final report

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Project Scoping (Integrity Assured – Certified Organic and MSA Supply Chain) Final Report

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1 Abstract

To increase both production and sales, R Radford and Son set an objective to develop a traceability system that assured the integrity of claimed “Certified Organic” and “MSA” meats along the supply chain for both boned and carcass beef and sheep-meats.

The incorporation of 2D bar-coding and SmartPhone technology with an appropriately modified stock processing system was proposed as the most cost effective and efficient means to capture, store, integrate and retrieve the necessary data to achieve the objective.

Through desk-top research and empirical analysis, this scoping project has tested the proposal by assessing Radford’s supply chain partners and likely consumer response to assured traceability, examination of 2D Bar Coding and SmartPhone technologies as they relate to the project and precise mapping of Radford’s current and proposed stock processing system.

The scoping has determined that expanded data capture and retrieval will provide new marketing opportunities for retailers to attract and “convert” the 44% of surveyed consumers willing to try Certified Organic and/or MSA meats.

For processors with a similar operating profile to Radfords, the “transcription errors” avoided by fully automating data recording and integration, delivers an estimated 33.8% Return on the Capital investment attendant to project implementation.

2 Executive Summary and Conclusions

Project Objectives

As Victoria's leading exponent of Certified Organic processing for the domestic market and leading and proponent of MSA accreditation, Radfords have identified the opportunity to increase consumer attraction to both categories through the use of 2D Bar-coding in conjunction with SmartPhone technology. Whilst these technologies are already being utilised for boned and packed retail meats, the proposed developments would greatly enhance traceability for whole carcass product.

Consultation with MLA and AMPC concluded that a preliminary Scoping Project (Go / No Go assessment) ought to be undertaken to evaluate the initiative.

Specific objectives of this scoping project are:

- To outline and better clarify the actions and steps required to effectively deliver & communicate the (IASC) system to the supply chain and consumer base, including benefit to the industry and adoption potential of this innovation.
- Articulate the expected measurable outcomes of that project.

Project Methodology

The project utilized personal interviews, empirical and desk-top research as follows:

- Interview assessments of Radford's (Certified Organic and MSA) Supply Chain partners (producers and retailers) overwhelmingly supported the project objectives with essentially all respondents either strongly agreeing or agreeing that Product Integrity and Market Development would be enhanced by the initiative.

- Precise mapping of Radford's current processing (livestock receipt through to carcass and boned-out delivery), confirmed that maintaining the integrity of Certified Organic and MSA processing, both change of livestock custody and segregation in particular, is inordinately time consuming and costly compared to that required for conventional stock. Most notably; there are no monitoring systems currently in place to attest continuance of segregation at or after change of custody from Radfords to customer and reliance is placed on the honesty of the retailer to do so. Later comment elaborates o why this *modus operandi* is not expected to change if the initiative move to implementation.
- Assessment of "2D Bar Coding" deliverables confirms that in concert with SmartPhones, the adoption of the consumer focused Quick Response (QR) is best suited to capture the supply and value chain benefits envisaged by the initiative. In particular, these technologies provide:
    - High degree of robustness (30% fault tolerance) and data storage / retrieval capacity
    - one-step process for directing users to a website, phone number, directions, promotions or other information
    - more efficient use of printed materials and reduce waste
    - essentially no cost to produce
    - integration with a wide range of marketing materials

- device independence that does not require special development for different platforms
- measurable "reader" actions that can be traced with web analytics

Whilst QR coding provides the enabling technology to write / record extensive data and information, it is the emergence of the SmartPhone that provides consumers with technology to immediately and conveniently read / recover the information and thereby facilitate the marketing outcomes enabled by the IASC project.

- Consumer surveys canvassed 100 participants (nation-wide) and determine that the ability for consumers to independently verify claimed / advertised province would facilitate a potential market share increase of 12.2% and 15.0% in respective Certified Organic and MSA consumption.

PROJECT BENEFICIARIES

Producers and Retailers (butchers, foodservice, supermarkest, etc)

Extrapolated nationally, the referred to increases in Certified Organic and MSA consumption would generate potential incremental retail sales revenue of $905.1 million annually, decreasing to $9.1 million at the 1% statistical probability level.

Notably and elaborated upon in the report, these calculation assume MLA statistics to determine (current) retail values for Beef and sheep-meats, inferring a composite value of $9.47 per kg which is markedly less (56%) than the $16.85 per kg margin derived from our retail price survey. Reconciliation on this difference will be reported as an addendum to this project.

Processors

Whereas increased market penetration and growth will accrue for producers and retailers of Certified Organic and MSA product; for Radfords (and similar processors), the project justification relies upon leveraging the efficiencies attendant to the project across all processing, with (a mere 0.3%) reduction in data capture errors delivering a 33.8% ROI.

R Radford and son have a long and highly regarded history of investing in Research and Development and openly sharing the outcomes with industry colleagues. With expected build duration of ten weeks; implementation of the IASC Project will serve as a demonstration site for others to assess and emulate. In particular; the adaptation of Cedar Creek Company systems to enable cost effect traceability of small-stock through smaller scale domestic abattoirs, should prove both commercially attractive as well as extending NLIS monitoring to the point where custody changes hands from the processor to the customer.

Whilst Animal Welfare is outside the prescribed scope of this project assessment; the CCTV elements nominated for inclusion in the project would in particular, provide a mechanism to alleviate the rising public concerns around what has clearly become an issue for Australia's red meat industry.

Consumers

Whilst not providing the same depth of "immediate" consumer scrutiny that individual QR coding on each portion of meat would deliver, it is considered that QR codes "attaching" to segregated stock displays will facilitate a sufficient degree of consumer attestation of claimed status (Certified Organic or MSA), whilst not significantly impacting on the retailers costs and efficiency. This said; the system also provides opportunity for entrepreneurial retailers to significantly

differentiate their offering from other Certified Organic or MSA meat providers. The report elaborates on some of these opportunities.

Under any option, automation of the trace processes from livestock receipt to carcass dispatch will provide supply chain participants with sufficient data (embedded in the QR code) to assure product integrity has been maintained and to respond to any consumer interrogation accordingly.

Contents

3 Background

In June 2011, R Radford and Son Pty Ltd proposed the development of appropriate software (computer program) to provide traceability of Certified Organic and MSA (bovine and ovine) product from the farm of origin to the retail butcher or food service provider.

Contemporaneously, the project would also introduce datamatrix / two dimensional (2D) barcodes into the supply chain, providing the capacity to record a vast amount of data / information on single, much smaller and unobtrusive medium.

Radfords sought MLA PIP funding support for “Integrity Assured – Certified Organic and MSA Supply Chain” (IASC) project.

Discussions and initial assessment of the project concluded that a preliminary Scoping project (Go / No Go assessment) ought to be undertaken to evaluate this initiative with regard to economic returns to the whole industry, clarifying project justifications and expected outcomes in terms of direct savings and risk management.

Business development consultants; Focused Management Strategies Pty Ltd (FMS) were engaged to undertake these works. FMS Interim Report determined that there was sufficient opportunity for the envisaged project to achieve its broad objective of increasing consumer demand for Certified Organic and MSA meats and therefore the scoping project should proceed to this Final Report that responds to the identified Project Objectives.

4 Project Objectives

The objectives of this project are to:

- To outline and better clarify the actions and steps required to effectively deliver & communicate the (IASC) system to the supply chain and consumer base, including benefit to the industry and adoption potential of this innovation.
- Articulate the expected measurable outcomes of that project.

5 Project Methodology

The project utilizes personal interviews, empirical and desk-top research as follows:

- **Interview assessments of Radford's (Certified Organic and MSA) Supply Chain partners** to corroborate (or otherwise) expected benefits ("what's in it for them")
- **Precisely map Radford's current processing** (livestock receipt through to carcass and boned-out delivery), identifying the impact of implementing the IASC project
- **Compare Radford's processing** (stock, documentation and data capture) with similarly sized / structure domestic processors
- **Articulate "2D Bar Coding" deliverables**
- **Conduct in-store consumer interviews** gauging likely adoption / use of enhanced traceability
- **Quantify expected IASC project outcomes** for – Radfords, Supply Chain Partners, Industry and Consumers

6 Project Outputs

The project will confirm or otherwise the expected outcomes from Radfords proposed "Integrity Assured – Certified Organic and MSA Supply Chain" project

Supply Chain Partner Survey

The IASC project extends the "Cut to Carcass" traceability functionality established by Radfords in 2008, ensuring product integrity throughout the product Supply Chain and enabling participants (individually or in collaboration) to develop the consumer marketing potential that the evolvement of 2D (Quick Response) product Bar-Coding and the emergence of SmartPhone technology offers. This functionality is considered particularly relevant to Certified Organic and MSA Producers and Retailers.

Survey methodology

A sample (representing the majority by volume) of Radford's Certified Organic and MSA Producers and Retailers (butchers and food service) agreed to participate in the survey, the essential conduct of which was:

- Key project related Considerations and attendant Questions were emailed to participants for them to determine their responses.
- On an agreed timetable; Focused Management Strategies (FMS) telephoned and interviewed each participant and recorded their responses and any additional comments or observations. Where appropriate, additional comments were circulated for other survey participants for their consideration and feedback.
- Finalised survey responses were emailed to each participant for confirmation or otherwise.

Survey responses
The selected sample of Certified Organic and MSA participants tend to be vertically integrated directly controlling both (livestock) production and retailer butchery, with (abattoir) processing facilitated by Radfords under contract**.** Supply Chain Questionnaires canvassed these participants addressing the project's essential aims of improved Product Integrity facilitating Market Development, these responses are summarised:

Product Integrity – livestock receipt
All respondents either Agreed or Strongly Agreed that Installation of bar code reader at livestock delivery race would significantly reduce recording errors and time-consuming "change of custody" disputes.

(Further consideration of this proposed installation has determined that; given the addition of a NLIS/ID scan on the small-stock floor, installation of a PC terminal (to enter data from accompanying delivery documents) will achieve the noted objective and provide a more efficient use of resources.)

All respondents either Agreed or Strongly Agreed that Installation of CCTV surveillance of stock pens would provide conclusive evidentiary proof of headcounts when stock are delivered outside normal business hours

Product Integrity – carcass load-out
All respondents either Agreed or Strongly Agreed that Installation of Code Reader at load-out to electronically record and store carcass count and weights would significantly reduce recording and invoicing errors and provide the provenance link between storage and dispatch.

All respondents either Agreed or Strongly Agreed that Installation of CCTV surveillance of load-out would provide conclusive evidentiary proof that custodial integrity is maintained

Market Development
All respondents either Agreed or Strongly Agreed that the ability of 2D bar-codes and SmartPhone scanning will support Certified Organic and MSA product marketing by providing:

- Consumers with verifiable evidence of claimed provenance
- Absolute product integrity – from "paddock to plate"
- Promotional advantage over non-participant competitors
- Increased consumer confidence and ability to grow sales volumes
- Refutation of exaggerated and/or reckless media coverage of red meat processing related issues

All but one respondent (undecided) either Agreed or Strongly Agreed that the ability of 2D bar-codes and SmartPhone scanning will enable further marketing enhancements (beyond the scope of IASC project) to be developed by individual Retail Butcher or Food Service enterprises.

