THE VALUE OF OPTIMISATION IN THE ALLOCATION OF BEEF CARCASES TO FABRICATION PLANS: A TEST CASE

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I. INTRODUCTION

Advancements in processing have enabled carcase composition to be accurately determined at chain speed. This provides opportunity to optimise the allocation of carcases to fabrication plans based on their cutability, maximising saleable lean and minimising trimming. Decision support tools have been developed to assist Australian processors and supply chains to make these decisions around carcase allocation. The Beef Carcase Value Calculator (BVC), which is a similar tool to the Lamb Value Calculator [1], uses Hot Standard Carcase Weight (HSCW) and fat depth measured at the P8 site (P8fat) to predict primal, fat, and trim weight, and estimate individual carcase value after adjusting for fixed and variable processing costs. The Beef Carcase Optimisation Tool (BeefCOT) builds on the BVC by using an integer linear programming model to allocate carcases of a known composition (HSCW and P8fat) to the most profitable cutting pattern based on cut weight predictions, labour costs, and market prices. The aim of this study was to use the BeefCOT to understand the value of optimisation in beef processing.

II. MATERIALS AND METHODS

Slaughter data from a population of 546 carcases from crossbred steers and heifers were modelled using the BeefCOT. Average HSCW and P8fat were 271 kg (range 121 – 427 kg) and 13 mm (range 2 – 32 mm), respectively. Two fabrication patterns were defined: pattern 1 included a drop weight 6 rib Cube Roll, a 3 rib Striploin and butt off Tenderloin; pattern 2 included a 6 rib bone-in Cube Roll and a 3 rib bone-in Shortloin. All other products remained the same across both patterns. A minimum of 100 carcases were required to be processed into each pattern. Labour rates for boning room staff and market prices for products were inputted in AUD and reflected typical industry pricing at the time. These details were used to build two test cases. The first test case applied constraints to the HSCW for each pattern, such that carcases in pattern 1 must weigh a minimum 250 kg, and carcases in pattern 2 must weigh a maximum 350 kg. The second test case applied constraints to the cut weight, such that the drop weight 6 rib Cube Roll in pattern 1 must weigh between 8 and 12 kg, with exactly 100 carcases allocated to this pattern. Random allocation and linear optimisation were used to analyse and compare carcase allocation in both test cases. Results are expressed as the percentage change in the optimised scenario compared to the random scenario.

III. RESULTS AND DISCUSSION

In the optimised scenario, both test cases resulted in an increase in total profit, product weight, and trim weight, along with a decrease in fat compared to the random scenario. In test case one, total profit increased by 0.37% compared to the random scenario. Total product weight and trim weight also increased by 0.07% and 0.01%, respectively, in the optimised scenario while fat decreased by 0.05%. Optimised allocation to pattern 1 resulted in a 2.48% increase in profit within this pattern, largely driven by a 4.26% and 4.31% increase in product weight and trim weight, respectively. Test case two provided similar results with profit, product weight, and trim weight increasing by 0.24%, 0.05%, and 0.01%, respectively, while fat weight decreased by 0.03%. Pattern 1 returned a 1.1% profit increase associated with improvements of 7.97% and 8.31% in product and trim weight, respectively. Using the second test case as an example, the allocation of carcases to cutting patterns showed P8fat was a key driver for the increased value (Fig. 1). In the random scenario, carcases between 200 and 280 kg were allocated to pattern 1, regardless of P8fat. Although the optimised scenario allocated carcases using the same weight range, P8fat indicated that for carcases of the same HSCW, those with P8fat of 15 mm or greater were more profitable when processed in cutting pattern 1. A similar allocation pattern was observed for the first test case, where P8fat determined the most profitable pattern for carcases of the same weight. The results of this study concur with work in other species that demonstrate the use of linear optimisation in maximising value through carcase allocation [2].

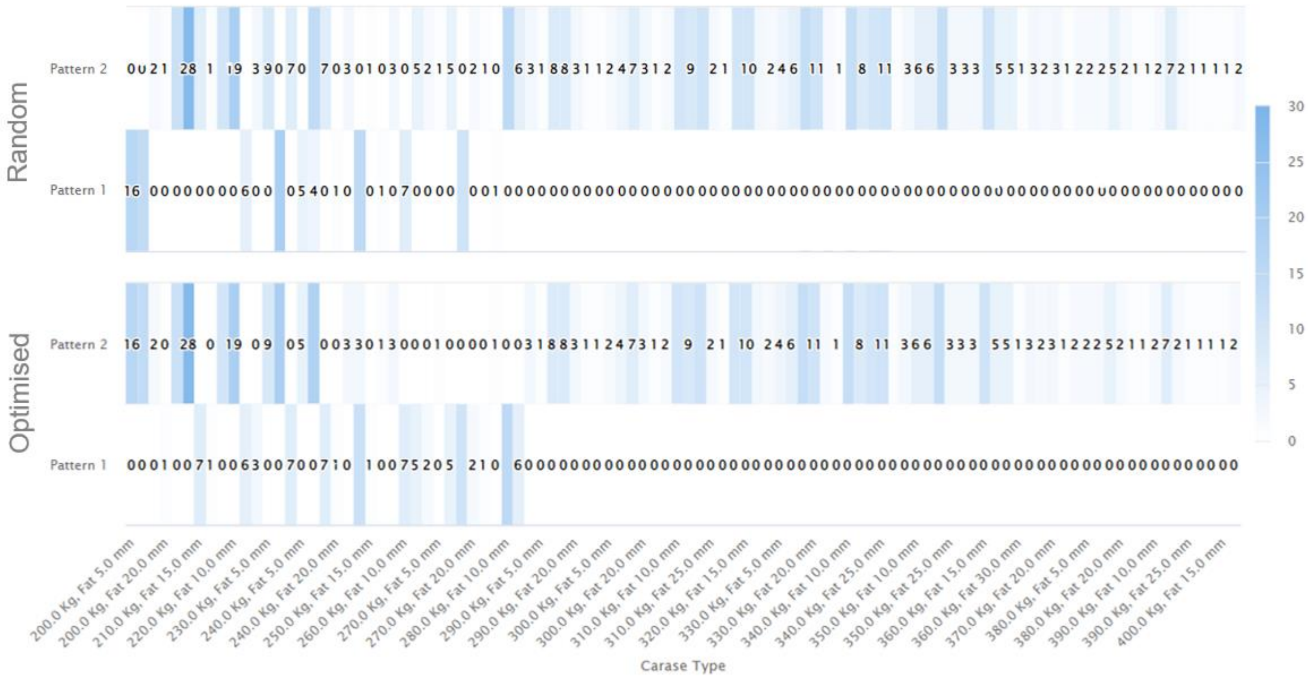

Figure 1. The allocation of carcase types to cutting patterns 1 and 2 in random and optimised scenarios.

IV. CONCLUSION

This relatively simple scenario with the BeefCOT highlights the opportunity to maximise carcase value and profitability through improved allocation of carcases to fabrication plans. The tool can assist production managers in matching chiller inventory with the most profitable fabrication plan based on production requirements. Future work in this area will include the addition of carcase quality data within the optimisation model and validation of results with production data from commercial partners.

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