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Partner Selection and Pricing Strategy for Milk Producer and Processors

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Abstract: Two of the greatest challenges faced when building an agent-based model of an agribusiness system are those of producer partner selection (who producers sell their output to) and buyer pricing strategy (to maximise profitability and capacity utilisation). In this paper, we describe, compare and contrast a number of partner selection and pricing strategies, show simulation results based on the interaction of various strategy mixes and discuss these results in terms of existing industrial organisation theory.

This paper outlines our attempts to use a simplified approach to modelling partner selection and pricing strategies. Three partner selection strategies were tested. These were based on a combination of a partner current or past performance, differing levels of loyalty towards their current partner and the selections made by their peers. Procurement pricing strategies revolved around buyers developing a model of market elasticity and using this to match supply to capacity and profitability. Three market conditions are explored; undersupplied, over supplied and balanced in monopoly, duopoly and competitive markets to understand which partnering strategies work best and under which conditions.

The simulation results go some way to reflecting the dynamics one would expect to see in real world markets but some questions around the adaptive behaviour of the agents involved have been raised. On one hand farmers can be viewed as purely price takers and strongly rational in an economic sense, while on the other hand being resistant to change with some showing a level of loyalty that is not bounded by short-term rational economic behaviour. This model may also oversimplify the complex and multi-dimensional procurement issue of balancing capacity utilisation and profit maximisation via a use of a single driver, market price. While an economically sound offer price can be derived purely from experience of price versus supply, our current model struggles to account for the behaviour of the other agent's procurement strategies. This can lead to cyclic periods of over and under supply being generated by not only the agent's current price offer but also from the reaction the other procurement agents competing for supply. This cyclic behaviour is buffered in the real world through a number of processes not considered by this model for example contractual agreements and trust formation.

As with a number of real world dynamic systems, heterogeneity plays a critical role in the long term stability exhibited by the system. While our efforts thus far do go some way to simulating the dynamics we would expect to see in the real world, the complexity of real world decision making is still not being captured as well as we would like. The price offer / product supply dynamic has been captured, but this does leave us with a dilemma. Price formation is not structured and predictable (as require for a neoclassical economic model), nor in a state of chaos (in which case a completely random strategy would be as good as any other strategy). Far from fitting with the neoclassical model of supply, demand and price, the emergence of price from this model aligns more to Emery and Trist's classification of a "turbulent field" whereby prices "...arise not simply from the interaction of the component organizations, but also from the field itself" (Emery and Trist, 1965, p26). Perhaps what we are missing in our model is the role of social values, which operate not as strategies or tactics, but as coping mechanisms.

Keywords: *Agent-based modelling, partner selection, price formation*

Abstract only