Financial Contribution
Only one respondent emphatically disagreed with the proposition that; in exchange for a period of exclusive access (or some similar consideration), they would be willing to make a commensurate contribution to the development cost of a IASC promotional project.

All other respondents were undecided on the nature and extent of any contribution, wanting to assess the scoping project outcomes before making a financial commitment, typified by the comment:

> *"We would positively consider contributing to some collaborative promotion of the project outcomes"*

Additional Comments or Considerations
Respondents provided a number of additional comments and observations which essentially indicated "the sooner the better" for the identified project outcomes. Other more notable comments were:

> *"Consistent with our objective of absolute trace / integrity; ideally system could be enhanced to monitor and confirm organic status for all boning room production (primals, trim, fat)."*
> *"The absence of regulation enables all comers to claim "Certified Organic" status. Project outcomes offer a means to identify non-complying participants and "force" them out of the sector."*

The following ledger (Q1 to Q5) distils the survey Questions down to the essential "for or against" considerations of the survey and **Table 1** summarises the resultant determinations:

Table 1 ledger:

Q1 Installation of bar code reader at livestock delivery race
Q2 Installation of CCTV surveillance of cattle pens
Q3 Installation of Code – Reader at load-out
Q4 Installation of CCTV surveillance of load-out

Q5 2D bar-codes and SmartPhone scanning will support Certified Organic and MSA marketing functionality by enhancing:
- 5.1 Verifiable proof of claimed provenance
- 5.2 Absolute product integrity – from "paddock to plate"
- 5.3 Promotional advantage over non-participant competitors
- 5.4 Increased consumer confidence and ability to grow sales volumes
- 5.5 Refutation of exaggerated and "reckless" media scare-mongering

Q6 2D bar-codes and SmartPhone scanning will enable further marketing enhancements
Q7 Participant willing to make a commensurate contribution to the development cost of a promotional project

Table 1 – Supply Chain Questionnaire responses

Responses	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Q1					
Q2					
Q3					
Q4					
Q5.1					
Q5.2					
Q5.3					
Q5.4					
Q5.5					
Q6					
Q7					

Current Processing System - R Radford & Son

The scoping project has examined Radford's Ante-Mortem, Post-Mortem and Distribution processes, mapping the flow of Product (livestock, carcass and boned meats), attendant Documentation and Data Capture.

Originally comprehending Radford's dual species, bovines and ovines, mapping was extended and revised to comprehend the introduction of goat processing at Radfords site in May 2012. Goat processing (all of which is conventional stock) essentially replicates processing of sheep-meats and other small stock.

Generic processing of bovines and ovines was chartered and the following elaborates on particular procedures attendant to MSA and Certified Organic stock:

Beef

Producer livestock penned at Radfords

- MSA livestock must remain segregated at all times and cannot be drafted
- Certified Organic livestock must remain segregated at all times and can be drafted only with other Certified Organic livestock
- Certified Organic livestock are either first or last processed each day

Livestock forms and documentation

All Stock

- Stock receival Form 6B
  - Producer / Supplier name
  - Number of animals
  - Sex
  - Condition
  - Radford (holding) Pen number
- Delivery Docket
  - Producer / Supplier name
  - Number of animals (confirmed by drover)
  - Sex (confirmed by Radford's drover)
  - Condition (confirmed by Radford's drover)
  - Holding Pen number (recorded by drover)
- National Vendor Declaration
  - Producer / Supplier name

Number of animals (confirmed by Radfords)
Sex
Producer Identification Number (PIC)

- Antemortem Record (QMS) Inspection and check-list

  Also alerts QA to "new supplier stock" requiring fat sample to confirm Organic status
- Stockyard Density Diagram Allocated pens for specified livestock

Certified Organic Stock

- NASAA Declaration (2004) Certified Organic producer's declaration
- Check-list Form FO1 Conformance check-list

Meat Standards Australia (MSA) Stock

- MSA Vendor Declaration Producer / Supplier name
  Number of animals (confirmed by Radfords)
  Sex
  MSA Registration Number
  Despatched time
  Delivered time
  Producer Identification Number (PIC)
- Check-list Form F1 Conformance check-list

  MSA conformance requires that stock must be processed within 24 hours of receival

Daily Kill Agenda

- Ear Tag identification number (ex NLIS sheet)
- System assigned Trace Identification animal / body number (daily order of slaughter)
  This creates the trace link (in Radfords / Sastek system) between pre and post mortem for each specific animal
- Body Weight *Finalised Daily Kill data uploaded to NLIS data- base at end of day's production.*

Daily Run Sheet – internal manual check record of bodies processed (through Rumping Station).

Identification Record – beef carcass (text and bar-code **label** attached to carcass) references NLIS data captured (ear tag scanned at Rumping Station), correlated with (Trace ID) body number. **Table 2.1** schedules readable (text) and bar-coded information currently recorded on Beef Carcass labels.

Table 2.1 – Beef Carcass labelled information

Data identified	Text	Bar-code
Abattoir MSA Registration Number	X	
Body Number	X	X
Carcass Category	X	X
Carcass Number	X	X
Certified Organic Registration Number	X	
Contractor	X	X
Customer	X	X
Date and time of Production / kill	X	X
Dentition	X	
Establishment number (Radford and Son – L21)	X	X
Fat depth	X	
Lot number	X	X
MSA logo	X	
Net Hot Standard Carcass Weight (HSCW)	X	X
NLIS Registration Number	X	X
NLIS stock identification number	X	X
Organic and NASAA logo	X	X
Producer (market / origin)	X	X
Sex	X	X

Identification Record – boned and boxed beef

Identification of individual primals is referenced to the Radford data-base and replicates the trace data applicable to the "parent" body. **Table 2.2** specify the Text and Bar-code labelling:

Table 2.2 – Boned and Boxed beef labelled information

Data identified	Text	Bar-code
Bar code sequence number	X	X
Best Before Date	X	X
Establishment number (Radford and Son – L0021)	X	X
Label ID	X	
Net Weight (KG)	X	X
Number if primals (PC)	X	X
Packed on Date	X	X
Packed on Time	X	X
Product Code		X
Product Description (eg "Eye Rump Side")	X	X
Serial number	X	X
Species (eg "Boneless Beef")	X	X
As appropriate: Producers Certified Organic ID	X	
Or Producers MSA ID	X	

Identification Record – boxed beef offal Table 2.3 specify the Text and Bar-code labelling for beef offal:

Table 2.3 –Boxed Beef Offal labelled information

Data identified	Text	Bar-code

Bar code sequence number	**X**	**X**
Best Before Date	**X**	**X**
Establishment number (Radford and Son – L0021)	**X**	**X**
Label ID	**X**	
Net Weight (KG)	**X**	**X**
Number if pieces (as appropriate)	**X**	**X**
Packed on Date	**X**	**X**
Packed on Time	**X**	**X**
Product Code		**X**
Product Description	**X**	**X**
Serial number	**X**	**X**
Species	**X**	**X**
As appropriate: Producers Certified Organic ID	**X**	
Or Producers MSA ID	**X**	

Load Out - Load-Out Report 4.9.6 records:

- Number of cartons of boxed meat (data copied to customers' Delivery Dockets)
- Number of carcases and weights loaded (data copied to Daily Run sheet)
- Temperature Report F-7L records the highest carcase temperature

Sheep-meats (and other small-stock)
Producer livestock penned at Radfords

- MSA livestock must remain segregated at all times and cannot be drafted
- Certified Organic livestock must remain segregated at all times and can be drafted only with other Certified Organic livestock
- Certified Organic livestock are either first or last processed each day

Livestock forms and documentation

All Stock

- Stock receival Form 6B
  Producer / Supplier name
  Mixed lots are identified by daubing each animal with a specific coloured paint mark
  Number of animals
  Sex
  Condition
  Radford (holding) Pen number

- Delivery Docket
  Producer / Supplier name
  Number of animals (confirmed by Radford's)
  Sex (confirmed by Radford's drover)
  Condition (confirmed by Radford's drover)
  Holding Pen number (recorded by Radford's)

- Stock-on-hand Book
  Add numbers to perpetual inventory

- Daily Run Sheet
  Total number intended for day's processing

- National Vendor Declaration
  Producer / Supplier name
  Number of animals (confirmed by Radfords)

Sex
Producer Identification Number (PIC)

- Antemortem Record (QMS) Inspection and check-list
  Also alerts QA to "new supplier stock" requiring fat sample to confirm Organic status
- Stockyard Density Diagram Allocated pens for specified livestock

Certified Organic Stock

- NASAA Declaration (2004) Certified Organic producer's declaration
- Check-list Form FO1 Conformance check-list

Meat Standards Australia (MSA) Stock

- MSA Vendor Declaration Producer / Supplier name
  Number of animals (confirmed by Radfords)
  Sex
  MSA Registration Number
  Despatched time
  Delivered time
  Producer Identification Number (PIC)
- Check-list Form F1 Conformance check-list
  MSA conformance requires that stock must be processed within 24 hours of receival
- **Daily Kill Sheet** Number and Classes of stock processed (reconciled with Daily Run sheet)
  Finalised Daily Kill data uploaded to NLIS data-base at end of day's production.
- **Stock-on-hand Book** Updated for number of stock processed
- **Daily Run Sheet** Updated for total number actually processed

Identification Record – Sheepmeat carcass (text and bar-code label attached to carcass).

Table 2.4 schedules readable (text) and bar-coded information currently recorded on lamb and sheep carcass labels.

Table 2.4 – Sheep-meat Carcass labelled information

Data identified	Text	Bar-code
Abattoir MSA Registration Number	X	
Body Number	X	X
Carcass Category	X	X
Carcass Number	X	X
Certified Organic Registration Number	X	
Contractor	X	X
Customer	X	X
Date and time of Production / kill	X	X
Dentition	X	
Establishment number (Radford and Son – L21)	X	X
Fat depth	X	
Lot number	X	X
MSA logo	X	
Net Hot Standard Carcass Weight (HSCW)	X	X
NLIS Registration Number	X	X
Organic and NASAA logo	X	X
Producer (market / origin)	X	X
Sex	X	X

Radford's owned stock is identified by affixing with a coloured clip, no clip or label. (The choice of identification is a function of Radford owned carcasses numbers compared to total carcasses processed)

- Private kills are labelled with customer name and destination
- MSA or Certified Organic (and NASSA) logos differentiate labels for these categories

Identification Record – boned and boxed sheep-meats

Identification of individual primals is referenced to the Radford data-base and replicates the trace data applicable to the "parent" body. **Table 2.5** specify the Text and Bar-code labelling:

Table 2.5 – Boned and Boxed sheep-meat labelled information

Data identified	Text	Bar-code
Bar code sequence number	X	X
Best Before Date	X	X
Establishment number (Radford and Son – L0021)	X	X
Label ID	X	
Net Weight (KG)	X	X
Number if primals (PC)	X	X
Packed on Date	X	X
Packed on Time	X	X
Product Code		X
Product Description	X	X
Serial number	X	X
Species	X	X
As appropriate: Producers Certified Organic ID	X	
Or Producers MSA ID	X	

Identification Record – Sheep-meat Offal
Sheep-meat Offal may be contained in Tubs, Bags or Boxes. **Table 2.6** specifies the Text and Bar-code labelling for sheep-meat offal:

Table 2.6 –Boxed Sheep-meat Offal labelled information

Data identified	Text	Bar-code
Bar code sequence number	X	X
Best Before Date	X	X
Establishment number (Radford and Son – L0021)	X	X
Label ID	X	
Net Weight (KG)	X	X
Number if pieces (as appropriate)	X	X
Packed on Date	X	X
Packed on Time	X	X
Product Code		X
Product Description	X	X
Serial number	X	X
Species	X	X
As appropriate: Producers Certified Organic ID	X	
Or Producers MSA ID	X	

Load Out - Load-Out Report 4.9.6 records:

- Number of cartons of boxed meat (data copied to Delivery Dockets)
- Number of carcases and weights loaded (data copied to Daily Run sheet)
- Temperature Report F-7L records the highest carcase temperature

Delivery
Radford's logistical planning both enjoys and relies upon out-of-hours (key to premises) access to substantially all retail customers. There are no monitoring systems in place to attest continuance of segregation (certified organic / MSA / conventional stock) at or after change of custody. Thus; existing procedures rely upon the integrity of the retail butcher / customer.

