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The Potential Value of Formed Silverside for

Gotzinger Smallgoods Using Smartshape Technology

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Executive summary

The potential value of SmartShape/Stretch technology (previously known as BOA) has been investigated with specific reference to producing shaped corned beef (silverside) by Gotzinger Smallgoods. A production trial was conducted to investigate potential savings and costs associated with using a prototype SmartShape machine to produce shaped silverside, compared to the current production process. Findings of the subsequent cost benefit analysis are included.

The production trial measured the yield loss incurred to both control (standard silverside process) vs product shaped using the SmartShape prototype machine. Estimates were made of the throughput capacity of the SmartShape machine and associated process, based on observations of its current production capacity. Yield loss from cooking was considerably lower for SmartShape (-14%) than the standard production (-26%). However, yield loss from slicing was slightly higher for the SmartShape product (11%) compared to the standard production (7%).

Production data from the trialwork was included in a cost-benefit analysis model. Within the analysis, additional costs from implementing SmartShape technology include capital costs, increased labour costs (excluding slicing labour requirement), consumables and repairs and maintenance. Direct production costs excluding capital equipment cost were $0.32/kg.

Benefits arising from implementing SmartShape include assumed increase in product value, reduced shrink loss (particularly reduced cooking loss) and reduction in the required cooking time, evidenced as saved energy and opportunity cooking capacity. Direct production benefits excluding change in product value were $0.19/kg.

The net operational position for Gotzinger smart shaped corned beef was an additional cost of $0.13/kg, not including capital cost which is highly dependent on volume processed.

There are reservations regarding the acceptance of the formed SmartShape product to current customers. Considering corned beef is perceived as a lower value “me-too” item in the market, it would be unrealistic to assume a sustainable premium price for shaped corned beef of greater than $0.30/kg. However, included are additional analysis with variations in throughput and price for future considerations, based on a desired payback period of 24 months. It is estimated that if Gotzinger Smallgoods were to use SmartShape to produce corned beef and achieved a $0.30/kg price premium, production would need to increase to 300 MT /annum, or charge a premium of $2.70/kg over existing product to achieve a payback period of 24 months.

Throughput volume was identified as a large driver within the cost benefit estimation. This analysis estimates that when running the machine at full capacity (650MT/per annum), the value of SmartShape technology is $0.15/kg of finished product which equates to A$454 256 annually. Gotzingers current production volumes for corned beef are 20MT /per annum, giving an annual net benefit of $-0.48/kg.

Based on current production for Gotzinger Smallgoods, this analysis finds SmartShape to be an unfavourable investment for forming silverside from outside flat primals. However, potential opportunities are presented within the report which may be applicable for consideration by both Gotzinger Smallgoods management, and other potential industry investors.

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Introduction

The potential value of SmartShape and SmartStretch technologies to the Australian beef processing industry had been previously estimated in a desk-top study (Green and Sweet 2008).

The purpose of this report is three fold:

1. To present the results of production trials conducted by Greenleaf enterprises regarding implementation of SmartShape technology for Gotzinger Smallgoods.
    a. Costs and benefits of using SmartShape for producing corned beef compared to existing (current) process.
2. Conduct a cost-benefit analysis to determine what SmartShape is potentially worth to Gotzinger Smallgoods.
    a. Describe the business (cost-benefit) model constructed by Greenleaf Enterprises for Gotzinger Smallgoods,
    b. Detail key findings, and
    c. Describe the assumptions included in the cost-benefit analysis.
3. Other relevant findings regarding the potential commercialisation of SmartShape, including;
    a. Limitations of the current system,
    b. Proposed equipment modifications required,
    c. Potential applications for use of SmartShape technology for Gotzinger Smallgoods with revised applications for the industry as a whole.

Production trial

A trial was conducted to measure yield loss incurred from the production of corned beef (silverside). Chilled (post-rigor) outside-flat primals were the value added product used in this study, therefore, this trial is specifically testing the use of the SmartShape component of the aforementioned technologies.

