Traceability Systems & Technologies Pilot in Alberta Auction Markets

Cost Analysis

October 1, 2009 through June 30, 2010

Canada

Government of Alberta

Growing Forward

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Executive Summary

The purpose of this report is to review of the scanning system implementation and pilot study at six auction markets in Alberta and to investigate a cost-benefit analysis of the projects' results. The report has a companion volume that presents the scanning system configurations, equipment and software used, and the scanning data for individual participant-markets during a nine-month period.

Information gathered for this report is based on six auction markets situated across the province of Alberta which included a variety of sizes and configurations: 2 medium, 3 large and 1 pre-sort. Definition of the market types were established by ranges of annual cattle volume, as illustrated in Table A below. The number of markets of each type in the full complement of markets in Alberta is provided in the table also.

Table A: Market Types as Defined by Annual Cattle Volume

Definition	Small	Medium	Large	Pre-Sort	X-Large
Size (# Head)	<20K	20K-50K	50K-120K	50K-120K	>120K
Number	5	4	15	2	2

The data collected in the pilot project represents the scanning of 328,634 head during 307 sales conducted at the six pilot auctions over a 9-month period from 1 October 2009 through to 30 June 2010. The total 28 markets in Alberta, by comparison, handled 1,884,311 head through 2785 sales in 2009.

Scope Options: At the request of AARD, three options relating to scanning were defined:

1. Scanning on Move-In only;
2. Scanning on Move-In and Move-Out for all shipments with data linked to a permit, and
3. Scanning on Move-In and Move-Out for all shipments with data relayed directly to CLTS.

Options 2 and 3 provide for scanning on move-out, one actively creating a buyer group lot linked to a permit for each group scanned out, and the other providing for scan data to be sent electronically to CLTS directly, without the preparation of a load permit.

Business Models: Three alternatives were specified in the RFP for ownership of, and operational responsibility for, the scanning activity. The original scope assumed that the markets would be the owners of the scanning system, and three potential operators for the system – the markets, the vendor, and a third-party operator were considered. Therefore three options were to be detailed:

1. Market Owned and Operated
2. Vendor Operated/Market Owned – Base Case
3. Third-party Operated/Market Owned

During the course of the work, an additional business model option was added to the three initial cases. The project manager was asked to examine the costs and implications of a Vendor-Owned and -Operated option as an additional alternative to the three original cases.

The three Scope Options and four Business Models resulted in a range of capital investment levels and operating cost profiles, as displayed in Tables B, C and D below. For the market-owned options, a total investment of between $5.87 million and $6.83 million would be required to outfit all 28 markets, including those in the pilot study – approximately $3.11 to $3.62 per head. The Vendor-Owned option provides a lower capital investment cost of between $3.18 million and $4.08 million ($1.69 to $2.17 per head year 1), as the traditional capital charges associated with the licensing, installation and training of the scanning software and equipment is included in a scanning fee charged to the markets.

Annual operating costs for each of the options are also displayed in Tables B, C and D. Costs attributable to the markets and scanning charges attributable to the scanning service provider in each case are detailed separately. For the market-owned cases, annual operating costs of between $3.71 million and $6.13 million are experienced – between $1.97 and $3.51 annually per head. The Vendor Owned and operated scenario has an annual operating cost of $4 million to $6 million or $2.12 to $3.19 per head.

In the tables below, operating costs are as experienced in the pilot project and do not account for the revenue attributable to the retagging activity at each site.

Table B: Annual Operating Costs for Each Option- Move In Only

Move-in Only	Market Owned and Operated		Market Owned/Vendor Operated		Market Owned/Third-Party Operated		Vendor Owned and Operated	
	All Markets	Per Head	All Markets	Per Head	All Markets	Per Head	All Markets	Per Head
Capital Cost	**$5,867,056**	**$3.11**	**$5,867,056**	**$3.11**	**$5,867,056**	**$3.11**	**$3,177,400**	**$1.69**
Operating Cost:								
Market Costs	$3,714,083	$1.97	$1,035,007	$0.55	$1,164,194	$0.62	$698,725	$0.37
Scanning Charges			$3,035,896	$1.61	$3,427,290	$1.82	$3,301,119	$1.75
Total Operating Cost	**$3,714,083**	**$1.97**	**$4,070,904**	**$2.16**	**$4,591,484**	**$2.44**	**$3,999,844**	**$2.12**

The Move-In Only option requires the least capital investment, since equipment is not installed at the load-out ramps, and is the lowest cost, since time is not spent managing scans on move-out.

Table C: Annual Operating Costs for Each Option- Move In and Move Out Linked to Permit

Move-in/Move-out Linked to Permit	Market Owned and Operated		Market Owned/Vendor Operated		Market Owned/Third-Party Operated		Vendor Owned and Operated	
	All Markets	Per Head	All Markets	Per Head	All Markets	Per Head	All Markets	Per Head
Capital Cost	**$6,758,034**	**$3.59**	**$6,758,034**	**$3.59**	**$6,758,034**	**$3.59**	**$4,014,378**	**$2.13**
Operating Cost:								
Market Costs	$5,893,093	$3.13	$1,321,565	$0.70	$1,321,565	$0.70	$887,943	$0.47
Scanning Charges			$4,810,183	$2.55	$5,285,887	$2.81	$5,113,696	$2.71
Total Operating Cost	**$5,893,093**	**$3.13**	**$6,131,748**	**$3.25**	**$6,607,452**	**$3.51**	**$6,001,638**	**$3.19**

The Move-In/Move-Out Linked to Permit option requires more investment than the first case, due to additional equipment and software installed at the load-out chutes, and has the highest operating cost range due to the additional labour costs and overhead attributable to this additional function.

Table D: Annual Operating Costs for Each Option- Move In and Move Out Data to CLTS

Move-in/Move-out Data to CLTS	Market Owned and Operated		Market Owned/Vendor Operated		Market Owned/Third-Party Operated		Vendor Owned and Operated	
	All Markets	Per Head	All Markets	Per Head	All Markets	Per Head	All Markets	Per Head
Capital Cost	**$6,826,884**	**$3.62**	**$6,826,884**	**$3.62**	**$6,826,884**	**$3.62**	**$4,083,228**	**$2.17**
Operating Cost:								
Market Costs	$4,272,070	$2.27	$1,212,805	$0.64	$1,212,805	$0.64	$774,412	$0.41
Scanning Charges			$3,386,818	$1.80	$3,791,704	$2.01	$3,695,101	$1.96
Total Operating Cost	**$4,272,070**	**$2.27**	**$4,599,623**	**$2.44**	**$5,004,509**	**$2.66**	**$4,469,513**	**$2.37**

The Move-In/Move-Out, Data Direct to CLTS requires additional capital to provide for the automatic relay of scan-out data to CLTS, but drives lower operating cost than the previous option, since less labour is involved.

Independent of the scope options, the market-owned and -operated business model and the vendor-owned and -operated business models are the lowest-cost alternatives.

The market-owned/vendor-operated case is the configuration used for the pilot project, and the total investments are the same as the third-party-operated case however there are some differences in operating costs due to the vendor being able to internalise a range of support and training services.

Market owners have identified that they have operating expenses over and above the actual scanning costs, and that scanning systems do take up valuable pen space and/or alleys in their yards that cannot be replaced because of expansion limitations with most markets due to their proximity to urban areas. Included in the capital investment and operating costs, therefore, is a provision for costs associated with their commitment of space that could otherwise be used for penning cattle.

In addition to the ownership and operational options, a question about the need to scan all cattle on move out was raised during review of the early project results. A sensitivity analysis was added to the analysis to determine the cost impact of conducting a Move Out scan only on “country cattle” – those being shipped to any destination other than a feedlot or a packing plant. While operational concerns about the feasibility of this segregation were raised – staff would probably remain on site for the same period of time as for a full scan-out. The financial impact of scanning only these cattle was calculated to be approximately $0.15 per head for all options.

The financial forecasts include the expected achievement of efficiencies in several key operating areas over a five-year period. Operating efficiencies are expected to provide a 10% reduction in scanning costs over the same time period by increasing staff experience, improvements in scanning methodology, and increased integration of the scanning function into the markets’ operating procedures. A reduction in scanning staff expenses associated with travel and accommodation charges is forecast to be achieved by local sourcing of at least 25% of the required scanning staff by the end of the forecast period.