Customer notification
Daily record compiled from processing data-base and emailed to customer / wholesaler. Automation of this process will be incorporated in the "back office" data management enhancements.

Comparison of Radford's processing with other domestic processors

Radford process flow-charts and elaborating notes were forwarded to two comparable domestic processors for there consideration and feed back. Follow-up telephone discussions confirmed that in all essential aspects, Radfords processing system is representative of domestic abattoirs of comparable size and operational structure.

Process mapping confirms that maintaining the integrity of Certified Organic and MSA processing, both change of livestock custody and segregation in particular, is inordinately time consuming and costly compared to conventional stock.

Post-mortem (refrigerated) storage and load-out (into delivery vehicles) in particular requires excessive manual checks and records to ensure integrity is maintained.

Installation of the software and hardware proposed under the original project scope are needed to both facilitate the identified project outcomes and to provide the overall processing efficiencies needed by Radfords and comparable abattoirs to justify the project investment.

2D Bar–Code Deliverables

The generic use of the word Bar-Code identifies both linear (one dimensional /1D) encoded data such as EAN and GS1 represented as parallel lines and datamatrix (two dimensional / 2D) code such as QR (quick responses) represented by an array of miniscule dots or squares.

The following summarises the key aspects of both 1D and 2D codes, the use of QR codes as a marketing tool and the status of QR codes within the Australian red meat sector.

1D Barcodes

EAN and other linear /1D barcodes are effective for laser barcode scanners which are typically used in point-of-sale systems in retail stores as well as in low-end and high-end handheld scanners. Formats differ in the kind and number of characters they can carry, how compact they can store information and the printing tolerances required.

The comparatively recently developed “Code 128” is structured to enable the bar-code to hold any character of the ASCII 128 character set. This count includes all digits, character and punctuation marks. This broad range of characters enables diversified information to be stored in the barcode. It is also fairly compact which gives good data storage to size ratio. It is mainly used in logistics for ordering, distribution and transportation, thus it is essentially geared towards non-Point of Sale products.

The bar code symbology used in the Australian Red Meat Industry Standard Variable Weight Carcass Label and Carton Label is GS1-128 (previously called UCC/EAN-128).
Both the physical size of the print media (ticket) used and the limited type of information that can be embedded, in particular the absence of Uniform Resource Locators (URL’s), makes GS1-128 incapable of meeting the consumer marketing objectives of the IASC project.

2D Codes

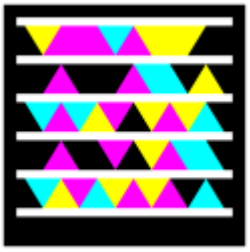
Instead of Bars, 2D codes use dots or tiny squares and can contain any kind of alpha-numeric data. They can hold significantly more data than a 1-dimensional barcode while, in the case of a QR (Quick Response), guaranteeing up to 30% fault tolerance, essentially; up to 30% of the code could be destroyed or obscured without loss of the coded data.
Importantly; the data cannot be read with a laser scanner and needs to be decoded using a 2D code scanner, hence the projects reliance on the exponential growth in smart-phones and the scanning function of “apps”.

Figs 1, 2 and *3* provide examples of 2D codes:

Fig 1: Datamatrix *Fig 2*: Maxicode *Fig 3*: QR Code

Because of their relatively small footprint, particular 2D code formats such as Datamatrix (opposite) are attracting significant use in logistics and operations but provide much reduced marketing scope when considered for consumer applications.

There are other 2-dimensional codes – some that are standardized and some that are proprietary. The Microsoft "tag" (opposite) for example is based on triangles rather than dots/squares and makes extensive use of colors to store more information in the same amount of space.



LED-based Bokode is an optical identification technology that can hold significant more data than other existing codes. Powered by a LED and covered by a mask, they are arranged as a collection of multiple Datamatrix codes within a lens of 3mm size.

Bokode strength lies in its capability to dynamically modify the stored codes without the need to produce a new tag. Since Bokodes are not simply printed on paper but feature electronic components such as a lens and LED, Bokodes are relatively expensive and not yet considered ready for the mass adoption.

Whilst beyond the scope of this assessment, the ongoing development of codes includes further capacity expansion by adding a "third dimension" by the use of colour and / or changed geometry (such as the Microsoft tag above) and in the case of device-to-device communications, adding a "fourth dimension" in the form of changing the encoded symbols over a time regime (reducing the quantity of data / information that needs to be present as the life of the product changes).

Notably; a new supermarket scanner, created by Japanese electronics manufacturer Toshiba Tec is able to identify objects without the use of a barcode. Instead of using a laser scanner, Toshiba's 'Object Recognition Scanner' recognizes the food product itself using a high speed camera which discards the image's unwanted background. As well as different varieties of fruits and vegetables, the scanner is able to recognise packaging and coupons.[1]

Quick Response (QR) Codes

[1] http://www.ausfoodnews.com.au/2012/03/14/toshibas-new-supermarket-scanner-%E2%80%9Crecognises-food%E2%80%9D.html

The most popular 2D code is the QR code. With a strong consumer focus, QR codes are typically found on advertisements, magazines and business cards. The QR code is (typically) free to use and highly flexible in terms of size and error / fault tolerance.

QR Codes and Marketing

QR code is effectively a 'printed-media' hyperlink that connects the physical world with the online world. For marketers, QR codes allow advertisements, brochures, posters, clothing and billboards to direct users to mobile landing pages that contain much more information and interactivity than can be provided on a printed page. This integration between print and web via a SmartPhone adds a new dimension of communication to marketing campaigns.

Formerly confined to industrial uses, QR codes have in recent years become common in consumer advertising and packaging, because the dissemination of SmartPhones "has put a barcode reader in everyone's pocket". As a result, the QR code has become a focus of advertising strategy, since it provides quick and effortless access to a brand's website.

Beyond mere convenience to the consumer, the importance of this capability is that it increases the conversion rate, that is; it increases the chance that contact with the advertisement will convert to a sale, by coaxing qualified prospects further down the conversion funnel without any delay or effort, bringing the viewer to the advertiser's site immediately, where a longer and more targeted sales pitch may continue.

QR Codes storing addresses and Uniform Resource Locators (URLs) may appear in magazines, on signs, on buses, on business cards, or on almost any object about which users might need information. Users with a SmartPhone equipped with the correct reader application can scan the image of the QR Code to display text, contact information, connect to a wireless network, or open a web page in the telephone's browser. This act of linking from physical world objects is termed hardlinking or object hyperlinking. QR Codes may also be linked to a location to track where a code has been scanned. Either the application that scans the QR Code retrieves the geographical information by using GPS and cell tower triangulation (aGPS) or the URL encoded in the QR Code itself is associated with a location.

Advantages from using QR Codes

Key advantages offered by QR codes include:

- **User Convenience** – QR Codes provide a convenient one-step process for directing users to a website, phone number, geographical directions, promotions or other information.
- **Environmentally-Friendly** – QR Codes can make more efficient use of printed materials and reduce waste.
- **Cost-Effective** – QR Codes cost (essentially) nothing to produce; their use is only limited by the parameters of a particular marketing strategy.
- **Versatile** – QR Codes can be integrated with a wide range of marketing materials for just about any purpose, including print collateral, outdoor display and direct mail.
- **Device Independent** – QR codes, as well as the landing pages they link to, can be viewed on all popular smartphone models and do not require special development for different platforms (e.g. iPhone vs. Android).
- **Measurable** - Actions triggered via QR Codes can be traced with web analytics or other tools for marketing campaign measurement.

- **Competitive Differentiation** – Because QR Codes are still relatively new in many markets, those who are among the first to employ them in their campaigns have the opportunity to identify themselves as leaders in strategic marketing.

Consumer Responsiveness to QR codes

Notwithstanding that world-wide consumer use of this technology is growing, growth in particular market segments can be seen to be retarded by the absence of a value proposition. Three key attributes must be present to improve response rates using QR codes:

1. Clear instructions and declared consumer value! (If people don't know what's behind the QR code, what's the incentive to scan it?)
2. QR codes will be scanned on mobile devices only, thus a mobile-centric experience must be provided, including an appropriate website and other inducement (advertisement, special offers, discount, related information, etc)
3. Pure black-and-white QR codes are boring! The big error-tolerance allows them to be adapted and changed to certain degree to introduce colour, imbed pictures, etc.

QR Codes and the Australian Red Meat Industry

The rapid adoption of 'smart phone' technology by Australians in the past two years has prompted the introduction of the first QR barcodes on fresh beef items on supermarket retail shelves that include traceability features.[2]

In what is considered to be the first Australian example of fresh beef items carrying QR-codes, a new line of gourmet sausages begun trialling in 2011 in about 50 Cole's supermarkets in Victoria. The sausages are manufactured by the Tibaldi Company in Melbourne, using meat from the premium Greenham Cape Grim grass-fed natural program in Tasmania.

Using a SmartPhone application, transfers the reader to the mobile-friendly Cape Grim website page carrying relevant information, including:

- Trace-back to supplier(s). The Cape Grim program is able to define suppliers within a narrow two-hour production window, even on de-constructed product like trim used in sausages. Typically that means two to four suppliers, whose information is included on the site. The traceability does not extend back to a specific beast, but to property-of-origin level.
- Recipes applicable to each specific product
- Handling instructions and food safety information
- General information about the Cape Grim brand.

Each pre-pack also carries a 10-digit number allowing customers without smart-phones to access the website via any web-enabled computer. (As this requires the reader / consumer to do some further work, the likely success of this device is questioned).

[2] http://www.beefcentral.com/p/news/article/634

Including the QR code allows a butcher to transfer that QR code to a retail-ready pre-pack in their chilled cabinet if they wish.

Greenhams also apply the codes to its own retail-ready lines and subsidiary further-processed products like packaged Cape Grim beef stock and jus, and pre-cooked pies.