Methodology

Three treatments were imposed to measure differences in yield between standard silverside process (CONTROL), and shaped product (SSHAPE) processed with SmartShape. Primals were randomly allocated to treatment:

1. Control (CON) – silverside processed as per standard protocols.
2. SmartShape (SSHAPE) – silverside processed using SmartShape. All other processes as per standard protocol.
    a. **SSHAPE(i)** – Processed into SmartShape packaging immediately following injection .
    b. **SSHAPE(ii)** – Processed into SmartShape packaging after 24 hours soaking in brine (following injection).

The throughput capacity of the SmartShape process was estimated for use in the business model to calculate the labour cost.

Measurements

Measurements were made to quantify yield loss at different points in the production process, as identified below.

- Weights
  - Load-in weight (before injection and pickling)
  - Injected weight before soaking in brine
  - Pre-trim weight (before vacuum packaging [CONTROL] or smartshape [SSHAPE]). Following pickling.
  - Packaged weight (pre-cooked weight)
  - Cooked weight (packaged, cooked)
  - Pre-sliced weight (whole cooked wt without packaging)
  - Slicing waste
- Dimensions
  - Maximum girth of trimmed, pre-cooked) silverside
  - Maximum girth of cooked product
- Shelf-life comparison between CONTROL and SSHAPE treatments (microbial counts)

Results

Results of the production trial are presented in Table 1. Regarding yield, the most noteworthy distinction between the CONTROL and SSHAPE treatments was seen in the cooking yield losses, which were larger for the CONTROL treatment compared to both SSHAPE treatments. Because differences between the two SSHAPE treatments were not large, the average between the two treatments was used within the business model (described below).

Table 1 Yield benefits arising from SmartShape process compared to control.

Percentage shrink losses				
SSHAPE(i)[a], [pre-brine]		SSHAPE(ii)[b] [post-brine]	Mean %'age SSHAPE shrink	CONTROL[c]
Itemised shrink	Percentage	Percentage		Percentage
Trim	-9.04%	-9.67%	-9.36%	-7.70%
Injection	23.20%	24.62%	23.91%	26.37%
Brine loss†	-5.53%	-4.87%	-5.20%	-5.06%
Cooking loss	-14.77%	-13.53%	-14.15%	-26.29%
Slicing loss	-10.79%	-10.97%	-10.88%	-6.81%
Total	-16.94%	-14.41%	-15.67%	-19.48%
SMY[d] (%)	82.99%	85.64%		81.64%

[a] **SSHAPE(i) treatment – processed into SmartShape immediately following brine injection.**
[b] **SSHAPE(ii) treatment - processed into SmartShape packaging after 24 hours soaking in brine (following injection).**
[c] **CONTROL treatment – processed as per existing silverside process.**
[d] **SMY – Saleable meat yield.**
† **Brine loss for SHAPE(i) and SHAPE(i) includes minor yield losses incurred from the SmartShape process.**

Brine loss

These data suggests a small difference in brine loss following injection between the two SSHAPE treatments. However, it is not possible to confirm if differences are derived from treatment or external sources of variation, such as variations within the meat that would influence the capacity of each piece to hold the brine.

Cook loss

Cooking loss was considerably reduced for SSHAPE treatments (-14.2%) compared to CONTROL (-26.3%). This was expected since the SmartShape treatments were cooked within the sealed plastic casing.

Slicing loss

It was expected that SSHAPE product would have had lower slicing loss compared to the CONTROL product because the SSHAPE product is more consistent in shape (see Figure 4, Figure 5 and Figure 6). However, the slicing yield was lower for SSHAPE product. The type of slicer that was used in the experiment may have contributed to this result. As seen in Figure 1, the product was held at one end while being sliced. The natural variability in shape of the CONTROL product means that a good operator is able to minimise the yield loss at the tail of the CONTROL portion by attaching to the smallest possible part of the silverside.