Retagging activity is attributed to the operator of the scanning function, and its cost and revenue are expected to reduce during the forecast period from the 4.5% experienced in the pilot study to 2.75% of all cattle processed.

It was extremely noticeable that the compliance rates with tagging were highest leading up to the expected 1 January 2010 date for elimination of bar-coded ear tags. It was also noticeable that the compliance rate immediately slipped once producers realised the 'no bar-codes' policy was not going to be enforced.

It is impossible for participants further down the supply chain to gain efficiencies that can be converted into increased prices when they are dealing with inconsistent and variable technology platforms and rules. Animals leaving the producer's premise without a RFID tag will result in increased costs by auction markets, backgrounders, feedlots and packing plants so any potential 'value' is offset by the costs incurred. The same can be said for animals leaving locations such as auction markets and feedlots that are identified as having a missing or non-reading RFID tag. By not having legislation that requires the tags to be replaced, either at cost to the seller or through subsidisation by the government or industry, the next receiver of the animal will have no choice but to incur the costs of handling and processing the animal manually.

The rates of animals with either bar-coded ear tags, missing tags or non functioning tags was identified through the pilot as being significantly higher than originally estimated. This highlighted that the current rate of retagging in auction markets within the province does not reflect the magnitude of the problem.

The potential benefits for markets – including enhanced inventory management and animal movement tracking, improved claim settlement, and more automated sale document preparation – are seen to rely fully on the integration and interoperation of the scanning system with the markets' business management systems. The value in the integration can only be achieved with 'clean' or 'cleansed' data. The pilot study identified a range of issues that need to be addressed as part of the presale 'Move In' processing as a significant percentage of animals showed missing or incorrect birth dates.

Current protocols with respect to retagging animals with missing, non reading or bar-coded ear tags and correcting data with obvious mistakes do not allow these issues to be addressed at the 'speed of commerce'.

Until these issues are addressed and legislation and protocols amended, there is little if any benefit in interfacing the scanning systems with the market management systems for the purposes of displaying individual animal or group lot information to buyers as incorrect or invalid data is likely to see the Vendors penalised by receiving a reduced price.

Table D (overleaf) summarizes the five-year forecast of operating costs and a reiteration of the capital costs for all 28 markets. Operating costs in the forecast are net of retagging revenue on the assumption that retagging becomes an integral part of the scanning activity once the system is implemented. Directly-attributable operating costs for the five-year period total between $16.45 and $34.87 million, depending on the business model and scope option.

Over the five years the forecast operating costs incorporate efficiency improvements in the scanning activities, some increases in the equipment maintenance and repair costs, and a reduction in the retagging revenue caused by increased compliance for tagging of inbound cattle. It is important to note that the market infrastructure costs for the installation – those expenditures relating to the market facility itself and largely contributed by the markets, including the land value, yard infrastructure and existing sheds and roofs – total 40-45% of the total capital investment, and approximately 9.5-10.5% of the total 5-year cost.

While an understanding of total costs and the costs of specific options are presented in the analysis, it is the comparative analysis that is important to support decision-making regarding the extension of scanning systems to all 28 markets. Following a decision to proceed, the capital costs can be subjected to a competitive RFQ process to establish specific cost levels at the time of implementation of the decisions. The same process can be applied to the operating costs under the Vendor-Operated cases and the Third-Party Operated case, possibly changing the relationship between these cases and the Market-Operated case.

The business models and the financial analysis are sufficient and appropriate for decisions to be taken about a rollout of scanning systems to additional markets, and to the narrowing of business models and operational scope options.

Table D: 5 Year Forecast

Capital and Operating Cost Summary All Markets - 5 Years	Move-in Only	Move-in Move-out Linked to Permit	Move-in Move-out Data only to CLTS
Market-Owned and -Operated			
Capital Invested:			
Market Infrastructure & In-Kind	$2,689,656	$2,743,656	$2,743,656
Scanning Infrastructure & Equipment	$3,177,400	$4,014,378	$4,083,228
Total Capital Invested	**$5,867,056**	**$6,758,034**	**$6,826,884**
Operating Cost:			
5-Year Net Operating Cost	**$16,446,364**	**$27,080,349**	**$18,549,564**
Total Investment - 5 Years	**$22,313,421**	**$33,838,383**	**$25,376,448**
Vendor-Operated/Market-Owned			
Capital Invested:			
Market Infrastructure & In-Kind	$2,689,656	$2,743,656	$2,743,656
Scanning Infrastructure & Equipment	$3,177,400	$4,014,378	$4,083,228
Total Capital Invested	**$5,867,056**	**$6,758,034**	**$6,826,884**
Operating Cost:			
5-Year Net Operating Cost	**$19,711,580**	**$30,223,601**	**$22,655,081**
Total Investment - 5 Years	**$25,578,636**	**$36,981,635**	**$29,481,965**
Third-Party Operator/Market-Owned			
Capital Invested:			
Market Infrastructure & In-Kind	$2,689,656	$2,743,656	$2,743,656
Scanning Infrastructure & Equipment	$3,177,400	$4,014,378	$4,083,228
Total Capital Invested	**$5,867,056**	**$6,758,034**	**$6,826,884**
Operating Cost:			
5-Year Net Operating Cost	**$23,423,263**	**$34,866,745**	**$25,757,110**
Total Investment - 5 Years	**$29,290,319**	**$41,624,780**	**$32,583,995**
Vendor-Owned and -Operated			
Capital Invested:			
Market Infrastructure & In-Kind	$2,689,656	$2,743,656	$2,743,656
Scanning Infrastructure & Equipment	Nil	Nil	Nil
Total Capital Invested	**$2,689,656**	**$2,743,656**	**$2,743,656**
Operating Cost:			
5-Year Net Operating Cost	**$19,419,294**	**$30,813,785**	**$22,103,355**
Total Investment - 5 Years	**$22,108,951**	**$33,557,441**	**$24,847,012**

The pilot sites were in operation within in a short period of time from the commencement of the project. Experience with the pilot sites combined with sufficient time to properly and individually plan implementation for other operations will result in improvements in a rollout to other markets.

Greater modification of existing facilities on market sites and optimization of workflows, albeit requiring additional capital beyond the pilot study levels, will improve effectiveness and acceptability of the scanning installations by market operators.

An opportunity exists to streamline traceability services at the markets. Livestock Inspection Service (LIS) brand inspection, scanning staff reading cattle and conducting age verification checks at the markets and onsite CCIA Mobile Field Representative (MFR) all have redundant services, and operationally could be combined into a single market support service.

Centralised management of audit-related services would assure consistent and efficient operation, and integrated reporting would provide a more complete and useful information flow for the markets and for regulatory agencies. There would appear to be no reason why the audit function of the MFR could not be amalgamated with the Brand Inspection staff at the auction markets. This change would reduce the cost of implementing traceability in the markets as the Brand Inspectors are more readily available throughout the entire receiving, sorting, selling and delivery process than the MFR. Additionally, it would reduce the current perception of over governance at the auction markets by producers, operators and buyers by having multiple agencies onsite.

The pilot project also identified significant differences in the performance of the different tags currently accredited by CCIA for use in Alberta. The significant fact is that a number of products consistently performed at an exceptionally high level of read performance (over 99%) while others were consistent under-achievers. The placement of the tags in the ear of the animal had an enormous impact on retention and readability of the different products throughout all pilot sites which could have been easily avoided.

Further assessment of the required tag performance needs to be undertaken to allow automation and efficiencies to be gained through the scanning and data transfer process. This assessment should include the minimum-acceptable read distances and read speeds for tags, in both best and worst orientation, to a panel reader positioned vertically on a chute.

RFID scanning is an intervention process at an auction market. However, intervention is industry standard practice at auction markets; from the moment the cattle arrive at the auction market to when they depart the facility they will experience a number of intervention activities, such as sorting, pregnancy checking, selling and comingling.

Overall, the benefits of the systems as piloted are in providing reliable, accurate animal identification and age-verification information at the speed of commerce. Fundamentally the pilot project proved that it is possible to scan cattle at the required speed and with the required accuracy within an auction market environment with all sites exceeding the minimum read performance of 95% of all RFID tags presented to the scanners in the first 2 weeks of operation.