Comments on the program from key stakeholders include:

> *"More and more Australians are now aware of the existence of QR codes, but many may not yet have actually used one, but we think that will change rapidly... it was largely about highlighting the points of difference in the Cape Grim program".*
>
> ***Peter Greenham – General Manager HW Greenham[3]***

> *"I believe the long-term secret to QR codes in beef will not be just as a product information portal to a web-page somewhere, but in building customer loyalty.*
> *It works particularly well for a brand like Cape Grim, which has a whole provenance story behind it with grass-fed, pristine environment, no HGP and other attractive attributes. But in the more generic end of the marketing spectrum, the QR code reader has the potential to also 'give the customer something back'."*
>
> ***Glen Feist - MLA domestic market manager[4]***

> "… *customer interest in product information was growing on an almost weekly basis, Coles Supermarkets sees a strong future for QR codes as part of a broad-based approach to meeting retail customer demand for more extensive and detailed food product information.*
>
> *"The information they are seeking around the provenance of a product, ingredients, recipe ideas using the product and similar information is continuing to expand rapidly.*
> *"We see the QR code system as an ideal mechanism to deliver that, but it is in fact just one of a number of options. Some of the others include point-of-sale links back to a website, and even extended conventional barcodes which have the capacity to hold a little more information."*
>
> *"It appeared to be a natural progression that as consumers wanted to know more about the food products they were purchasing, the source of supply was an important part."*
>
> ***Chris Nicklin, Cole's Meat business category manager.[5]***

Internationally; whilst research such as "The Future of In-Aisle Mobile: A Framework for Consumer-Centred Innovation" assess QR codes ability to store more information than traditional barcodes as a means of enhancing food traceability and consumer access to food nutritional and allergen information by governments, industries and academia alike. Of particular relevance to the IASC project, this report also notes that there is a lack of information and guidance in stores about how QR codes work, and where to download the applications used to scan the QR code.[6]

Commenting on Michigan State University pilot beef traceability program, (project leader) Associate Professor Dan Buskirk noted that 2D barcodes – give meat consumers an in-depth history of the animal, offering shoppers a "wealth of information" about the product and how it

[3] An i on the best beef, The Weekly Times, September 28, 2011 p.18

[4] An i on the best beef, The Weekly Times, September 28, 2011 p.18

[5] http://www.beefcentral.com/p/news/article/650

[6] http://whitehorse.com/mobile-retail/

was processed …where it came from, whether it was grass-fed, grain-fed, organic or hormone free.[7]

> *"Even if it has a little bit of value to consumers, it adds incentive to producers to get involved in these [livestock tracing] programs."*

Operational Considerations

QR code content
Noting that the elements that can be encoded into QR codes is evolving in response to new demands, the following lists elements currently available for encoding in QR codes.

- **Plain Text**
- **Website URL**
- **GPS Coordinate** / Google Maps Location
- **Telephone Number**
- **SMS Message to a number**
- **Contact Details** (VCARD)
- **Email Address**
- Email Message to an address
- Calendar Event (VCALENDAR)
- Wifi Login Information for Android device
- Paypal Buy Now Link
- Twitter Profile / Status Update
- Facebook Profile / Like
- LinkedIn Profile / Share
- FourSquare Venue
- iTunes Link (music, album, artist, app, etc.)
- YouTube Video Link

The highlighted **(Plain Text, Website URL, etc)** are considered of most relevance to the IASC project

QR Code Error Correction
The essential robustness of QR codes in the physical environment is their ability to sustain "damage" and continue to function even when a part of the QR code image is obscured, defaced or removed. The original data in the QR code is converted into a polynomial, effectively mathematically adding backup data to the QR code.

There are four error correction levels used for QR codes, with each one adding different amounts of "backup" data depending on how much damage the QR code is expected to suffer in its

[7] Barcode tracks meat, The Weekly Times, July 13, 2011 p.17

intended environment, and hence how much error correction may be required. QR codes also include a display of the error correction level used in that particular QR code:

- Level L – up to 7% damage
- Level M – up to 15% damage
- Level Q – up to 25% damage
- Level H – up to 30% damage

Figure 4 illustrates the appearance of QR Codes that incorporate these various levels of error correction.

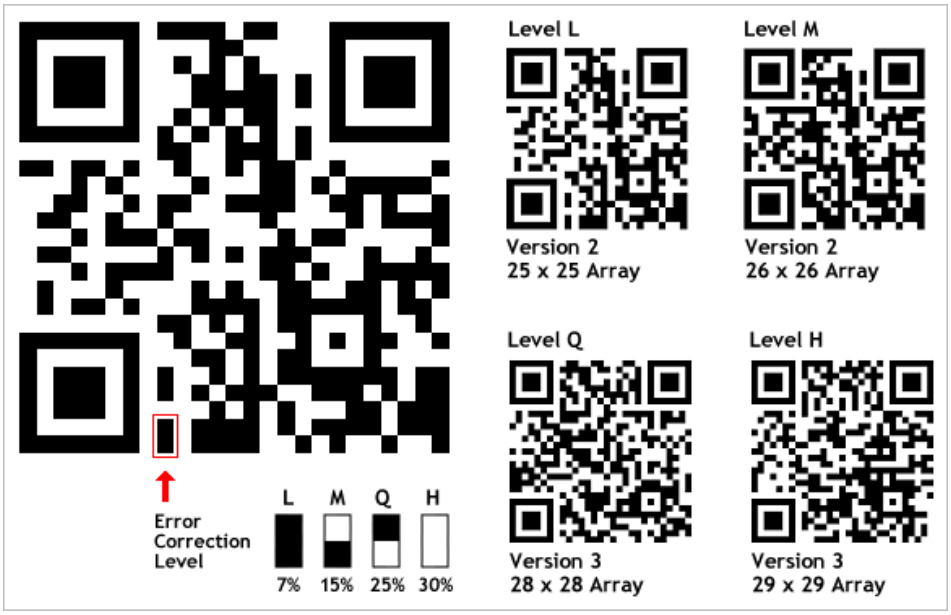


Figure 4 QR Code error corrections

The more data input into QR codes, the more rows and columns of modules will be introduced into the code to compensate for the increased data load. As the error correction level increases, there will also be an increase in the number of rows and columns of modules required to store the increasing amount of backup code-words.

In summary, key attributes of the different levels of error correction are:

- The lower the error correction level, the less dense the QR code image is, which improves minimum printing size.
- The higher the error correction level, the more damage it can sustain before it becomes unreadable.
- Level L or Level M represents the best compromise between density and ruggedness for general marketing use.
- Level Q and Level H are generally recommended for industrial environments where keeping the QR code clean or un-damaged will be a challenge. Accordingly; Level H is considered the best option to be adopted by any IASC implementation project.

Notwithstanding that there is a single ISO standard for QR codes, there are variables within the ISO standard (error correction level being one of them) that will result in a different looking QR code image based on how that particular QR code creation website (QR Code Generator) sets these variables. Thus; dependent on the error correction level being used by that particular website, QR codes containing the same data may look different.

QR Code Generators
Numerous Web sites offer free QR code generator services, (which may also include no-cost or low-cost storage and management of codes). Pivotal is the Generator's ability to handle data in different formats. Following summarises the key characteristics considered fundamental for efficient and effective QR Code Generation:[8]

- **The QR code generator should be flexible.**
  QR codes can contain a lot of different types of information and the QR code generator should be able to handle all these various types of information.

- **The QR code generator should be easy to use.**
  Some generators try to incorporate as many types of information as possible, but the resulting interface is too confusing to use to be of real help.

  A tabbed and properly indexed QR code generator is highly desirable if working with different types of URLs, data, social media platforms, and graphics.

- **The QR code generator should allow download of codes in different file formats.**
  While most services that allow you to create QR code allow you to download the generated codes in graphic format, it is preferable to have the code in vector format such as a PDF file that doesn't lose its resolution when enlarging. This is particularly helpful if producing large versions of the QR code for printed materials.

- **The QR code generator should allow the code to be easily embedded.**
  This greatly expedites putting up the generated code solely onto a Web site.

Marketing Considerations

QR Marketing Mistakes

As with any marketing media, QR codes themselves are a means to an end: **an offline-to-online delivery mechanism**. It's what's beyond the code that usually determines whether the experience will delight or disappoint the reader / consumer. Following are the five key QR marketing mistakes identified by marketing commentators:[9]

- Not Testing the Code
- Getting Too Fancy With Text
- Directing the reader to Non-Mobile Pages
- Putting QR Codes where there's No Data Signal
- Not Offering Enough Value to the user/reader

[8] http://beqrious.com

[9] http://mashable.com/2011/08/02/qr-code-mistakes/

Effective Use of QR Codes in Marketing Campaigns

Following are key considerations in order to utilize QR codes strategically in communications:[10]

- **Context and Content** - the QR code should direct the user to targeted content that complements the printed material where the code is located. Simply pointing a QR code at a website's homepage isn't likely to convert into action.
- **Instruction/Call to Action** - target users may need a cue to entice them to scan the QR code. It may also be helpful to provide some information about what users can expect to find after scanning code (e.g. "scan this code for a special offer...").
- **Mobile Landing Page** - the person who scans the code will be on a handheld device (SmartPhone). Therefore, ensure that the users is directed to a mobile-friendly landing page. Sending users to a website formatted for desktop viewing won't be helpful, and won't make a good impression.
- **Tracking & Reporting** – a QR code tracking and reporting system enables tracking the number of scans over time, capture of geographic data and other information.

Mobile Landing Pages – a must

Standard website landing pages that are designed for desktop viewing do not display well on a mobile device. Converting visitors (to customers) on mobile devices requires landing pages that are properly designed for handheld display and touch-screen interaction. If users are directed to web pages that are difficult to view on a handheld it will make a negative impression and there's a good chance they'll move on to a competitor that offers a better mobile experience.

The key elements identified as requisite in the design of a Mobile Landing Page are:[11]

- **Design & Layout** –ensure that the mobile page is formatted for viewing on smaller handheld or tablet screens
- **Mobile-Specific Content** – viewers on mobile devices are best served by streamlined content that is easy to digest at-a-glance
- **Touch-Screen Interface** –ensure that any interactive page elements (submit buttons, form elements, links and navigation) are sized appropriately for a touch-interface.
- **Device Detection** – place device detection on desktop landing pages so that users on handhelds will be detected and redirected to the mobile equivalent.
- **Call-to-Action**– ensure that your mobile landing page includes a strong call-to-action that will inspire visitor action and lead to "conversions".

QR Marketing Strategies

Following are ten prominent QR marketing.[12] Whilst some may not have extensive application in the red meat supply chain, individual retailers (butchers / restaurants) in particular may see opportunities that will enhance their existing marketing:

[10] http://mashable.com/2012/01/14/qr-code-marketing/

[11] http://www.hswsolutions.com/services/mobile-web-development/mobile-landing-page-design/

1. REINVENT THE SHOPPING EXPERIENCE

– BRING IT TO THE CONSUMER IN A VIRTUAL FORMAT

2. ENHANCE THE USER EXPERIENCE

– DIRECT CONSUMERS TO ADDITIONAL VISUAL AND/OR AUDIO INFORMATION

3. STREAMLINE THE CUSTOMER'S VISIT

- integrate apps with pre-paid debit / credit cards to avoid queues

4. NOTING THE THINGS YOU ENJOY

- scan QR code labels to find out (and record) more about a favoured product. (This would have particular application for implementation of the IASC project for both restaurants - QR Coded incorporated in menus and butchers - QR Coded price stickers).