Primals are halved for the SmartShape process. This is another contributor to slicing loss because the SSHAPE portions are essentially held (attached) twice by the slicing machine for each primal. While the yield loss (measured as front and tail slicing loss; Figure 2) for each SHAPE portion was less compared to that observed for CONTROL, the loss for each sliced portion was replicated for SSHAPE cut compared to whole CONTROL portions.

Slicing the SSHAPE portions did however increase slicing efficiency, since 3 SSHAPE portions were able to be sliced per slicing run (Figure 1), thereby equal to 1.5 CONTROL portions. It was therefore assumed that a 30% saving in labour may be realised during slicing since only 1 primal can be sliced per run using the existing process (CONTROL). Slicing volume throughput is expected to increase from 333 kg/hour to 500 kg/hour with the use of SmartShape.

Figure 1 Slicing of three SmartShaped portions showing attachment; equal to 1.5 (whole) silverside portions (CONTROL) per slicing run.

Figure 2 Yield loss from slicing SmartShape silverside product, with front waste positioned above the tail waste for each portion.

Microbial growth

A potential reduction in microbial growth on Smart Shape product was identified when designing the trials. Cooking and cooling product in the bag may reduce the microbial load on the product as compared to chilling exposed cooked primals in open blast chillers. Shelf life trials did not indicate any significant difference in shelf life between the treatments, probably because both treatments were sliced post cook using the same process. No benefit in shelf life was identified.

Reduced cooking time for SmartShape product

It was observed during the production trials that the smaller, more consistent shape of the SmartShape product allows for a reduction in cooking time, compared to the standard silverside product. Gotzinger Smallgoods use a steam oven for their standard silverside products, with the duration of cooking determined by the time for the product to reach the desired internal temperature. Operators are alerted when the temperature probe placed in the product reaches temperature, and the cooking cycle is terminated.

In the production trial, both CONTROL and SSHAPE treatments were cooked in the same oven (batch) but on separate racks. The temperature probe was firstly placed within the SSHAPE product. The SSHAPE product was removed when the cooked temperature was attained, the probe was placed within the CONTROL product and the cooking cycle was resumed. The cooking cycle was ended when the CONTROL silverside product reached the cooked temperature.

After the SSHAPE product was removed from the oven, the CONTROL product required a further 220 minutes to reach temperature (3.67 hours). Because temperature of the oven (and product) was reduced while the SSHAPE product was removed (thereby increasing the cook time), it is conservatively estimated that a 2 hour saving in cooking time is attainable by SmartShape product compared to standard silverside.

Within the cost-benefit analysis, this two hour reduction in cooking time was used to estimate energy saving. The cost of running a steam boiler for Gotzingers volumes was not significant in

dollar terms. Where a company is short of cooker capacity this saving in cook time would be beneficial if more batches of product could be processed per day.

Cost benefit analysis

The data collected from the yield trial was used to estimate the potential value of including SmartShape technology within the existing Gotzinger production system, with specific reference to producing corned beef from outside-flat primals.

The estimated effect of implementing SmartShape technology for producing corned beef by Gotzinger Smallgoods is discussed according to the following sections:

- Operational costs,
- Capital costs, and
- Product value.

Operational costs

Based on the current production data for Gotzinger Smallgoods, it is estimated that investment in SmartShape technology will realise an annual benefit of A$-8 552. Gotzinger Smallgoods operational cost of implementing SmartShape to produce corned beef are $0.32/kg, and the operational benefits are $0.19/kg giving a net operational cost to SmartShape of $0.13/kg.

Capital costs

Product throughput is a significant driver within the cost benefit analysis. The change in capital equipment cost per kilogram by increasing corned beef production from current volumes (20 000kg/annum) to maximum annual capacity (655 200kg/annum) on one 8 hour shift. The capital cost is reduced from $0.85/kg to $0.03/kg.