The bigger challenge is ensuring that cattle arrive at the facility with functioning RFID devices and with accurate birth date information so that their age verification data can be made available at the time of sale to maximise the potential of obtaining the highest possible price for the vendor. It is imperative

however that the auction market sector is not penalised compared to other forms of livestock sales, such as direct or ranch transactions, through the traceability implementation process. If one sector of the industry is disadvantaged with costs compared to another, even temporarily, resistance against the implementation of the system is inevitable.

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1 Introduction

1.1 Purpose of the Report

This report, together with a companion reading metrics report, provides the business case details and the cost-benefit analysis for the project titled **Traceability Systems and Technologies Pilot in Alberta Auction Markets.**

The project is governed by the terms and conditions of a Request for Proposals by the Government of Alberta, RFP Number 2009-004-TRACE issued by Alberta Agriculture and Rural Development (AARD).

Together, the reports are intended to provide decision-support for AARD to determine the utility, cost and benefits of extending the pilot implementation of scanning systems for cattle from the six pilot locations to all 28 of the active auction markets in the province of Alberta. The financial and cost-benefit analyses are based on both the actual information collected during the pilot study and on a five-year forecast of investment and projected costs based on the pilot study.

Three possible scope options, described below, were considered to be the reasonable options for the longer-term operation of scanning systems in auction markets in the province. The differential in cost of preparing a permit for the load upon move-out scanning would also be assessed. A sensitivity analysis was to be undertaken for the options including scanning upon move-out to identify the marginal cost of scanning cattle being shipped to Packers and Feedlots.

In addition, four optional ownership-and-operation combinations were considered as business alternatives upon roll-out across the province. The capital and operating cost estimates for each of the options would be calculated. Assessing these options would provide the full range of ownership and operational possibilities and provide both capital and operating cost comparisons as the objective decision criteria. These financial criteria were to be enhanced in the analysis by the identification of the strengths and weaknesses of each of the business options, to allow a fully-supportable decision.

Finally, an overall cost-benefit analysis was undertaken to provide a view of the benefits of implementing scanning systems in all 28 markets in Alberta, by considering the financial and other business benefits to the markets, to the industry and to government.

1.2 Options and Alternatives Studied

Scope Options: At the request of AARD, three options relating to scanning were defined:

1. Scanning on Move-In only;
2. Scanning on Move-In and Move-Out for all shipments with data linked to a permit, and
3. Scanning on Move-In and Move-Out for all shipments with data relayed directly to CLTS.

The cost impact of excluding Move-Out scanning for shipments to Packers and Feedlots is also included as sensitivity on cases 2 and 3 above. In this case only cattle that were not going to a Feedlot or Packing Plant would be scanned since cattle entering the feedlot are scanned on arrival with a movement events submitted to the CLTS and all tags are retired at the packing plant directly to the CLTS.

In addition, costs per head have been calculated for these options based on the market volumes provided to ITS.

Business Models: Three alternatives were specified in the RFP for ownership of the scanning equipment and operational responsibility for the scanning activity. The original scope assumed that the markets would be the owners of the scanning system, with three potential operators for the system – the markets, the vendor, and a third-party operator were considered as options. Therefore three options were to be detailed:

1. Market Owned and Operated
2. Vendor Operated/Market Owned – Base Case
3. Third-party Operated/Market Owned

As noted above, the second of these is the option used in the pilot, and it is therefore considered to be the "Base Case" for analysis in the detail following.

During the course of the work, an additional business model option was added to the three initial cases; the project manager was asked to examine the costs and implications of a Vendor-Owned and -Operated option as an additional alternative to the three original cases. For purposes of analysis of this option, it was assumed that the vendor of the system (hardware and software) would provide a turnkey service to the markets, on a fee-for-service basis. This would include all equipment, hardware and software directly related to the scanning functions required. This configuration has been included as a fourth case in the financial analysis and is described along with the original three options in the sections following.

1.3 Approach to Financial Analysis

The financial analysis has been undertaken in two steps. First, the actual operating and capital costs of the six pilot locations were gathered and analysed and then extended to the full range of markets known to be in operation in the province to provide a "base case" for costing and forecast purposes. This entailed determining costs and investment levels for both Small and Extra-Large markets, neither of which were represented in the pilot study, by adjusting the infrastructure and equipment for the number of head processed per year and by developing a pro-forma operating cost based on variable and fixed cost levels observed in the pilot market cases.

Capital assets contributed by the markets to provide for the scanning system and crew – land and some market infrastructure – have been valued and included in the total investment calculation. A return on these assets has been included in the operating costs to recognize the value of "in-kind" contribution by the market. No other costs-of-capital, for example borrowing costs to purchase the hardware and software used in the system, have been included in the calculations.

Operating costs and capital investment for a single market of each size and configuration were calculated and total operating and capital costs for all 28 markets is provided for comparative purposes, both in total and on a per-head basis. This step allowed a full valuation of the project based as closely as possible on the pilot project conditions.

Second, the capital cost estimate prepared for each of the structural options was combined with a five-year forecast of operating costs developed for each case. Capital costs were similar among the structural options except that the Vendor-Owned and -Operated case bundled the capital cost of equipment and software it supplies to each market into a fee charged to the markets on a monthly or per-head basis.

A total five-year investment by the industry was calculated for each case and option, on both a total cost and cost-per-head basis. Efficiencies gained by experience drawn from the pilot study and believed to be possible from improved methods and controls were included in the operating cost forecast, with the effect of reducing labour costs. In addition, an estimate of the charges relating to the maintenance and replacement cost for scanning equipment was included in the later years of the forecast, serving to increase operating costs and therefore partially offsetting the labour reductions noted above.

For the forecast, the anticipated retagging revenue was applied to the operating costs for each market configuration. This decision was based on the fact that retagging becomes an integral part of the scanning operation once implemented. Therefore costs of each option and per-head costs are shown both in total and net of these revenues.

1.4 A Note on Value-Add and Benefits

Value-add scenarios of scanning at auction markets attributable to the industry and to the government are presented in the analysis. However, there are few if any benefits to the markets themselves under the operating conditions established for the pilot study. The potential benefits for markets – including enhanced inventory management and animal movement tracking, improved claim settlement, and more automated sale document preparation – are seen to rely fully on the integration and interoperation of the scanning system with the markets' business management systems. The value in the integration can only be achieved with 'clean' or 'cleansed' data. The pilot study identified a range of issues that need to be addressed as part of the presale 'Move In' processing as a significant percentage of animals showed missing or incorrect birth dates.

Current protocols with respect to retagging animals with missing, non-reading or bar-coded ear tags and correcting data with obvious mistakes do not allow these issues to be addressed at the 'speed of commerce'.

Until these issues are addressed and legislation and protocols amended, there is little if any benefit in interfacing the scanning systems with the market management systems for the purposes of displaying individual animal or group lot information to buyers; incorrect or invalid data are likely to see the Vendors penalised by receiving a reduced price.

These issues can be easily addressed by providing authority to accredited third parties who are conducting the scanning to correct the data and have it verified and audited by the LIS brand inspector onsite at each facility.

For these reasons, no value-add or operating benefits were included in the financial analysis presented in this report.

Note: *For the sake of this project, 'Speed of Commerce' is defined as "the total time taken for a market to normally receive, sort, sell and deliver livestock prior to the commencement of any scanning activities, taking into consideration industry best management practices for safe, stress-free animal handling."*

2 Market Types and Scanning Options

2.1 Market Types

The auctions were separated into three sections in this report;

- Medium;
- Large; and
- Pre-Sort.

In the pilot project there were two medium, three large and one pre-sort auction.

Small markets are considered to be those with annual volumes of less than 20,000 head, none of which were among the pilot study markets.

Medium markets are considered to be those with annual volumes between 20,000 and 50,000 head. There were two markets in this range in the pilot study; their metrics were averaged for use in projections and comparisons.

Large markets are considered to be those with annual volumes between 50,000 and 120,000 head. There were four markets in this range for the pilot study; one of which was determined to be in the Pre-Sort category. Metrics of the remaining three were averaged for use in projections and comparisons.

Pre-Sort Markets are considered to be those within which all cattle except cows and bulls are weighed and sorted using individual scales the day prior to the sale. Annual volumes for these markets are between 50,000 and 120,000 head. There was one market in this category in the pilot study.

Extra-Large Markets are considered to be those with annual volumes over 120,000 head. No markets of this size were among the pilot study markets.