5. GIVE CUSTOMERS SOMETHING THEY WANT

- offer a free download to attract and stimulate "conversation" via URL scan

6. PROVIDING REAL-TIME INFORMATION

- provide real-time updates of promotions, specials, etc

7. INITIATE SHARE-WORTHY COMPETITIONS

- use social media links to expand a customer base

8. PERSONALIZED GIFT GIVING

- imbed personal messages in QR code and attach it to product (like a gift card)

9. HELP YOUR CUSTOMERS GROW THEIR BUSINESSES

- issue unique QR codes (to butchers, restaurants) for decal window display which passersby can scan to find information about that business

10. SHARE MODERN DAY MIXTAPES

- include seamless link to music mix QR code

SmartPhones

Whilst QR coding provides the enabling technology to write / record extensive data and information, it is the emergence of the SmartPhone that provides consumers with technology to immediately and conveniently read / recover the information and thereby facilitating the

[12] http://mashable.com/2012/01/14/qr-code-marketing/#434718-Personalized-Gift-Giving

marketing objectives essential to the IASC project. Notably; what constitutes a smartphone today may change by next week, next month, or next year.[13]

General Use of SmartPhones and Applications (Apps)

Demonstrating the penetration that SmartPhone technology has achieved; **Table 3** schedules the change in world-wide SmartPhone annual sales for the period 2009 through 2011 and forecast for 2012, deriving a compound (year-on-year) growth rate of 167% over the period.
Assuming a retention of three years, it is estimated that some 1.3 billion SmartPhones will be in-use at the end of 2012.[14]

Table 3: SmartPhone world-wide sales

Platform	2009	2010	2011	Forecast 2012	Estimated total in-use at Dec 2012
Android	6.8	67.2	219.5	320	606.7
Blackberry	34.4	47.5	51.5	40	139.0
iPhone	24.9	46.4	89.3	130	265.7
Nokia	80.9	111.6	93.4	50	255.0
Windows	15.0	12.4	8.8	10	31.2
Other	9.3		14.2	20	34.2
Total	171.3	285.1	476.7	570	1331.8

Sources data: iReceipt.com.au; table compiled by Focused Management Strategies

In partnership with research company IPSOS; Google has recently conducted a global study of over 30,000 SmartPhone users in 30 countries, including Australia.

Google's research revealed that, with 37 per cent of Australians owning a SmartPhone, Australia has the second highest SmartPhone penetration in the world.[15] Thus; with a population of some 22.7 million, nearly 8.4 million Australians own a SmartPhone, equating to 0.6% of the world-wide total (8.4 / 1331.8). Comparatively; Australia represents only 0.3% of world population and this "over-representation" in SmartPhone ownership underscores Australian's accepted higher propensity to adopt advancing technologies.

The Google study also claimed that by calendar year end 2011, 50 per cent of Australians will have a SmartPhone.[16]

Google's Natalie Rojowsky concluded that… "While the mobile revolution is moving at different speeds across the globe, it is evident everywhere. This research underscored how consumers are using their mobile devices to access the web, look for local information, and purchase products and services. However…Businesses seem to be lagging behind the consumer in terms of use and support of mobile marketing which represents a significant opportunity."

[13] http://cellphones.about.com/od/smartphonebasics/a/what_is_smart.htm
[14] http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats/
[15] http://www.ausfoodnews.com.au/2011/09/08/smartphone-boom-may-shift-retail-boundaries-in-australia.html
[16] http://www.marketingmag.com.au/news/smartphones-more-widespread-than-thought reports that ownership between the ages of 15 and 65 reached 68% in Aug 2012, and predicted 92% by 2017

Rojowsky's observations echo key findings of "The Future of In-Aisle Mobile: A Framework for Consumer-Centred Innovation" report released by international consumer technologies specialists White Horse Digital Futures Group, this report concluded that:[17]

- More consumers are able to use their SmartPhone to scan, research and compare the prices of products, and that this is changing consumer behaviour. However, retailers are slow to respond adequately to this consumer capability.
- The evolution of the use of SmartPhone in retail will develop from SmartPhone technology being used as a device external to the store to eventually becoming part and parcel of the in-aisle retail experience.
- Many SmartPhone owners use their devices for a range of shopping functions, including searching for a lower price for a product, looking up product reviews and store information, scanning the electronic tag of a product to view product information, or downloading coupons and discount offers delivered to their SmartPhone. The report stated that retailers should be catering to this trend in retail behaviour.

A recent report by PriceWaterhouse attributes the spread of mobile devices as one of the key factors for the rise in on-line shopping. According to the report, in 2012 so far, 34 per cent of online transactions were made via mobile phone.[18] In a related report, IBIS World forecast the value of Australian on-line shopping for food, groceries and alcohol to reach $1.87 billion (18% of $10.4 billion) in 2012.[19]

Attesting to both the overall growth indicated in **Table 3** and the shifting market share of the various platforms; web-based outsourcing brokers Freelance.com statistics reveal the number of freelance jobs available for Android apps rising 26 per cent to 2,863 compared to the fourth quarter of the calendar year 2011, while jobs for iPhone apps lifted 27 per cent to 4,318 and iPad was up 19 per cent to 1,828. Editorialising; freelance.com concluded that "… the demand for mobile app developers has been insatiable and will continue to grow as more businesses seek to offer their products and services on these platforms."[20]

Research for the Australian Communications Consumer Action Network (ACCAN) released on 6 September 2012, shows 58 per cent of people opt for mobile phones, compared with only 29 per cent who use fixed lines.

Other developments that further imbed SmartPhones as a multi-faceted consumer tool include The Google Wallet application which enables storage of the consumers credit or debit card details on (highly secure) Google servers that can be used from the phone or computer for in-store and online shopping. The efficiency of the Google system is marketed as making "your phone your wallet" requiring merely to tap the back of the phone to a Near Field Communication (NFC) point of sale terminal or checkout. The transaction is wireless and is said to be secure and being accepted at an increasing number of businesses.[21] Telstra recently reported that orders for the new [Apple] iPhone 5 sold out in a record 18 hours.[22]

Usage in the Food and Grocery sector

[17] http://www.ausfoodnews.com.au/2011/07/29/opportunities-await-retailers-for-in-aisle-mobile-phones.html
[18] http://www.ausfoodnews.com.au/2012/08/09/australian-online-shopping-drives-retail-change.html
[19] http://www.ibisworld.com.au/industry/default.aspx?indid=1837, Online Shopping Market Research Report, ANZSIC X0004, April 2012
[20] http://www.news.com.au/technology/mobile-apps-developers-in-hot-demand/story-e6frfro0-1226340716592
[21] http://www.ausfoodnews.com.au/2012/08/16/phone-applications-alternative-to-credit-card-payments.html
[22] *In line for i-5*, Melbourne Herald Sun, September 18, 2012 p.17

"Tech-savvy grocery shoppers are turning to iPhone applications to save time and money…customers are ditching pen and paper to create online shopping lists by scanning product barcodes at home."[23]

This (28 Aug 2011) news report lead-in reflects the increasing use of SmartPhone technology by Australian food retailers, reporting that Woolworth's free app has been downloaded 400,000 time since its launch on 11 August 2011 (equating to 23,5000 hits per day), whilst Coles has had about 500,000 downloads of its similar app since 2009.

The rapid local development of apps by Full-Service Supermarkets (FSS) echoes international innovations that have included multinational food giant Tesco launch the world's first 'virtual shop' in Korea and the walls of the Seonreung subway station in downtown Seoul came to life with virtual displays of over 500 of Tesco Homeplus' most popular products with barcodes. Customers can scan the barcodes using a Homeplus app on their SmartPhone and get the products delivered to their door.[24]

Emulating Tesco's market foray[25]; in more recent months, Woolworths unveiled its "virtual supermarkets" at Flinders Street Station in the Melbourne CBD and at Town Hall Station in central Sydney.

Shoppers in Melbourne and Sydney can now purchase Woolworth grocery products by scanning the barcodes on the billboards with their SmartPhones. The barcodes then take users to Woolworths' mobile app where the store's full range of products can be purchased and delivered (for a delivery fee) to shoppers within hours.[26]

Australia's first 'click and collect drive-thru' supermarket was launched by Woolworths in August 2012. Consumers access the service via their SmartPhone, Tablet or Personal Computer. Once customers have completed their order, they select the drive-thru option and choose a collection time. Shoppers collect their shopping buy presenting identification at the Woolworths drive-thru bay.[27]

The barcode-issuing agency GS1 Australia and food giant Nestlé Australia have announced a world-first for the delivery of product data to customers.[28]

The Global Data Synchronisation (GDS) based process will enable Nestlé Australia to make its extended product data available to consumers via the new GS1 GoScan iPhone application. GS1 GoScan is the first whole-of-industry endorsed application to deliver trusted extended product

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[23] *Shopping lists go app-market*, Melbourne Herald Sun, August 28, 2011 p.5
[24] http://www.ausfoodnews.com.au/2011/09/08/smartphone-boom-may-shift-retail-boundaries-in-australia.html
[25] ausfoodnews.com.au/2011/09/08, *op cit*
[26] http://www.ausfoodnews.com.au/2012/02/21/woolworth%E2%80%99s-new-%E2%80%9Cvirtual-supermarkets%E2%80%9D-in-sydney-and-melbourne.html
[27] http://www.ausfoodnews.com.au/2012/08/09/woolworths-opens-australia%e2%80%99s-first-%e2%80%98click-and-collect%e2%80%99-drive-thru-supermarket.html
[28] http://www.ausfoodnews.com.au/2012/07/23/major-international-brand-adopts-global-product-data-phoneapp.html?

information to consumers, direct from the brand owners. This data includes nutritional and ingredient information, allergen declarations and other consumer advice, dietary information, etc. The data is validated for completeness and accuracy during Nestlé's label approval process and also when it is loaded onto GS1net, and then processed through to GS1 GoScan's database where it becomes available to consumers via the iPhone application.

GS1 GoScan is expected to be launched in October 2012. GS1 Australia continues to work with brand owners to upload their data for use in GS1 GoScan and is inviting other food companies to participate.

Reflective of the 2011 actions of the Obesity Policy Coalition,[29] one of Australia's leading public health research bodies, The George Institute, has launched a new SmartPhone app which gives a "Traffic Light" rating based on the amount of total fat, saturated fat, sugars and sodium per 100 grams – green for 'low', amber for 'medium' and red for 'high'.[30]

By scanning the barcode of Australian packaged foods using an iPhone camera, shoppers will receive immediate, nutritional advice via the FoodSwitch app.

Usage in the Red Meat sector
Following are a representative selection of topical reporting on the use of SmartPhones and apps within the Australian and international red meat industry:

> ***Super steak a click away –*** *MLA app takes guess work out off cooking steak*[31]
> Meat and Livestock Australia's iBeef iPhone application helps consumers get the most out of their beef by taking the guess work out of cooking.
> "*We know iPhones are a really good way to communicate with people while they are in the shop or kitchen…Downloads are the key; spreading the information is what's powerful…The feedback has been positive [app downloaded 1000 times in its first fortnight]*
>
> *Andrew Cox – MLA Marketing Manager*

> ***Big brands outed by iPhone app*** *– giving consumers information that's not on the label*[32]
> A popular smart phone application that gives an ethical rating on food brands gives a big thumbs down to some major brands supplied by Australian farmers.
> The Shop Ethical application, which rates more than 2800 products, including food brands, was downloaded to 10,000 iPhones last year.
> Several big food brands flunked out in its ethical rating criteria, which includes foreign ownership and animal cruelty records…
> *"It's really about giving consumers some power in the store to make decisions with information that's not printed on the label."*
>
> *Nick Ray, Ethical Consumer Group coordinator.*

Whilst the "*Big brands outed by iPhone app*" report demonstrates the ability of SmartPhone technology to empower consumers, it also highlights the opportunity for meat industry supply chain (and others) to positively respond to the new information and communication paradigm.