Product value

Based on the current corned beef product and the current customers, it is difficult to see SmartShape formed silverside product being able to attract a premium of greater than $0.30/kg sustainably for Gotzinger Smallgoods. Included below are discussion points in relation to product price:

- The current product is “traditional” corned beef. It has minimal pump at 23% compared with other corned beefs at higher than 50% pump. Therefore, price is already positioned as a premium.
- Shape alone is the only benefit to the product and that is not great enough to warrant a large price increase. The consistent shape of the SmartShape product (e.g. Figure 4, Figure 5 and Figure 6) would allow for a minimal saving in labour and product wastage for current customers. Some examples are included below:
    - An existing Gotzinger Smallgoods product that was clearly able to save 4 to 5 hours in staff time did not guarantee that the product attained a premium sell price. For various reasons, some customers were unwilling to pay the premium price, despite recognising the obvious saving in labour.
    - The SmartShape formed silverside was used by staff at the Gotzinger deli for making corned beef sandwiches (Figure 3). Four pieces of SmartShaped product was used

on the sandwich compared to three of the standard product. However, there was no saving in product wastage, since both portions of silverside were exactly the same weight (58 g).

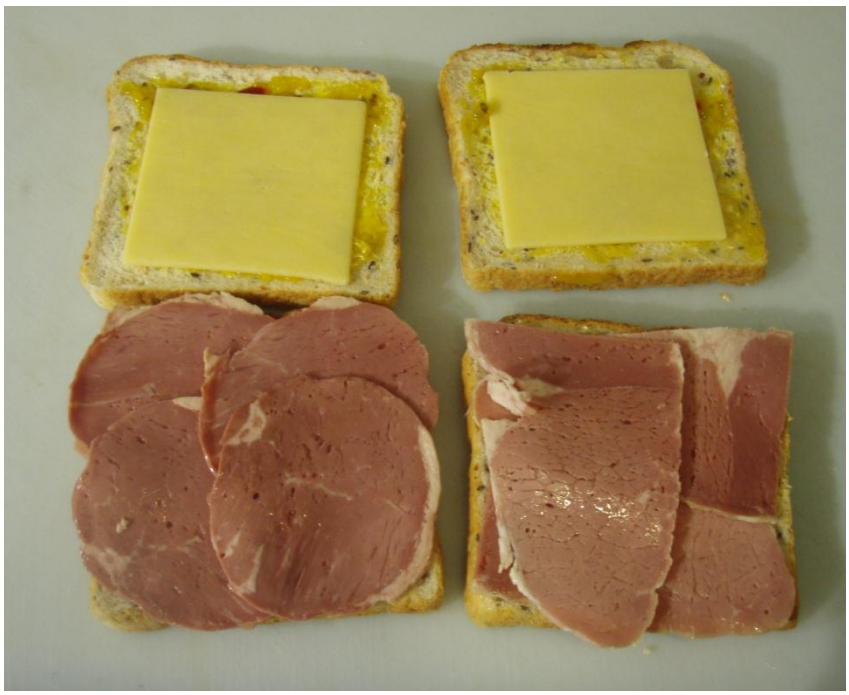

Figure 3 Use of the SmartShape corned beef product (left) and standard product (right) on a sandwiches prepared by Gotzinger Smallgoods deli staff. Both portions of corned beef weighed 58g.

- In an open market environment, competitors will reduce corned beef price to maintain market share putting downward pressure on SmartShaped corned beef prices or volumes. In other words, for the Gotzinger Smallgoods example, undercutting by competitors would greatly reduce the attractiveness of a formed silverside product when priced at a premium.

Figure 4 Sliced SmartShape silverside product.

