USING SOFT SYSTEMS METHODOLOGY TO HELP MODEL BEEF PRODUCTION SYSTEMS AS SUPPLY CHAINS

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INTRODUCTION
The Total Genetic Resource Management system (Kinghorn, these proceedings) is a potent implementation of animal breeding technologies in a decision support tool. Extending the implementation in a similar manner from breeding to processing of cattle could yield gains in efficient use of resources leading to greater profitability for all industry members (Kinghorn, 1999). To do this the beef industry needs to be modelled as a supply chain of cattle breeding-production-processing. There has been limited success in implementing decision support tools partly due to poor involvement of participants in the development process (Newman et al., 1999). Soft systems methodology (SSM) — an ontological tool that draws the participants into the process of constructing the system (Davies and Ledington, 1991)—could be used to describe the beef production supply chain. The objective of this investigation was to use SSM to model beef production systems in Australia in order to discover opportunities to effectively support supply chain optimisation.

METHODOLOGY
A brief overview of SSM follows. Participants express the problem; systems are formulated by describing the systems’ basis (called root definitions); conceptual models are generated by identifying CATWOE (a mnemonic for Customers, Actors, Transformation, Weltanschauung <world view>, Owners, and Environment) and formalised; models are assessed for expressed problem situation relevance; and actions are taken to improve the problem situation.

Stakeholders from parts of the industry (scientists, primary producers, consultants, extension officers, processors) were involved. Partnership was made with a large geographically-dispersed beef enterprise covering many segments of the industry (as well as discussion with producers in vertical alliances), and SSM principles were applied during interviews and discussions with enterprise staff, leading to a description of the breeding, production and processing system as a supply chain.

RESULTS AND DISCUSSION
In almost all interviews mistrust between processors and producers was expressed as the dominant impediment to successful alliances. An adversarial relationship existed making the development of stable vertical relationships difficult: if the producer wins then the processor loses and vice versa. Horizontal relationships are also difficult because of competition among individuals within sectors. Discussions about a decision support tool as a means of improving relations among sectors by optimising profit across sectors and improving the understanding of the beef industry as a supply chain were positively received.
Different views of the supply chain emerged. Figures 1 and 2 show two (of many potential) models of beef supply chains arising from different perspectives of the industry. The former, the view mainly of indirect participants (e.g. animal breeders), tended to see the system as the biological production system, while the latter view, of direct participants (producers/processors) saw the processors as part of the system. The former is primarily driven by optimum development of livestock (indicated by the thick arrows) —biological parameters dictate what decisions are made and the processor is a consumer of system products. The latter reflects profit as driving the system (thicker arrows); the genetic base was viewed as a source for inputs to the system—thus profit dictates what decisions are made about management.

Figure 3 shows critical decision points (CDP), key performance indicators (KPI) and information some finishers may use in the profit-driven system model. Decisions are supported by economic and biological information. For example, the break-even point is a KPI that informs the cattle-selling CDP. This KPI requires information on costs of buying cattle, transport, feed, and capital among other information. Exploring the differing values of KPIs can lead to improved profits and better decisions made; management or sector weaknesses can be examined. For example, if marginal costs to finish steers for a given market may yield a break-even point above market...
prices, the decision maker may choose to reformulate the ration, vary the number of days on feed to minimize costs, or change markets.

Systems-thinking encourages finishers to consider their impact beyond the boundaries of their operations. The supply chain relationships are modelled and can be considered as alliances among decision makers. Thus system actors should be able to better respond to the effects of up-stream CDPs and can see how their decisions impact down-stream participants.

SSM does not take a “magic bullet” approach to problem solving; most systems are complex constructs of real world human activities. Its approach is robust because it involves the user in describing a system which hosts these activities without the expectation that at the end of the process one has achieved “the answer”. The resulting system model is perceived as a step towards a better understanding of the real-world system.

Figure 3. Finishers’ Critical Decision Points, Key Performance Indicators and Information

A difficulty with SSM, because its approach is a departure from a “hard” systems approach, may prove to be taking actions based on what is learned. “The system” doesn’t exist: any system model is just one representation of reality. This framework may be difficult conceptually for researchers such as animal breeders who are accustomed to “hard” results. However it was useful for engaging industry members and for determining their needs. Perhaps
the greatest drawback to SSM is bridging what was learned with a strategy for developing tools to take action.

CONCLUSION
SSM was useful for assisting the systems modelling process and for directed learning involving the end-user. Processes need to be adapted to bridge discoveries about systems to implementing innovative actions. The system descriptions that were realised, when taken back to the users, did seem to adequately reflect the realities of their beef production systems. Academic participants understand beef supply chain systems differently from industry participants and one view is not necessarily less valid than another. However, when researchers attempt to develop technology to assist practitioners, system view does have implications about who the end-users are and what questions should be addressed. This will impact the adoption of any technology developed to assist decision-making. In this case a negotiation tool that assists vertical alliances, and mitigates in-ward focusing of individual supply chain participants would be valuable. Broadening participants’ scope during decisions making should yield better supply chain profits through better management of breeding, production and processing resources.

ACKNOWLEDGEMENTS
The authors thank Tim Landsberg as industry liaison and Meat and Livestock Australia for research funding, and the industry partners who made this study possible.

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