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[29] http://www.ausfoodnews.com.au/2011/09/05/anti-obesity-activists-launch-smartphone-app-with-traffic-light-signals.html
[30] http://www.ausfoodnews.com.au/2012/01/18/australian-invented-%E2%80%98foodswitch%E2%80%99-smartphone-app-to-provide-traffic-light-rating-for-foods.html
[31] Super steak a click away, The Weekly Times, November 9, 2011 p.102
[32] Big brands outed by iPhone app, The Weekly Times, February 1, 2012 p.19

Further to this; the Future of In-Aisle Mobile: A Framework for Consumer-Centered Innovation[33] also emphasises the apparent failure by (food sector) retailers to embrace and leverage consumer expectations of SmartPhone technology, noting in particular:

- More consumers are able to use their SmartPhone to scan, research and compare the prices of products, and that this is changing consumer behaviour. However, retailers are slow to respond adequately to this consumer capability.
- The evolution of the use of SmartPhone in retail will develop from SmartPhone technology being used as a device external to the store to eventually becoming part and parcel of the in-aisle retail experience.
- Many SmartPhone owners use their devices for a range of shopping functions, including searching for a lower price for a product, looking up product reviews and store information, scanning the electronic tag of a product to view product information, or downloading coupons and discount offers delivered to their SmartPhone. The report stated that retailers should be catering to this trend in retail behaviour.

SmartPhone usage - Consumer trends

A detailed analysis by Dealsta of Woolworths SmartPhone app development concludes that mobiles have become integral to the shopping experience and highlighting the following functions:[34]

- 84% of (US) shoppers use their phones while they shop (there is a lack of comparable Australian statistics but the markets are similar)
- 70% are comparing prices
- 67% are accessing product reviews
- 61% are looking for specific store information – hours, other locations.
- 'Sales and Promotions' are what shoppers want to know about when they are close to a brand's store or product location

Furthermore, a (April 2011) Google survey found that 95% of SmartPhone users have looked for location information, with 88% of these users having acted on this information within one day, often contacting or visiting a business.

Google also found that 79% had used their SmartPhones for shopping, with 75% having made a store purchase, either at the shop or on their phones.

CONSUMER SURVEYS

An on-line consumer survey sampled 100 consumers (nationally) on 17 key points with an invitation to participants to add any additional pertinent comments or observations. Following summarises and interprets the survey results:

- **Gender** – Of all respondents, 54% are Female and 46% Male. This relatively close split is somewhat consistent with the ABS national ratio of 50.3%: 49.7% and infers that differentiated marketing based on gender would not yield an advantage significant enough to warrant the likely additional cost.

[33] opportunities-await-retailers-for-in-aisle-mobile-phones, *op cit*

[34] http://www.ausfoodnews.com.au/2011/09/02/woolworths-shopping-app-%E2%80%93-a-fresh-analysis.html

- **Age** – Apart from the 1% (I respondent) in the under 20 years strata, significant representation is present across the remaining five age strata essentially allowing this demographic to be assessed across three segments: 32% *establishing* (respondents are aged 20 to 40 years), 42% *enhancing* (aged 41 to 60 years) with the remaining 25% *ensconced* (aged 61 years and older). Comparable ABS national indices are 38.3%, 35.8% and 25.9% indicating that whilst collectively the establishing and enhancing sample (76%) is consistent with the national ratio (74.1%), here is a "shift" of some 6% between these strata. This may have implications for market segmenting.

- **Location** – 58% of respondents are metropolitan based and 42% regional. Reflecting the sampling criteria of ensuring a "good-size" regional representation; this split varies substantially from the (ABS) ratio of 69% metro and 31% regional.

- **Product knowledge** - 63% of respondents had some knowledge of Certified Organic meat, however of this 51% had only "a little knowledge". Whilst 54% had some knowledge of MSA product with 39% proportion of those with only a little knowledge.

  Alternatively assessed, 88% and 85% respectively had little or no knowledge of Certified Organic or MSA meat indicating both the extent of the market potential and the work needed to be done to realise that potential!

- **Product purchase** – Whilst 39% of respondents purchase some Certified Organic meat, 67% purchased some MSA product. This disparity may be attributed to the price differential between products and the extensive and continuing MSA promotional campaign undertaken by Woolworths in 2011.

- **Independent verification** of claimed province (as envisaged by the AISC project) would have 45% of respondents more likely to trial and 27% new buyers of Certified Organic meat. Similarly, 44% would try and 34% buy MSA product.

  These ratios infer a potential market share increase of 12.2% (.45 x .27) and 15.0% (.44 x .34) in respective Certified Organic and MSA consumption would be facilitated by the project.
  Dual endorsed (Certified Organic MSA) product would attract 45% of consumer to trial and 30% new buyers.

- **Market value –** for the significant majority (74%) of the survey population the data infers an average weekly household red meat expenditure of $25, with the remaining 26% of respondent's household expenditure on red meat exceeds $51 per week, whilst MLA[35] and ABS[36] data indicates a national average red meat expenditure of $23 per week.

  Comparison and analysis of these data confirms the validity of the sample result, where applying the Product Purchase ratios for Certified Organic and MSA, derives an overall incremental spend of $29.70 ($51-$23 x .39) + ($51 - $23 x .67), approximating the spend delta of $28.00[37]
  FMS's in-store retail butcher pricing survey canvassed major supermarkets, independent suburban and metro market retail butchers of Conventional, MSA and Certified Organic red meats to determine a representative composite sell price per kilogram beef and lamb. **Table 4** and attendant notes summarises those results:

[35] http://www.mla.com.au/About-the-red-meat-industry/Industry-overview
[36] ABS, Household expenditure survey, cat, no, 6535.0.55.001
[37] If for example these ratios were respectively 10% and 30%, the derived value of $11.20 (28.00 x .1) + (28.00 x .3), would suggest a "flaw" in the survey results

Table 4 – Retail Butcher Pricing

	Conventional $/kg	**MSA** $/kg	**Certified Organic** $/kg
Beef - Average common items	**21.33**	**21.67**	**37.51**
Percentage increment over Conventional			*75.84%*
Beef - Average all recorded items	**16.76**	**17.68**	
Percentage increment over Conventional		*5.49%*	
Lamb - Average common items	**18.66**		**33.78**
Percentage increment over Conventional			*81.06%*
Lamb - Average all recorded items	**17.18**		**33.78**

Conventional: MSA – Beef

The availability of all conventional cuts in MSA specification allowed for comparison of fifteen cuts (ranging from $8.00 to $32.00 in price) and provides a sound statistical measure of the average price per kg. Thus a shift from conventional meat to MSA graded can be expected to generate a 5.49% increase in retail sales revenues.

Conventional: Certified Organic - Beef

The absence of cheaper cuts in the Certified Organic beef offering, restricts the comparison to seven products, determining an average retail sales increment of 75.84%

Conventional: Certified Organic - Lamb

Although further restricted to three cuts only, the determined increment of 81.06% approximates that of beef and is therefore considered by and large to be representative of the price differential.

- **Information download** - 81% of respondents currently download information to their Personal Computer, while 22% download to their SmartPhone; these ratios are broadly consistent with general statistics.

  Critical to the IASC project objectives; whilst downloads by PC currently exceed SmartPhones by approximately 4:1, recent research indicated that Australia's SmartPhone ownership has increased by 15% in the year to June 2012 reaching 52% of the population and projecting that in less than two years' time mobile internet use will surpass PC desktop use.[38] Topically; Apple attracted over 2 million pre-release orders for the new IPhone, selling-out inside 24 hours of announcing their latest device.

  Thus; assuming only adult SmartPhone ownership, organic growth in SmartPhone adoption will expand the nominal project reach from the current 3.7 million (16.7 million x .22) to over 8.4 million (16.7 x .50) by June 2014.

- **Complementary information –** reflecting the proposition of "enhancing the consumer experience"; the survey invited those who access QR codes to nominate any and all complementary intelligence about red meat they would appreciate being made accessible through SmartPhone / QR technology. This invitation attracted 10 responses with an emphasis on cooking instructions, recipes and nutritional quality.

[38] http://www.mybusiness.com.au/technology/the-importance-of-having-a-mobile-optimised-business-website

Livestock Welfare
Whilst outside the prescribed scope of this IACS project assessment and not canvassed by the consumer survey; the CCTV elements nominated for inclusion in the project would in particular, provide a mechanism to alleviate public concerns around livestock welfare.
Noting that Australia represents about 3.5% of world beef production; **Table 5.1** provides the results (number of references) of a web searches on "cattle welfare" and "Australian cattle welfare", indicating that 41% of world-wide references to cattle welfare are generated by Australian activity.

Substituting "cruelty" for "welfare" returns an extraordinary 176% of references being attributed to Australia and emphasising the incidents connecting "cattle" to "cruelty" in the Australian industry.

Table 5.1 Web references – cattle welfare

Search	Web results	%
Cattle **Welfare**	1,830,000	
Australian Cattle **Welfare**	745,000	41%
Cattle **Cruelty**	442,000	
Australian Cattle **Cruelty**	777,000	176%

Table 5.2 provides web search analysis of Sheep/ Lamb data, again showing reference to the Australian industry as being significantly disproportionate to both world-wide activity and to Australia's 7.4% production share.

Table 5.2 Web references – sheep welfare

Search	Web results	%
Sheep **Welfare**	1,540,000	
Australian Sheep **Welfare**	370,000	24%
Sheep **Cruelty**	501,000	
Australian Sheep **Cruelty**	159,000	32%

PROJECT IMPLEMENTATION and EXPECTED OUTCOMES

Implementation

Whereas the project will facilitate increased market penetration and growth for producers and retailers of Certified Organic and MSA product; for Radfords and comparable abattors, the project justification relies upon capturing the efficiencies attendant to the project across all processing including conventional meats.