Table 1: Alberta Auction Markets by Size

Markets	Pilot	Rollout	Total
Small	0	5	5
Medium	2	2	4
Large	3	12	15
Pre-Sort	1	1	2
Extra Large	0	2	2
Totals	**6**	**22**	**28**

The table below summarizes the market profile data for all of the markets in the province considered for a full rollout of the scanning systems, including the pilot locations.

Table 2: Auction Market Profile Data

Market Type	Number of Markets	Total # Of Head Sold through Ring	Average # of Head Per Market	# of Sales Per Year	Average # of Sales Per Market	Average # of Head Sold Per Sale
Small	5	57,579	11,516	399	80	144
Medium	4	147,776	36,944	350	88	422
Large	15	1,161,893	77,460	1553	103	752
Pre-Sort	2	154,920	77,460	206	103	752
Extra-large	2	362,143	181,072	277	139	1307

Factors based on throughput and capital requirements have been used to provide estimates for Small and Extra-large markets, included in the balance of the potential candidates for the business case, using the experience and expertise of the study team.

Equipment and its configuration are similar among Small and Medium markets, given the need to have a minimum scale of panel readers and office space, and therefore capital costs for equipment are approximately the same. The largest capital factor beyond land and physical infrastructure is the purchase and installation of high-flow scanning alleys. Land use, gates, pens, etc, attributable to the scanning operations are expected to be greater for Medium markets.

Table 3: Acreage by Market Type

Acreage by Market Type		Area	Avg. Area
Small	Calculated	0.20	0.20
Medium	Market A at:	0.23	
	Market B at:	0.25	0.24
Large	Market C at:	0.25	
	Market D at:	0.28	0.32
	Market E at:	0.42	
Pre-Sort	Market F at:	0.37	0.37
X-Large	Calculated	0.52	0.52

Although the current Pre-Sort facility operates without a high-flow scanning alley, additional Pre-Sort facilities are anticipated to require one for full-service operation. Therefore, for planning purposes, a high-flow alley with attendant land and physical infrastructure investment have been included in their scope.

For planning purposes, Extra-Large markets are anticipated to require two high-flow scanning alleys to manage their peak volume, and the additional space and physical infrastructure that goes with them.

2.2 Generic Description of Move In and Move Out Process

Move In

- The Move In process starts as cattle begin to arrive at the auction market, often the day prior to the sale and continues until the last animals arrive on the day of the sale. It is worth noting that in some cases cattle continue to arrive at the market for several hours after the sale has begun.
- Project scanning staff operated reading equipment and data collectors to record RFID information as the cattle are received. They are moved through the reading system and delivered to their nominated pen. They also conduct simultaneous presale auditing activities, and deal with discrepancies and CLTS errors as they are identified.
- Cattle with missing or non-reading tags are retagged and rescanned.
- Several CLTS database queries and transactions are processed. They include;
    - Verification of devices;
    - Age Verification;
    - Move In Recording;
    - Retag transactions, if necessary; and
    - Other events relevant to the market.

Move Out

- The Move Out process starts when an auction begins and often continues well after the sale is completed. In some cases this can be days following the sale.
- Adjustments are made for cattle staying over at the facility or alternately for cattle whose delivery location may change. This occasionally requires a certain number of cattle to be reprocessed.
- Project scanning staff operate reading equipment and data collectors as the cattle are dispatched moving them through the reading system and delivering them to their nominated transport operator. They also conduct simultaneous post-sale auditing activities, and deal with discrepancies and CLTS errors as they are identified.
- Cattle cannot have a Move Out event recorded until they are issued with the required permit information from the onsite LIS brand inspector.
- Several CLTS database queries and transactions are processed. They include:
    - Move Out Recording; and
    - Other events relevant to the market

Additional Notes

- At the conclusion of the sale day, the total cattle received are balanced with the total cattle dispatched. The actual number of cattle received is cross-referenced with the cattle numbers shown on the Move In Manifest documentation and any discrepancies need to be identified and corrected.
- It is unlikely that the same staff and/or equipment are used for both Move In and Move Out activities given these processes take place for the duration of the sale which can often exceed 36 hours from when the first animal was received.

2.3 Scope Options

Three "scope options" have been described for inclusion in the Business Case:

1. Move-In Only
2. Move-In/Move-Out Linked to Permits, and
3. Move-In/Move-Out Data Direct to CLTS

These are largely based on perspectives expressed by the customers of the participating markets and/or by the preferences of the market operators in the pilot study. While the goal of the project has been to undertake scans both in-bound and out-bound – Option 2 above is therefore the de-facto "Base Case" for the current study – the predominant practice at five of the participating markets fits all the proposed options.

The **Move-In Only** option reduces the total activity, and therefore reduces the cost somewhat compared to the other options and therefore relies on the receiving facility and new owner of the cattle to record receipt and confirm the transfer of stock onto their premise.

From a traceability perspective, this approach limits the ability of the markets to use the system's information in inventory management, unless or until the scanning system is fully interactive with the markets' sale management systems. The opportunity to provide load manifests based on the animals scanned out of the yards is lost, thereby limiting the potential to track the cattle during transfer, and confirming their arrival at the destination premise. This option relies on the receiving premises to record the animals upon arrival without the added security of a cross-check between the shipping and receiving location.

In order to operate in this mode, the equipment complement listed in Table 4 below is required for "Move-in Only" at markets of each type described in Section 2.1. This equipment is the basis of the capital cost estimates provided in the Financial Analysis and Forecast data presented in Section 3, following.

Table 4: Capital Equipment Required for Move In Only

Capital Equipment Required	Move-in Only					
	Small	Medium	Large	Pre-Sort	X-Large	All Markets
Hi-Flow RFID Reading System		1	1	1	2	**25**
Dual Panel RFID Reading System	1	1	1	1	2	**30**
Dual Panel RFID Reading System with data box						
RFID Wand Reader (1 Meter) with full keypad	1	1	1	1	1	**28**
RFID Wand Reader (2-3 Meter) with full keypad	1	1	1	1	2	**30**
Internet Sticks	1	1	1	1	2	**30**
Wireless transmission system (antenna and router)	1	1	1	1	2	**30**
Scanning Software Package	1	1	1	1	1	**28**
Harsh Environment Computers*	1	2	2	3	3	**55**
Scanning Office Printer	1	1	1	1	2	**30**
Net Books laptops						
LED Displays	1	2	2	1	4	**53**

**Harsh Environment Computers generically refer to IP 64 rated Windows PC's and higher that are tolerant to the operating temperature range, dust resistant and splash resistant, ideally with a touch screen for ease of use.*

In all scope options, the Small markets do not require the Hi-Flow RFID Reading System included in all other market types. Scanning in Small markets will be accomplished with hand-held Wand Readers. The Pre-Sort locations require additional portable computers due to the multiple points of entry to the system employed in the pre-sort mode. The Extra-Large markets require a second Hi-Flow system and attendant equipment and infrastructure to accommodate the volume managed through the market.

Configured for Move-in Only, the installation does not include the Dual-panel RFID Reading System with Data Box used in the move-out scanning included in the following two scope options, nor the Net Book Laptops employed when move-out data is automatically relayed to CLTS without being linked to a permit.

The **Move-In/Move-Out Linked to Permits** option potentially allows a closed-loop system for all scanned cattle managed through the markets. It requires staff involvement in outbound scanning to ensure that permit numbers are recorded with each lot scanned. The permits represent, from a traceability perspective, a lot identifier for all cattle leaving the market.

In order to operate in this mode, the equipment complement listed in Table 5 below is required for "Move-in Move-out Linked to Permit" at markets of each type. This equipment is the basis of the capital cost estimates provided in the Financial Analysis and Forecast data presented in Section 3, following.

Table 5: Capital Equipment Required for Move In and Move Out

Capital Equipment Required	Move-in Move-out Linked to Permit					
	Small	Medium	Large	Pre-Sort	X-Large	All Markets
Hi-Flow RFID Reading System		1	1	1	2	**25**
Dual Panel RFID Reading System	1	1	1	1	2	**30**
Dual Panel RFID Reading System with data box	1	2	2	2	4	**55**
RFID Wand Reader (1 Meter) with full keypad	1	1	1	1	1	**28**
RFID Wand Reader (2-3 Meter) with full keypad	1	1	1	1	2	**30**
Internet Sticks	1	1	1	1	2	**30**
Wireless transmission system (antenna and router)	1	1	1	1	2	**30**
Scanning Software Package	1	1	1	1	1	**28**
Harsh Environment Computers*	1	2	2	3	3	**55**
Scanning Office Printer	1	1	1	1	2	**30**
Net Books laptops						
LED Displays	1	2	2	1	4	**53**

Configured for Move-in Move-out Linked to Permit, the installation does include the Dual-panel RFID Reading System with Data Box used in move-out scanning; however, since staff are involved in linking the move-out scan to the load permit, additional laptop computers are not required at the move-out chutes.