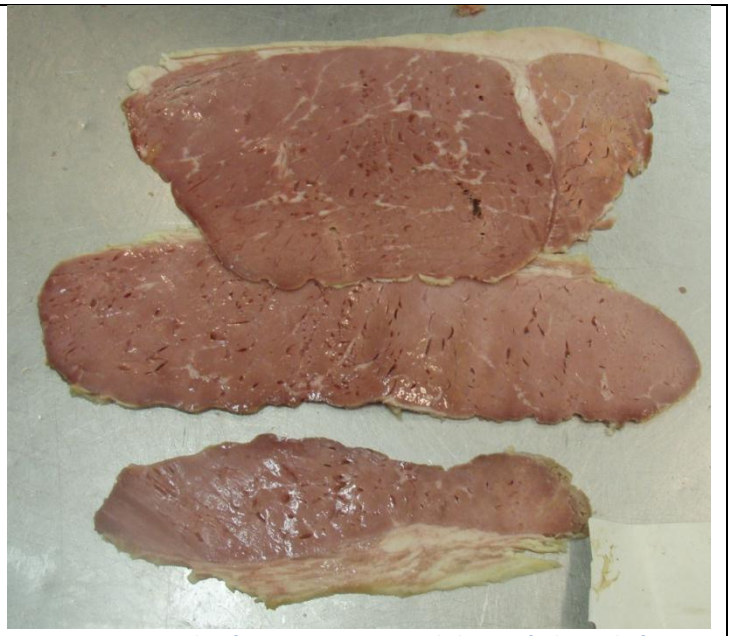

Figure 5 An example of variation in size and shape of silverside from the standard process (CONTROL). These were slices were taken from one primal.

Figure 6 (a & b) The shape and size of formed product using SmartShape is compared to standard silverside (CONTROL treatment).

Limitations of SmartShape in its current form

1. Market acceptance of shaped silverside product at a premium is questionable. It is unclear if customers would pay a premium for shaped silverside product over conventional silverside. Currently, the model assumes that a $0.30 premium is achievable for the SmartShape product. This is the largest single contributor to the total benefit. When the $0.30 premium is removed, the annual plant benefit is further reduced (-$14 552; **Error! Reference source ot found.**).
2. Size of the shaped (cooked) product. Current concerns are that there would be resistance to the current finished product because the size is too small for existing silverside customers. Underlying issues include:
    a. The ring size is currently the limiting factor, however, the size of the moulding vessel may also require re-working if a larger product size is required. Attempting to shape a cut of meat into a casing size that is too small results in reduced throughput rate (labour waste) and increased yield loss (Figure 7).
3. Plastic casing. Consideration of the type and configuration of plastic casing are required. For this trial, a plastic casing was easier to handle when soaked in water before use. Future considerations may be required to include option to soak plastic casing before use.
4. The current system does not have wide tolerance of variation in size between primals. This is particularly evidenced when portions are too big, which increases labour and yield loss (see point 1a above).
5. The automated size selection requires refining. It does not accurately select the appropriate plastic casing size. This increases the cost of the process; both labour (decreased throughput rate) and yield loss (Figure 7). It also presents a risk (safety and machinery break-down) if the system is not understood by the operator.
6. Risk of red jelly waste on the outside of cooked portions. Once formed (shaped and within the plastic casing), product must be sealed with pressure to prevent formation of red, “jelly like” waste on the outside of the cooked portions. The use of clippers is required to prevent this occurring. Figure 8 shows SmartShape product that was not sealed at the ends using clippers with the resulting unfavourable waste. The majority of product from this portion (Figure 8) was wasted. Figure 9 shows minor jelly like waste when sealed using clippers, with the amount considered inconsequential.
7. For corned beef product, the automated function within the current prototype is not consistently accurate enough for commercial use in its current form. It is suggested that a more simplified manual system may be more applicable, where three similar ring sizes are available for the operator to manually select according to dimensions of the portion being shaped. Essentially, it is believed that a good operator will more accurately determine the desired casing size given the different dimensions of outsideflat primals.

Figure 7 Costs are increased from attempting to form product into a casing size that is too small.

Figure 8 Formation of "jelly-like" waste occurs during cooking when plastic casing is not sealed with pressure to create a firmly packed product. The use of clippers is required.