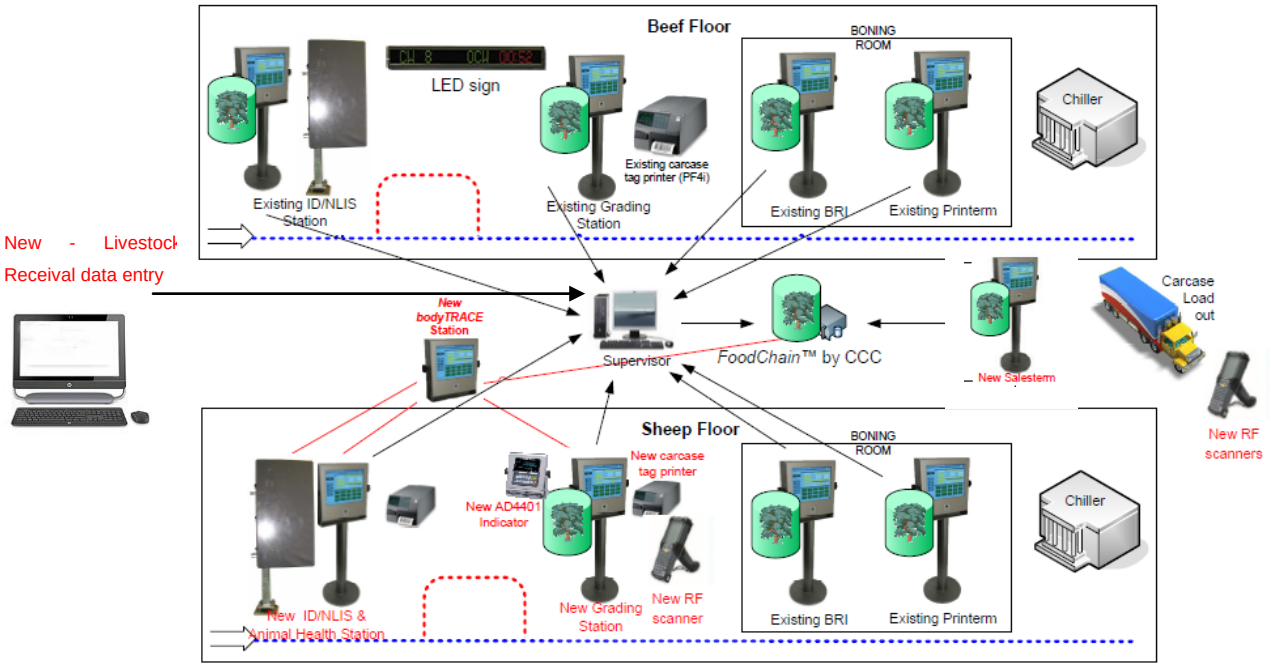
Nominally, any increase in Certified Organic and/or MSA meat consumption will be substitutional rather the incremental to Conventional meat, however as Victoria's most prominent and one of only a few Domestic processor of Certified Organic, Radfords can expect to attract incremental volume from other (non-certified) processors.

In order to determine the viability of the nominal investment by Radfords, this scoping project has assessed the likely market take-up of the project deliverables. However, an analysis addressing

costing and plan for the implementation of the requisite value chain enhancements are beyond the comprehension of this scoping. Accordingly; the following considers only the investment and expected outcomes for Radfords, with any further elaboration on other the supply chain participants (producers and retailers) to be the subject of assessment by others.

Thus, for Radfords, the essential elements for implementation are the acquisition and installation of new and integration of existing (hardware and software) components that will provide the systemised processes and protocols necessary to ensure product integrity is maintained throughout the meat processing (abattoir) operations.

Fig 1 provides a diagrammatic representation of the proposed system, indicating exiting and "new" processes and equipment and the integration of all these.



The following assesses the project implementation by reference to the four essential functions of the abattoir; **Livestock Receival and Custody**, **Processing**, **Storage and Load-out** and **Administration** and elaborates on the Key features and their contribution to an IACS system:

Livestock Receival and Custody

Installation of data entry terminal at livestock delivery race will significantly reduce recording errors and time-consuming "change of custody" disputes.

Installation of CCTV surveillance of livestock pens will provide evidentiary proof (footage) of headcounts when stock is delivered outside normal business hours. Stored footage will also support compliance with continuous segregation of Certified Organic, MSA and Conventional livestock.
Introducing livestock identification data capture at the time and point of livestock receival greatly reducing the duration wherein "livestock" and attendant "documents" can misalign, thereby embracing the strictures of maintaining integrity in the traceability function and efficiency to the overall processing system.

Processing and Storage

With the noted exceptions, the proposed system essentially replicates existing Beef Floor traceability data-capture and procedures on Radford's Small-stock floor, adding 2D Bar Coding and integrating all elements via the (CCC) *FoodChain*™ data-processing and reporting.

The system introduces a printer to enable the operator to produce and attach a "detain tag" for diverted small-stock. The detain tag for carcasses presenting as such will be scanned (on and off detention) at the Grading Station to ensure correlation is maintained. CCC have recommended the inclusion of a secondary Body Trace Station to enhance the trace integrity for small-stock entering and leaving the 'retain rail'.

Logistics – Storage and Load-out

Servicing all species and both carcass and boxed meats, installation of a Data entry terminal (Salesterm) and associated Scanner at load-out to electronically record and store carcass count and weights will significantly reduce recording and invoicing errors and provide the provenance link between storage and dispatch.

Installation of CCTV surveillance of load-out would provide conclusive evidentiary proof that custodial integrity is maintained.

Notably; Radford's ability to make essentially all deliveries out-of-hours provides the logistical flexibility to keep stock (carcass and boxed) below refrigerated storage capacity. Any increase in throughput attendant to the project is not expected to require investment in additional cool rooms.

Administration

Radfords Accounting, Sales and Stock Control (computer) data processing utilize the "New Views" platform. This software is both antiquated, expensive to maintain (requires highly specialised external support) and cannot be fully integrated with Logistics monitoring and control. Moreover; none of the existing platforms can be cost effectively and efficiently integrated with the proposed CCC *FoodChain*™ stock tracing system. Accordingly; the project comprehends the assessment, acquisition and installation of a common "back office" platform that can manage all stock related administration and be easily integrated with *FoodChain*™.

Outcomes – Radfords Cost: Benefit Assessment

Process mapping confirms that maintaining the integrity of Certified Organic and MSA processing, both change of livestock custody and segregation in particular, is inordinately time consuming and costly compared to conventional stock. Post-mortem (refrigerated) storage and load-out (into delivery vehicles) in particular requires excessive manual checks and records to ensure integrity is maintained and recording errors are detected.

Preliminary assessments identified industry leading Cedar Creek Company (CCC) as the most likely provider of the required processing software and hardware, with ancillary equipment and services provided by others. The Project Capex – Milestones schedules the equipment and services (and budget estimates) for defined stages of the project implementation:

Apart from the Livestock Receival PC station, "back office" software platform and ancillary equipment (CCTV etc), the system (computer hardware and software) will be supplied, installed and commissioned by the CCC, comprehending:

- Research and Development (R&D) required to provide specific application for Certified Organic and MSA traceability.
- Upgrade of existing "Sastek" *FoodChain* to CCC *FoodChain* to enable support of small stock supply chain traceability

- Integration of new Sheep Grading Station
- "Salesterm" (sales terminal) and RF Scanner at load-out
- Integration of existing on-floor systems
- Integration of Accounting and back office systems
- Onsite training
- Documentation including:
    - As-built documentation of the completed system
    - Training Guide for the CCC-supplied systems

Expected Market Impacts

Market Growth

Australians are becoming increasingly concerned about the food they are eating. They are worrying about how healthy it is, where it comes from and how its production affects the environment.

Noting high level of producer / retailer support for the IASC project, the following assessment is restricted to identifying the key information that consumers want and expect to obtain about the food they eat and how the AISC elements can address this with regard to red meat.

To identify the IACS project outcomes that respond to consumer expectations, our research has extensively relied upon contemporary media reports of those relevant matters. The following summarises the essential content and how the IASC system responds to the specific elements.

Labelling and Traceability

Interest in where foods are coming from has never been higher among consumers. This is being driven by an interest in supporting local suppliers, a desire for ethnic-style lines, concerns over the quality and safety of imported products, or the demand for authenticity in terms of products from a particular country or region. In particular, country of origin information is important to consumers and is valued more in fresh food products such as fresh meat than other food categories.

In 2012 FSANZ concluded that extending Country of Origin Labelling requirements to unpackaged meat will facilitate "…building consumer trust and confidence in the food supply" and that suppliers would be better off if they took control of a voluntary system for identifying the local origins of their products.

> *The essence of the IASC project is to facilitate the capture, storage, retrieval and reporting (downloading/interrogating) of a range of data that current mediums are unable to efficiently manage. The prominent capability is to enable consumers to trace-back the red meat they have or intend to purchase/eat to its place of origin and the processes and practices adopted by that place.*

Health and Nutrition

Identifying the top food and drink trends for 2012, international research included… the active promotion of health benefits on products as a key priority, whilst local research observes that "Australians can now scan barcodes, see what's in a food, and switch to a healthier choice in an instant."

> *The 2D bar coding intrinsic to the IASC project provides the scope to imbed both immediate "health and nutritional" information and by web-site linkage, to enable the industry to both profile and promote the benefits of (certified organic, MSA or*

conventional) red meat consumption and counter unsubstantiated claims and generalisations to the contrary.

Sustainability

Despite growing consumer demand, too few food manufacturers appear to make the environment a top-tier issue. Moreover, confusing labels and conflicting claims about the sustainability of many products have caused lack of consumer confidence in such claims.

Current label information and claims like ‘organic’ and ‘grass-fed’ are mixed messages which can relate to animal care, chemical use, health perceptions etc, and are not explicitly and unambiguously environmental information.

Rather than only providing basic information, consumers who want to make “green” decisions when buying products should have access to a life cycle assessment of the products.

The ability to efficiently increment the data captured by the system and for that accumulating data to be easily retained, retrieved and assembled (in meaningful reports), will provided “life cycle assessment” capability.

Organics

Australian consumers generally have a very basic understanding of the term 'organic food' but are not familiar with organic farming practices, the value of certified organic and how this differs from conventionally farmed produce. There is also an issue of "trust" in organic labelling.

Whilst recent research has concluded that there is a lack of strong evidence that organic foods are significantly more nutritious than conventional foods. However; it also concluded that consumption of organic foods may reduce exposure to pesticide residues and antibiotic-resistant bacteria and along with concerns around genetic modification; this is claimed by the Organics Federation of Australia to be the primary reason why people buy organic food.

The small market share for organic products is mainly due to some significant limitations on organic farmers. Supply constraints, particularly in the meat segment, have limited growth in the industry. These constraints have been due to the lack of an organised supply chain. For example, organic feed, abattoirs and processors are often located too far away from farmers, which can make transport costs uneconomical. Inconsistent product quality is also a problem, due to the difficulty of organic farming and the newness of the industry. There is also a lack of consistent supply of organically farmed products, which affects demand and makes it difficult for retailers and exporters to invest in infrastructure to support the industry. The fragmented nature of the industry, varying products and philosophies, and competing certifying organisations have also held up industry development.

Notwithstanding these issues, Australian’s appetite for organic food keeps growing, with annual sales of fresh organic food surging by up to 15% a year and tipped to reach $900 million nationally by 2016-17. On current ratios, the value of beef (15.4%) and lamb (5.1%) equates to $185 million, however along with organic wine and evidenced by Woolworths recording a 30% increase in organic fresh beef sales last year, experts predict red meat will be next to boom.

Noting again the systems’ data management objectives, the application of these capabilities in relation to Certified Organic meat, provides the industry with evidence to overcome the trust issues that retard the segments growth. Importantly’ R Radfords and Son are Victoria’s leading processors of Certified Organic (red) meat, are centrally located to the State’s largest Certified Organic producer regions and by virtue of their

numerous awards and media profile, offer a highly attractive platform from which to launch a concerted "from paddock to plate" Certified Organic red meat market development strategy.

Meat Standards Australia (MSA)

Demand for a consistent, high quality product saw a record 1.72 million head of cattle graded under Meat Standards Australia in 2010-11 an increase of 11% on 2009-10. However, only 13% of the 23,376 producers registered nationally come from Victoria.