The **Move-In/Move-Out Data Direct to CLTS** option provides for the identification of animals leaving the market, with the transfer of move-out data directly to the CLTS database in an automated process. Shipment data is not collected by lots, and the discrete in-bound-outbound link is therefore lost. The advantage of this option is the potential for slightly reduced scanning staff time and cost.

In order to operate in this mode, the equipment complement in Table 6 below is required for "Move-in Move-out Data Direct to CLTS" markets of each type. This equipment is the basis of the capital cost estimates provided in the Financial Analysis and Forecast data presented in Section 3, following.

Table 6: Capital Equipment Required for Move In and Move Out Data only to CLTS

Capital Equipment Required	Move-in Move-out - Data only to CLTS					
	Small	Medium	Large	Pre-Sort	X-Large	All Markets
Hi-Flow RFID Reading System		1	1	1	2	**25**
Dual Panel RFID Reading System	1	1	1	1	2	**30**
Dual Panel RFID Reading System with data box	1	2	2	2	4	**55**
RFID Wand Reader (1 Meter) with full keypad	1	1	1	1	1	**28**
RFID Wand Reader (2-3 Meter) with full keypad	1	1	1	1	2	**30**
Internet Sticks	1	1	1	1	2	**30**
Wireless transmission system (antenna and router)	1	1	1	1	2	**30**
Scanning Software Package	1	1	1	1	1	**28**
Harsh Environment Computers*	1	2	2	3	3	**55**
Scanning Office Printer	1	1	1	1	2	**30**
Net Books laptops	1	2	2	2	3	**53**
LED Displays	1	2	2	1	4	**53**

Configured for Move-in Move-out Data Direct to CLTS, the installation does include the Dual-panel RFID Reading System with Data Box used in move-out scanning. Also, since staff are not involved in linking the move-out scan to the load permit, additional laptop computers are required at the move-out chutes to perform the data transfer automatically.

It is important to note that all of the options considered currently have a common limitation. It is impossible to provide full traceability of all animals passing through the market if those animals that remain in the 'feed or holding pens' for some time without a sale are not accounted for within the system by daily scanning or other means of identification.

In addition to these scoped options, it was suggested that cattle moving to a feedlot or to slaughter need not be scanned at move-out. While there are some potential compromises to full traceability and to the full management of inventory of cattle through the markets under these conditions, a sensitivity analysis was undertaken to determine the differences in cost that would result from such a decision.

2.4 Business Models

As noted in Section 1.2, four business model options are to be considered for the possible rollout of the scanning / age verification capability to all 28 markets – the original three cases and a fourth, Vendor-Owned and -Operated. These are based on two factors – ownership of the hardware and software, either by the vendor or the market; and operation of the scanning and verification system, either by the vendor, the market, or another third-party contractor. The four options are:

1. Market Owned and Operated
2. Vendor Operated (Market Owned) – Base Case
3. Third-party Operated (Market Owned)
4. Vendor Owned and Operated

The following descriptions of the four business models do not attempt to address the question of who will be paying for the service over the longer-term. Investments and costs are identified with the participants in each of the cases, based on their roles in each of the Options, but settlement of compensation and payment is assumed to be dealt with in a future decision by participants, the industry and government.

In all cases, there are **capital costs** for physical infrastructure, purchase and installation of scanning equipment, and software acquisition, described together as 'Hardware and Software'. Site modifications, including gates, holding pens, lighting, enclosures, office facilities and sheds, etc..., are collectively referred to as 'Physical infrastructure'. 'System infrastructure' including computers, network elements, and related electronic gear are also a required capital purchase. Capital items related to the on-site staff, such as scanning wands, phones and other communications devices, and other miscellaneous equipment, are collectively referred to as 'Equipment'.

In addition, there are **operating costs** to be accounted for in each option. These will include personnel-related costs for wages and benefits, travel and related expenses, etc., and facility-related expenses for electricity, telephone and internet access, insurance, maintenance, and space usage and site access costs. External services suppliers, in this analysis the vendor and the third-party operator, will have their own corporate expenses that are attributable to the project, and therefore to each facility. Hardware and Software support expenses and maintenance costs for capital items and equipment will also pertain to each installation.

For all Business Models a 'year 0' is included in the analysis. From the pilot study it has become apparent that a run-in period of up to a year would be needed on each site to prepare the scanning system for assumption on a 'turn-key' basis by whichever owner and operator will be managing and operating the facility in the longer term. It is anticipated that this initial period would be funded in a different manner than the ongoing operation of the facility. A run-in year will allow for a 'de-bug' period for both the system and for the facility and infrastructure, and integration of the scanning system with market operations and systems. The run-in period will also provide time for familiarization by market operators

and their customers and training of staff for the ongoing operations. The year might also allow confirmation of the eventual ownership/operations management decision.

2.4.1 Market-Owned and -Operated

In this scenario, the Markets prepare the physical infrastructure and purchase the required hardware and software, and have it installed on-site. The Vendor supplies the software, and undertakes configuration and implementation at the Market. As in the pilot study, and the business cases detailed in this report, the vendor may also supply and support the scanning hardware and other system components and equipment. The Vendor trains Market personnel in the use of the software system.

The Vendor will also provide support and upgrade services for the installed software and support and maintenance of the scanning hardware and other equipment.

The Market acquires a licence for the software and pays the costs for configuration of the standard Vendor software. The Market pays a monthly or quarterly software service and support fee to the Vendor (may include a per-head charge for system use), and a maintenance and support fee to the hardware supplier.

Table 7: Advantages and Limitations to Market Owned and Operated

Advantages	Limitations
Lowest operating-cost option (under current Move In procedure), largely due to the avoidance of travel and accommodation expense for scanning operational staff	Potential staff inefficiency unless cross-trained. Generically a higher skilled computer literate labour unit/s is required compared to generic market staff
High level of commitment to success of the system	Market required to develop or purchase expertise in system operation and trouble-shooting
No concern for confidentiality of market information	Data control and integrity
Market can fully interoperate scanning and sale functions via direct control	Training to up skill staff. Likely to be additional staff turnover and increased labour costs from scanning staff not being required on non sale days.
Costs are all maintained and controlled by one party	Need to reinvest in capital equipment after five-year life
Potential to cross-train staff for scanning and other Market work	Only financially viable if current Move In methodology is applied. Other Move In methodology's are cheaper and more efficient for non markets staff to undertake.

2.4.2 Vendor-Operated (Market-Owned)

In this case, the Markets prepare the physical infrastructure and purchase the required hardware and software to the Vendor's specification, and have it installed on-site. The Vendor may or may not be the hardware supplier, although in the pilot study this was the case and has been carried over into the forecast.

The Markets recognize an in-kind capital contribution to the scanning facility and an opportunity cost for the land and infrastructure taken up by the scanning activity, and the space and access used by the Vendor's personnel for the operation of the systems.

The Vendor delivers the following services:

- Provision of trained personnel and required equipment for scanning and related activities
- Provision of and support for software, including required upgrades and interoperation with Markets' sale-support systems, CCIA and LIS, under a service agreement with the market and access and security agreements with the other agencies
- Provision of and maintenance and support for hardware supplied by the Vendor, including required upgrades and interconnection with Markets' sale-support systems under a service agreement with the Markets
- Preparation of standard, basic reporting by sale, with weekly and monthly summary reports
- Retagging for missing and unreadable tags

The Market pays for the acquisition and installation of hardware as specified by the Vendor and for the acquisition and configuration of the Vendor's software. The Market pays a monthly service and support fee to the Vendor to maintain the currency of the software and a maintenance fee for upkeep of the hardware and the system infrastructure.

The Market pays a base monthly or quarterly fee plus a per-head charge to the Vendor for scanning services, reporting and related activities.