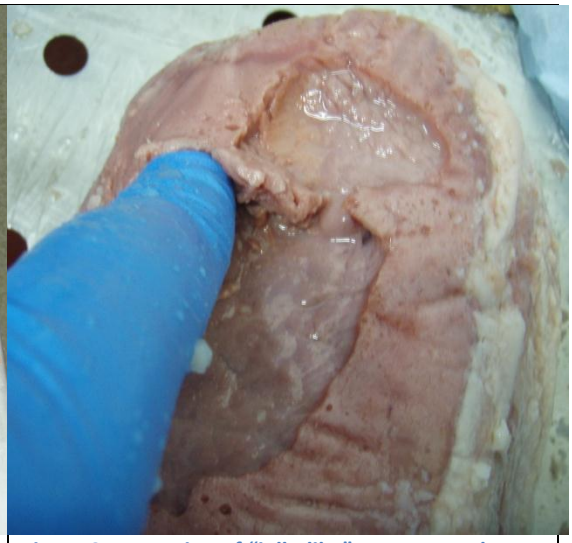

Figure 9 Formation of "jelly-like" waste was also observed when plastic casing was sealed using clippers. The quantity was minimal and inconsequential.

Strategic considerations

Although this analysis does not find the use of SmartShape technology to be financially viable for Gotzinger Smallgoods, the potential for the technology to achieve financial benefit is still recognised. Below are comments regarding the use of SmartShape technology for both Gotzinger Smallgoods and other potential investors in the future.

1. There are a range of products that may be suitable for processing through SmartShape, although only results for corned beef are presented here. Implementing SmartShape process is likely to be more favourable where the technology can value-add multiple products within the same enterprise.
    a. The real value in SmartShaping is proposed in using lower value cuts and increasing their value through shaping to be the equivalent of existing products that use a more expensive raw material.
    b. A possible example is for production of pastrami using outside flat primals instead of the more expensive eye rounds. Using the same source product with SmartShape as per existing process does not increase the operating margin of the final product.
2. It is anticipated that the majority of current Gotzinger customers would not be willing to pay more than $0.30/kg for formed Silverside. However, this does not exclude the potential for other customers to be willing to pay more for a formed silverside product. Examples of potential customers that may value consistently shaped product at more than $0.30/kg include:
    a. Broadline distributors; a consistent shaped product may allow for easier portion control for mass catering,
    b. Flight meals on airlines; a consistent product for consistent meals for all customers. The limitation here is small seasonal volumes,
    c. Prison meals; as above,
    d. Mainstream sandwich outlets, e.g. Subway,
    e. Retail customers, pre-packaged retail packs.
3. Throughput volume was found to be a large driver in the cost-benefit analysis. If the processing capacity was higher, capital cost per kg of implementing SmartShape are reduced.
4. Silverside currently produced by Gotzinger Smallgoods is a more “traditional” product compared to other corned beef products, and only has limited brine injection (23%) when compared to others that pump to over 70%. Products injected to much higher levels than observed at Gotzinger Smallgoods, will benefit more from reduced cooking losses by implementing SmartShape technology. That is, the observed 12% reduction in cooking loss is greater for product with brine injection over 50% compared to those observed for Gotzinger Smallgoods (23%).
5. There may be potential for reduced microbial growth in SmartShape product. The potential for reduced microbial load on the portions following cooking in the SmartShape product was raised from discussions with staff at Gotzinger Smallgoods. It was suggested that because the SmartShape product is contained within the plastic casing during cool-down and chilling that occurs post cooking, the microbial counts may be lower. This may allow for cooked portions to be kept chilled for longer before slicing. This may also enable the shelf-life of

SmartShape produced silverside to be extended, provided hygiene standards post cooking are high.

6. Yield loss through SmartShape is reduced when the portions are smaller (i.e. there is greater capacity to absorb odd shaped portions). The outside flat primals used within this trial were smaller than others processed. For the aperture size used, this meant that there was minimal yield loss arising from the SmartShape process.

References

Green P, Sweet T (2008) Review of Boa Technology. Commercial Application in the Australian Red Meat Industry. Meat and Livestock Australia, Sydney, Australia.