The relatively slow uptake of MSA grading in Victoria is attributed to the propensity for the Victorian beef industry to purchase stock through the saleyard system and the absence of the necessary infrastructure investment to keep MSA segregated within the confines of most saleyards. However and largely attributed to Woolworth's decision to adopt Meat Standards Australia guidelines across its entire supply chain, 592 Victorian producers signed up for the system last year an increase of 59% on the 373 of the previous year.

Radfords are Victoria's leading domestic processor of MSA meat and as with Certified Organic, are able to leverage the new capabilities that the IASC project provides with their highly regarded profile to invigorate the Victorian market for MSA.

Enhanced Information / Utility

Along with information regarding health issues and the origins and sustainability of food, a number of key trends are well entrenched or emerging in what consumers expect from along their food supply chain.

Whilst current prominence is given to alternative cooking methods and recipes, including new choices for prepared part-prepared meals and more adventurous and 'premium' flavour combinations, growing demand towards locally-produced and locally-sourced fresh food, the supply chain's ability to reduce waste and calls for labels to "explain" whether meat had been slaughtered according to rituals and whether stun guns were used are some other recent developments.

Either uniquely or in combination, the IASC system components of data capture, 2D bar-coding, SmartPhone inquiry and web-site linkage, provides multiple mediums for enhancing both the extent and utility of current, emerging and future information demands from consumers.

Of particular relevance to any project to encourage greater Certified Organic and or MSA meats by utilizing contemporary communications technology, there is a general lack of information and guidance for consumers about how QR codes work and where to download the applications used to scan the QR code.

Consumer retail

The development to date of QR coding in the red meat industry, both locally and elsewhere in the world, is focused on processed and pre-packed meat product, with no apparent work done in relation to carcass meat as proposed by the IASC project.

Furthermore, whilst the proposed implementation will initially address beef processing, the IASC project comprehends adaptation for small-stock and multi-species processing (veal / calves, sheep, lambs, goats, pigs, etc).

Thus; whilst a QR code system for consumers to trace-back pre-packed meat products is being assessed in the market-place, implementation of a system that adopts QR coding as a medium

for consumers to attest the maintenance of integrity pre and post the butchers/retailers breakdown of a carcass requires assessment of conflicting considerations:

The combination of Plain Text Message and embedded Website URL coding facilitates a number of options as to the "mode and extent" of information that can be made accessible by consumers:

- **Tray displayed attestation -** Nominally; individual QR codes would be down-loaded and replicated by the retail butcher and affixed to "trays" of meat sourced from each particular carcass. Encoded text would reference individual data confirming the coded meat portion as either Certified Organic or MSA or both. This would require real-time (seamless) interrogation of the supplying abattoir data-base to link the carcass back to (Certified Organic or MSA) livestock.

  Whilst this system would maximise consumer assurance, it would require significant "time and care" by the butcher (printing and affixing individual QR Codes).

  It would also prevent the butcher from "topping up" the meat display (with meat from another carcass), adding further time/labour/cost and requiring additional display space to segregate the meat portions cut from different carcasses.

- **Stock displayed attestation -** Whilst some butchers are exclusively Certified Organic or MSA, generally; retail outlets will carry these premium products as adjuncts to conventional meat and therefore requiring segregated storage and display.

  Thus, a simplified (and static) text string statement similar to *"…to confirm that this product is Certified Organic (or MSA or both), we invite or you to visit the web-site of our supplier – R Radford and Son"* would be attached to each of the segregated display areas. An embedded URL would direct the reader to Radfords mobile-centric web-site displaying NASAA and MSA Certifications. Radford web-site links would in-turn direct readers to NASAA and MSA web-pages and certified producer web-sites.

- **Store attestation –** This option would merely require an in-store display / displays of a QR code (text string) elaborating on the butcher's certified status, again with embedded URL links to the supply-chain websites.

From a "consumer interface" perspective, the Stock Displayed option is considered the best to accommodate consumer attestation of claimed status (Certified Organic or MSA), whilst not significantly impacting on the retailers costs and efficiency.

This could be enhanced (at minimal cost to the retailer) by replicating the QR code on "sealing labels" (similar to those typically used by Supermarket delicatessens), affixed to the consumer purchase (butchers paper, bag or package), allowing the consumer to garner more information at their leisure pre or post consumption of the meat.

Individual butchers may also elect to extend "the boundaries" (e.g. QR Codes on individual trays / cuts and/ or replacing 1D bar-code in adhesive price / product tag) as suits their particular marketing strategies.

Restaurants could elect, for example, to supplement their menus with a schedule of QR codes for each of the meat cuts offered and/or run a video display of the "clean and green" environment where the source livestock were produced.

Under any option, automation of the trace processes from livestock receipt to carcass dispatch will provide supply chain participants with sufficient data (embedded in the QR code) to assure product integrity has been maintained and to respond to any consumer interrogation accordingly.

NB: Radford's logistical planning both enjoys and relies upon out-of-hours (key to premises) access to substantially all retail customers. There are no monitoring systems in place to attest continuance of segregation (certified organic / MSA / conventional stock) at or after change of custody, nor does the proposed system overcome intentional or unintentional substitution or commingling of primals or portions. Accordingly; no matter what the system, maintaining segregation at the consumer interface, remains reliant upon the integrity of the individual retailer.

Potential Market Development

Responding to whether Coles saw value in moving down the traceability/identity path linking each QR-coded item back to a single or small group of cattle suppliers, Meat business category manager Chris Nicklin noted:[39]

> *"…more and more, provenance was coming through as a highly-rated feature among consumers."*

The IASC scoping Consumer Survey identified 39% of respondents as knowing what a QR code but only 3% currently use them.

This limited use of QR codes to interface with consumers is attributed to the absence of a sufficient inducement to attract consumers to firstly scan the QR and then take the desire action. This is well reflected in the following comment by Glen Feist[40]

> *"Using the overseas experience as an example, QR marketing came out as a fad, but pretty quickly customers wanted more than just information."*

Thus, implementation of the IASC project will both require and significantly benefit from a campaign alerting consumers to what QR codes are and how they can facilitate better informed decisions for consumers of red meat.

Nominally; when combined with an expected exponential increase in consumer ownership of SmartPhones, the 97% of consumers who don't currently use QR codes offers an opportunity to increase market penetration some thirty-three fold. For supply chain participants this represents a significant "first to market" opportunity.

This close correlation with the MLA and ABS indices allows the potential annual market value to be calculated:

Table 5 summarises an assessment of the likely incremental increase in (retail) revenues facilitated by the IASC project and a sensitivity measure for nominal intermittent outcomes ranging from 100% down to 1%. These results, indicating that if extrapolated nationally, the survey ratio of "new buyers" would generate incremental retail sales revenue of over $905.1 million annually, decreasing to $9.1 million at the 1% probability level.

[39] http://www.beefcentral.com/p/news/article/650
[40] An i on the best beef, *op cit*

Table 5 Incremental Annual (Retail) Revenue at probability level of:

		100%	75%	50%	25%	10%	5%	1%
		$ millions	$ millions	$ millions	$ millions	$ millions	$ millions	$ millions
Facilitated additional annual sales								
Certified Organic - ratio12.15%								
Tonnage 114,210								
Incremental Revenue	**$832,043,891**	**$832.0**	**$624.0**	**$416.0**	**$208.0**	**$83.2**	**$41.6**	**$8.3**
MSA - ratio14.96%								
Tonnage 140,624								
	$73,072,238	**$73.1**	**$54.8**	**$36.5**	**$18.3**	**$7.3**	**$3.7**	**$0.7**
Total incremental revenue	**$905,116,129**	**$905.1**	**$678.8**	**$452.6**	**$226.3**	**$90.5**	**$45.3**	**$9.1**

The base data used relies on MLA statistics to determine (current) retail values for Beef and sheep-meats,[41] inferring a composite value of $9.47 per kg. We note that this value is markedly less (56%) than the $16.85 per kg margin derived from our retail price survey. Presumably and in the absence of statistical data detailing the functional elements of the $9.47 value, large volume / low value products such as grinding beef and offal, fat, trim, etc, weigh-down the composite value. Pending confirmation or otherwise by MLA that this the case, conservatism dictates that we assume the lesser value / potential incremental revenue.

Along with being Victoria's prominent processor of Certified Organic and an industry leader in adopting of MSA protocols, over a number of years Radfords have positioned themselves as a "Centre of Excellence" in red meat processing and have attracted numerous local, regional, state-wide and national awards that confirm this status. In particular, Radfords efforts to achieve environmentally sustainability have been widely recognised and rewarded. Notably; in a time when much of Australia's red meat industry is the focus of both public and Governmental scorn, Australia's premier rural and regional current affairs television program "Landline" has featured Radfords as a showcase of what the industry can achieve.[42] Collectively, these attributes give Radfords the degree of credibility to make them the ideal "linchpin" around which any future Certified Organic and MSA consumer marketing campaign could be developed.

[41] http://www.mla.com.au/Prices-and-markets/Trends-and-analysis/Beef/Domestic-consumption and http://www.mla.com.au/Prices-and-markets/Trends-and-analysis/Sheepmeat-and-lamb

[42] http://www.abc.net.au/landline/content/2012/s3615247.htm

7 Conclusions

- The project has the overwhelming support of livestock producers and Certified Organic and MSA wholesalers / retailers, with essentially all surveyed respondents either agreeing or strongly agreeing to the key objectives proposed by the project.
- Process mapping confirms that maintaining the integrity of Certified Organic and MSA processing, both change of livestock custody and segregation in particular, is inordinately time consuming and costly compared to conventional stock.
- Whereas increased market penetration and growth will accrue for producers and retailers of Certified Organic and MSA product; for Radfords (and similar processors), the project justification relies upon leveraging the efficiencies attendant to the project across all processing.

  Installation of the software and hardware proposed under the original defined project scope are therefore needed to both facilitate the identified project outcomes and to provide the overall processing efficiencies needed by Radfords to justify the project investment.
- Whilst the exponential growth in Australians uptake of SmartPhone and related apps has yet to be matched by the adoption of QR code technology, market developments in both red meat retail and the broader food sector, are expected to provide a rapid increase in demand for the “information portals” that QR coding is particularly suited to meet.

  From a “consumer interface” perspective, the addition of QR Codes communicating / linking to the certified status and origins of a retail display is considered the best to accommodate consumer attestation of claimed status (Certified Organic or MSA), whilst not significantly impacting on the retailers costs and efficiency.
  Automation of the trace processes from livestock receipt to carcass dispatch will provide supply chain participants with sufficient data (embedded in the QR code) to assure product integrity has been maintained and to respond to any consumer interrogation accordingly.
- Consumer survey determine that the ability for consumers to independently verify claimed / advertised provenance would facilitate a potential market share increase of 12.2% and 15.0% in respective Certified Organic and MSA consumption.

  Extrapolated nationally, these survey ratios would generate potential incremental retail sales revenue of $905.1 million annually, decreasing to $9.1 million at the 1% probability level.
- Whilst initially conceived as providing “paddock to plate” traceability, the implied time and cost to retailers of fixing bar-codes to meat portions from various animals appears prohibitive. Restricting bar-code identifiers to the individual and segregated display case level will avoid this cost impost while still providing consumers with the ability to attest the claimed provenance prior to purchase. Importantly; the system will provide the ability of individual retailers to replicate “parent” 2D Codes if this is conducive to their own marketing activities.