Table 8: Advantages and Limitations to Vendor Operated (Market Owned)

Advantages	Limitations
High level of commitment to success of the system	Potential concern for confidentiality with Vendor personnel on multiple Market sites however this is not likely to be reality due to commercial contracting arrangements
Markets have the choice of pre-screened hardware suppliers	Requires close relationships between Vendor and multiple hardware suppliers if non Vendor specified hardware is used
Ownership of assets is straight-forward	Market required to reinvest in capital equipment after five-year life cycle
Costs are transparent to those who control them	
Vendor can transfer staff from site to site so that productivity and cost efficiency of skilled scanning labour is maintained	
Vendor can reduce scanning costs as more markets adopt the system to share fixed labour costs	

2.4.3 Third-Party-Operated (Market-Owned)

This case is very similar to the Vendor-Operated (Market-Owned) case, with the Third-Party Operator (TPO) assuming the service delivery provided by the Vendor in that case. The TPO case is slightly less efficient due to the unbundling of the services provision from the system support activities supplied by the Vendor.

The Markets prepare the physical infrastructure and purchase the required hardware and and have it installed on-site. The Vendor supplies the software, and undertakes configuration and implementation at the Market. The Vendor trains TPO personnel in the use of the system. The Vendor will also assist in the establishment of procedures for scanning, retagging and reporting, and provides support and upgrade services for the software.

The Markets will provide the facilities appropriately configured and the required hardware as specified by the Vendor. The Markets recognize an opportunity cost for the land and infrastructure taken up by the scanning activity, and the space and access used by the TPO's personnel for the operation of the systems.

The Vendor provides the following services:

- Provision of and support for software, including required upgrades and interoperation with Market sale-support systems, CCIA and LIS, under a service agreement with the TPO

- Provision of and support for hardware, including maintenance and service support, under a service agreement with the Market

The TPO provides the following services:

- Provision of trained personnel and equipment for scanning and related activities
- Preparation of standard, basic reporting by sale, with weekly and monthly summary reports
- Retagging for missing and unreadable tags

The Market pays for the acquisition and installation of hardware as specified by the Vendor and for the acquisition and configuration of the Vendor's software. The Market pays a monthly service and support fee to the Vendor to maintain the currency of the software and a maintenance fee to the Vendor as the hardware supplier for upkeep of the hardware and the system infrastructure.

The Market pays a base monthly or quarterly fee plus a per-head charge to the TPO for scanning services, reporting and related activities.

Table 9: Advantages and Limitations to Third Party Operated (Market Owned)

Advantages	Limitations
TPO potentially represents a specialized provider with advanced skills	Multiple parties involved in the success of the system
TPO can transfer staff from site to site so that productivity is maintained	Concern for confidentiality of market information as there is now a minimum of 3 parties involved
TPO can transfer staff from site to site so that productivity and cost efficiency of skilled scanning labour is maintained	Market required to provide more coordination between supplying parties
TPO can potentially reduce scanning costs as more markets adopt the system to share fixed labour costs	Need to reinvest in capital equipment after five-year life

2.4.4 Vendor-Owned and -Operated

In this case, the Markets prepare the physical infrastructure to the Vendor's specification. The Vendor supplies the hardware, software and system infrastructure.

The Markets recognize an opportunity cost for the land and infrastructure taken up by the scanning activity, and the space and access used by the Vendor's personnel for the operation of the systems.

The Vendor delivers the following services:

- Provision of trained personnel and the required hardware, software and equipment for scanning (in and out) and related activities

- Provision of and support for software, including required upgrades and interoperation with Markets' sale-support systems, CCIA and LIS, under access and security agreements with these agencies
- Provision of and maintenance and support for hardware, including required upgrades and interconnection with Markets' sale-support systems under a security agreement with the Markets
- Preparation of standard, basic reporting by sale, with weekly and monthly summary reports
- Retagging for missing and unreadable tags

The Market pays a base monthly or quarterly fee plus a per-head charge to the Vendor for scanning services, reporting and related activities.

Table 10: Advantages and Limitations to Vendor Owned and Operated

Advantages	Limitations
Lowest capital-cost option due to amortization of scanning and system hardware by Vendor and its inclusion in the monthly system charge	Potential concern for confidentiality with Vendor personnel on multiple Market sites however this is not likely to be reality due to commercial contracting arrangements
High level of commitment to success of the system	Vendor-owned assets on market-owned facilities
Vendor can select and optimize hardware and system infrastructure	
Vendor can optimize performance of the integrated total function via direct control	
Vendor can transfer staff from site to site so that productivity and cost efficiency of skilled scanning labour is maintained	
Vendor can reduce scanning costs as more markets adopt the system to share fixed labour costs	
Costs are all maintained and controlled by one party	
Volume pricing may be possible with common- or single-sourcing acquisition of hardware, system infrastructure and equipment.	
Investment in capital equipment included in operating cost throughout the period; limited need for market to reinvest after five-year life	

3 Financial Assessment of All Options

3.1 Anticipated Capital Cost

Following an exhaustive review of the capital costs accrued at the pilot locations, a pro-forma estimate of the capital cost for the full scale of the project has been calculated. The number of markets in each of the market types, Small, Medium, Large, Pre-sort and Extra-large was established from the annual volumes of the 28 markets in the province supplied to the project team and with AARD's knowledge of their operating practices. Configurations of equipment and other capital requirements were designed for Small markets and for Extra-Large markets, and capital estimates for the full population of markets in the province were calculated.

3.1.1 Summary of Capital Costs for Pilot Facilities

The capital cost summary in Table 11 below presents the capital costs for the pilot locations, with two exceptions:

1. A calculation of acreage committed to the physical infrastructure for scanning and related activities at each pilot location, and a local valuation estimate for acreage in each location was secured. In all of the capital estimates for the rollout of the system to additional markets, a value based on these factors has been included in the capital cost of the pilot sites and of the remaining Alberta markets.

   The inclusion of the land value in the capital costs for each case acknowledges the commitment of this value by the markets. For the business case, this implicit investment represents an opportunity cost to the markets, since the committed acreage and accompanying infrastructure – corrals, gates, etc. – are not available to the markets for other business purposes.

   An opportunity cost has been calculated for each case and included in the operating cost forecast, including a return on investment and a usage value for the land and infrastructure committed to the scanning activity.

2. In addition, as noted earlier, the review of the pilot locations established that a standard Pre-Sort location would require a high-flow alley in addition to the two single-alley systems that were installed at the Pre-Sort location in the pilot.

   Therefore, the Scanning Equipment estimate for the Pre-Sort location has been increased to accommodate this additional requirement. On this adjusted basis, capital costs for the six pilot sites have been calculated to total just over $1.2 million.

Table 11: Capital Cost Summary in Pilot Auction Markets

Capital Cost Summary - Pilot Markets						
	Small	Mid-Sized	Large	PreSort	X-Large	All Markets
Land Lease and Fees	$0	$65,509	$165,858	$47,810	$0	$279,177
Corrals	$0	$85,018	$127,527	$11,368	$0	$223,913
Handling Facilities	$0	$29,000	$43,500	$8,000	$0	$80,500
Scanning Equipment	$0	$134,000	$201,000	$88,500	$0	$423,500
Office & Sheds	$0	$28,950	$43,425	$0	$0	$72,375
Office Equipment	$0	$45,818	$68,727	$25,064	$0	$139,609
Services	$0	$10,150	$15,225	$3,500	$0	$28,875
Total Capital Costs	**$0**	**$398,445**	**$665,262**	**$184,242**	**$0**	**$1,247,949**

It is important to state that capital cost forecasts are based on reasonable, currently-available pricing from suppliers and estimates that are designed not to underestimate future costs. That said, it is quite likely that RFQ processes and negotiations with suppliers might result in lower capital costs than are estimated and forecasted here.

3.1.2 Summary of Capital Costs by Market Type and Scope Option – All Markets [1]

The total value of capital expenditure for all markets in the province, including the six pilot locations, is between $5.9 million and $6.9 million, increasing as the scope of the operation changes. Capital costs for individual Small markets range from $104.9K to $120.2K; Medium and Large operations range from $222.6K to $270.9K; Pre-sort configurations range from $181.9 to $217.9K; and Extra-Large markets require an investment between $388 and $456.4K.

