.

In **New South Wales**, a recent amalgamation of departments saw minerals, fisheries, forests and agriculture come together under the banner of the NSW Department of Primary Industries which can be found at www.dpi.nsw.gov.au. The former NSW Agric specialised Extension Support Unit in the Regional Relations & Education Branch will be set up to look after extension training, property management planning, and monitoring and evaluation. There are still between 350 and 400 front line extension and education staff in NSW.

In **Victoria**, an amalgamation that foreshadowed what was going to happen in NSW brought together agriculture, fishing and aquaculture, minerals and petroleum, science and R&D, and trade and investment. On the website at www.dpi.vic.gov.au, the Agriculture and Food page has a link to "Research and Education".