Table 12: Capital Costs by Market Type

Capital Costs ($000)	Per market					All Markets
	Small	Medium	Large	Pre-Sort	X-Large	
Move-in Only	$ 104.9	$ 222.6	$ 234.0	$ 181.9	$ 388.0	$ 5,867.1
Move-in Move-out – Permit	$ 118.9	$ 256.9	$ 268.2	$ 215.2	$ 452.3	$ 6,758.0
Move-in Move-out – Data Only	$ 120.2	$ 259.6	$ 270.9	$ 217.9	$ 456.4	$ 6,826.9

[1] In all tables in this section of the report, the markets are defined by size, and the number of each type in the full provincial roll-out are as included here:

Definition	Small	Medium	Large	Pre-Sort	X-Large
Size (# Head)	<20K	20K-50K	50K-120K	50K-120K	>120K
Number	5	4	15	2	2

For individual markets of different types, the Small markets differ from Medium, Large and Pre-Sort by not requiring investment and infrastructure for a high-flow alley. Extra-Large markets differ primarily by requiring investment and infrastructure for a second high-flow alley.

As illustrated in Table 12 above and detailed in the sections following, the capital cost for an installation for Move-in Only, for all of the market types, is between 12% and 16% lower than for either of the Move-in Move-out cases. This is predominantly the result of additional chute scanning for move-outs in these two scope options.

For all 28 markets, the Move-out with Permit option requires an additional $890.9K investment over the Move-in Only case while the Move-out with Data Transfer Only requires a further $959.8K investment.

Overall, the numbers illustrate that the capital cost is proportionally constant across the three scope options, the majority of the investment being in infrastructure and equipment for the main scanning activity.

The Tables 14 to 24 in Section 3.1.3 following provide a detailed description of the capital investment for each market type and summarize the total capital investment required to install the scanning capability in all 28 markets, both the currently-participating pilot sites and the remaining 22. These tables include capital investment for each of the scope options: Move-In Only, Move-In/Move-Out Linked to Permits, and Move-In/Move-Out Data Direct to CLTS.

The Capital Cost Summary tables are supported by a very detailed assessment of capital requirements for each type and option. Each category of capital cost is described in Table 13 immediately below.

Table 13: Capital Requirements for each Market Type and Option

Capital Cost Category	Assets Included
Auction Market Infrastructure	Land, related yard infrastructure and roofs and outbuildings
Scanning-Specific Infrastructure	Handling facilities, scanning office and sheds and services (electrical)
Scanning Equipment	RFID Panel Readers and related infrastructure, including installation
Mobile Equipment	RFID Wand Readers and miscellaneous equipment
Network and Communications	Internet sticks, wireless transmission equipment and miscellaneous
Scanning Software	Software specific to scanning only (i.e. excluding market integration)
Computer hardware	PCs and laptops specific to scanning only, and LED displays

3.1.3 Description of Capital Costs

3.1.3.1 Auction Market Infrastructure

Auction market infrastructure includes three major areas of capital investment – Land, Yard Infrastructure, and Roofs and Outbuildings. These three areas are detailed in the notes following.

Table 14: Capital Investment- Land

Land	Small	Medium	Large	Pre-Sort	X-Large
Acres Required	0.20	0.35	0.40	0.24	0.55
Cost/acre	$135,000	$135,000	$135,000	$135,000	$135,000
Land Cost	**$27,000.0**	**$47,250.0**	**$54,000.0**	**$32,400.0**	**$74,250.0**

During the initial site visits with the participating pilot sites it was quickly evident that each would lose the use of certain pens, alleys, buildings, roofs and land to facilitate the scanning of cattle. It was vital to locate the scanning areas in centrally located high volume stock flow areas in order to facilitate scanning without impeding the speed of commerce.

This meant that the required land/area could not be used by the market for day-to-day sale operations. The project manager first calculated the total square footage required for scanning at the participating auction markets to provide a foundation for estimating the cost of the land for the scanning systems. Local real estate agents were consulted to determine local real estate values for similar properties in the area. An average cost was calculated for the six pilot sites. The square footage required for each specific size market was then multiplied by the average land cost to arrive at an average land value of $135,000.00 per acre. (It should be noted that this high land value is attributed to auction markets being predominately located adjacent to industrial land or close to a town.)

Picture 1, 2 and 3: Penning facilities in various sized auction markets.

Table 15: Capital Investment-Yard Infrastructure

Yard Infrastructure	Small	Medium	Large	Pre-Sort	X-Large
Gravel	$1,408	$4,376	$4,376	$3,168	$6,200
Site Prep	$1,100	$3,419	$3,419	$2,475	$5,000
Rebar & Supplies	$176	$547	$547	$396	$800
Labour	$1,400	$2,800	$2,800	$1,800	$5,600
Concrete	$6,000	$12,000	$12,000	$12,000	$24,000
Posts	$1,382	$1,224	$1,224	$576	$3,456
Planks	$1,250	$3,672	$3,672	$1,728	$5,000
Steel Panels and Gates	$5,000	$8,500	$8,500	$2,500	$12,000
Total Infrastucture Costs	**$17,716**	**$36,538**	**$36,538**	**$24,643**	**$62,056**

In four of the six pilot sites the land identified for scanning included existing yard infrastructure for day-to-day auction activities. This existing infrastructure still required modifications to level the ground, install gates, build alleys, fences, catwalks, and stairs, and all other infrastructure to facilitate scanning. Two sites had to either rebuild or transform the required area for scanning.

Using the data gathered from the installations in the six pilot auctions, are comparative assessment was generated to project costs for yard infrastructure in all Alberta auction markets for scanning. Quotations were provided by local contractors to help determine the yard infrastructure cost based on the required square footage of land necessary to scan.

Picture 4, 5 and 6: Cattle leaving the scanning system to be penned (4), Construction of new pre-scanning pens (5), Scanning office built over the scanning pens (6)

Table 16: Capital Investment-Roofs and Buildings

Roofs and Outbuildings	Small	Medium	Large	Pre-Sort	X-Large
Roofs and Outbuildings Cost	$7,500	$20,000	$20,000	$7,500	$30,000
Total Roofs and Outbuildings Costs	**$7,500**	**$20,000**	**$20,000**	**$7,500**	**$30,000**

In three of the pilot sites there were existing roofs and outbuildings that were utilized for scanning. Local contractors were contacted for quotations to build roofs and outbuildings over the main scanning area (*It should be noted that the variances in external temperature did not impact the read rates on cattle throughout the pilot however shelter was required to protect the equipments and provide a suitable working environment for scanning staff*).

Roofs and outbuildings are required to maintain the integrity of the actual yard infrastructure. This was evident in the three pilot sites that provided roofs and shelter. In these sites lower site maintenance is required (no snow removal), computer screens do not get distorted by sunlight and light reflections from snow, and panels and wand scanners have a longer life expectancy when kept out of the snow and rain. Cattle can be retagged and confined for reading more efficiently and data integrity is not compromised by weather impacting data collection practices.

Picture 7, 8 and 9: Scanning area of a medium sized auction (7), Construction of scanning area (8), Chute system of a Pre-Sort auction (9).

3.1.3.2 Scanning-Specific Infrastructure

Scanning-specific infrastructure also includes three areas of capital cost – Auction Market Handling Facilities, Offices and Sheds (distinct from "Roofs and Outbuildings" above), and Services. These three areas are detailed in the tables and notes following.

Table 17: Capital Cost-Auction Market Handling Facilities

Auction Market Handling Facilities	Small	Medium	Large	Pre-Sort	X-Large
Head Catch	$1,500	$3,650	$3,650		$7,300
Slide Gates	$600	$1,800	$2,100	$1,200	$4,400
Alley Modifications	$2,900	$6,550	$10,850	$6,300	$15,000
Total Handling Facilities Costs	**$5,000**	**$12,000**	**$16,600**	**$7,500**	**$26,700**

**Head Catch: Small = 1, Medium and Large = 2 and X-large = 4*

**Slide Gates: Small = 1, Medium = 3, Large = 4, X-large = 8*

All auction markets have existing handling facilities used for pregnancy checking, vet checks, tagging, processing, branding, brand inspections, and numerous other activities. Auction markets must install handling facilities close to the scanning area to tag and inspect animals brought for sale, and to avoid impacting commerce by moving cattle back and forth from handling facilities. In all of the pilot sites, except the pre-sort, new handling facilities were installed in order to perform all scanning services and practices in one location.

Picture 10, 11 and 12: Single alley scanning system (10), Retagging process (11), animal in a head gate for retagging (12).

Table 18: Capital Cost- Auction Market Office and Sheds

Auction Market Office & Sheds	Small	Medium	Large	Pre-Sort	X-Large
Scanning Office Cost	$5,000	$5,000	$5,000	$5,000	$10,000
Total Office Costs	**$5,000**	**$5,000**	**$5,000**	**$5,000**	**$10,000**

Only 1 **Office is required for most market types but the X-Large requires 2*

A new scanning office was built to facilitate all aspects of scanning in all of the pilot sites except the pre-sort pilot site (existing buildings were used). This office was used as a secure place to house breaker boxes, computers, printers, wand readers, chargers, power supplies for panel readers, and all other tools necessary to perform the scanning service.

Table 19: Capital Cost- Auction Market Services

Auction Market Services	Small	Medium	Large	Pre-Sort	X-Large
Electrical	$3,000	$5,000	$5,000	$5,000	$7,500
Additonal Lighting	$1,500	$2,500	$2,500	$1,500	$4,000
Total Services Costs	**$4,500**	**$7,500**	**$7,500**	**$6,500**	**$11,500**

A dedicated breaker is required in order for a low-frequency RFID reader to work at full capacity. Electricians installed a dedicated power line for the RFID readers in all pilot sites. In addition, all scanning offices were wired with light and electrical sockets to perform day-to-day scanning activities. In five of the six pilot sites, additional lights around the scanning area and pens had to be installed to allow scanning staff to efficiently work in all hours during scanning activities.

3.1.3.3 Scanning Equipment

Table 20: Auction Market Scanning Equipment

Auction Market Scanning Equipment	Small	Medium	Large	Pre-Sort	X-Large
High Flow Panels		$50,000	$50,000	$50,000	$100,000
Dual RFID Panels	$10,000	$10,000	$10,000	$10,000	$20,000
Dual Panels w/Data Box					
Total Handling Facilities Costs	**$10,000**	**$60,000**	**$60,000**	**$60,000**	**$120,000**

**High Flow: Medium, Large and Pre-sort = 1, X-large = 2*

** Only 1 **Dual Panel** is required for most market types but the X-Large requires 2*

High-flow readers were installed in five of the six pilot sites. These readers consist of a multiple panel configuration that allows for cattle to be scanned in multiples (two to three abreast) as they move unobstructed down a five-foot wide alley.

Picture 13, 14 and 15: Multi panel scanning system (13), Animals moving through multi panel scanning system (14) (15).

Dual panel readers were installed to accommodate scanning cattle in single lane situations and loading/unloading chutes. In the scenario's requiring scanning cattle out of the auction markets, dual panel readers with data boxes provided users the capacity to key in data directly on the data box. This data included manifest and permit information as cattle were unloaded into the markets and loaded out.

Picture 16, 17 and 18: Single alley scanning system (16) (17), Data box (18)

3.1.3.4 Mobile Equipment

Table 21: Auction Market Mobile Scanning Equipment

Auction Market Mobile Scanning Equipment	Small	Medium	Large	Pre-Sort	X-Large
Wands - Standard Length - 1 meter	$3,750	$3,750	$3,750	$3,750	$3,750
Long Wands - 2-3 meter	$6,500	$6,500	$6,500	$6,500	$13,000
Miscellaneous	$500	$1,000	$1,000	$500	$1,500
Total Handling Facilities Costs	**$10,750**	**$11,250**	**$11,250**	**$10,750**	**$18,250**

**Small Wand: All markets = 1*

Only 1 **Long Wand is required for most market types but the X-Large requires 2*

Mobile scanning equipment is not stationary or hardwired. This includes wand readers used to scan cattle, purchased in different wand lengths to handle all situations, including a data-entry all-in-one unit. It was determined during the pilot project that each market will need at least one short wand for scanning cattle in a chute or single alley and a long wand to scan cattle in pens and alleys and from catwalks. Site-specific miscellaneous equipment consists of spare chargers, batteries, holsters, hangers, and cases.

Picture 19, 20 and 21: Reading cattle with a one meter wand (19), 2 meter wand (20) and 3 meter wand (21).

3.1.3.5 Network and Communications

Table 22: Auction Market Network and Communications

Auction Market Network & Communications	Small	Medium	Large	Pre-Sort	X-Large
Internet Sticks	$350	$350	$350	$350	$350
Wireless Transmissions	$3,526	$3,526	$3,526	$4,000	$7,052
Miscellaneous	$1,150	$1,150	$1,150	$1,150	$2,200
Total Network & Communication Costs	**$5,026**	**$5,026**	**$5,026**	**$5,500**	**$9,602**

Only 1 **Internet Stick is required for most market types but the X-Large requires 2*

Network and communications consists of real-time internet for downloading age replication data daily, creating birth certificates, and submitting CLTS movements to the main database. In addition, the internet was required to email RFID numbers to the on-site Mobile Field Representative (MFR) and to

auction market personnel for tagging and age verification data. Wireless transmission equipment provided a booster to send data from wand readers to the scanning computers when scanning cattle in remote feed pens and alleys.

3.1.3.6 Scanning Software

Table 23: Auction Market Scanning Software

Auction Market Scanning Software	Small	Medium	Large	Pre-Sort	X-Large
Scanning Software	$5,000	$10,000	$10,000	$10,000	$10,000
Total Scanning Software Costs	**$5,000**	**$10,000**	**$10,000**	**$10,000**	**$10,000**

Custom scanning software – Stockman™ – was designed by ITS specifically for the pilot project as no other commercially available software could meet the necessary requirements as set out by AARD; this software was updated and refined throughout the pilot project to meet the needs of the project participants, the producer, the auction market, and CLTS. This software met the needs of the auction markets for the pilot project.

Assuming traceability does become mandatory, auction markets will likely require the integration of the scanning process into their auction software system for seamless data management and usage. This requirement would result in a much higher investment than standalone scanning software. Since this was not part of this RFP the project manager did not include a cost summary for a complete integrated software package. Scanning software costs are therefore based on the cost of the product used in the pilot study.

3.1.3.7 Computer Hardware

Table 24: Auction Market Computer Hardware

Auction Market Computer Hardware	Small	Medium	Large	Pre-Sort	X-Large
Scanning & Office Computers	$5,000	$10,000	$10,000	$15,000	$15,000
Scanning Office Printer	$500	$500	$500	$500	$1,000
Netbooks	$1,000	$2,000	$2,000	$2,000	$3,000
LED Displays	$1,900	$3,800	$3,800	$1,900	$7,600
Total Computer Hardware Costs	**$8,400**	**$16,300**	**$16,300**	**$19,400**	**$26,600**

**Scanning Computer: Small = 1, Meduim and Large = 2 and X-large = 3*
**Only 1 Printer is required for most market types but the X-Large requires 2*
**Netbooks: Small = 1, Medium, Large and Pre-sort = 2 and X-large = 4*
**LED Displays: Small and Pre-sort = 1, Medium and Large = 2 and X-large = 4*

Computer Hardware consists of computers, printers, net books and LED displays. For the pilot project, the project manager used Panasonic Tough Book computers (*although any comparable Harsh Environment Computer would be acceptable*), although very expensive, the most rugged computer on the market. The Panasonic CF-30, was used as the master computer on site and then a CF-15, which is a Panasonic tablet computer, was also used where a secondary or portable computer was required.

This computer was synchronised with the master computer in order to store all data within a single database. The tablet worked very well as a chute-side application for scanning during pregnancy checking, semen testing, and tagging. Net books were required for the Move-Out to CLTS Only option. Net books were connected directly to the readers data box, which collects the data at a loading chute. Utilizing wireless internet sticks, the project staff connected remotely to the net books from an offsite office and submitted daily data to the CLTS to ensure data was submitted in the right event order.

Picture 22, 23 and 24: Stockman™ Software display on the Panasonic CF-30 Toughbook

3.1.4 Capital Expenditure for all Scope Options – Detail

On the following pages, details of the anticipated capital expenditures required to establish scanning capability for each of the three scope options and for each market type under each scope option are provided. Capital expenditures for a single market are detailed for each market type and the capital cost for all of the 28 markets in the possible rollout of the program (including the 6 markets included in the pilot study) are provided in Tables 25 to 27 following. The number of markets of each type within the province is detailed in Section 2.1 and are inserted in a small table accompanying each report section.

For the Move-In Only option, detailed in Table 25 below, capital equipment required scanning cattle arriving at the market and being scanned into pens is included. This provides for capture of the manifest number, RFID information upon arrival, identification of missing or mis-read and unreadable tags, and age verification of all successfully-read cattle.

Table 25: Pro-Forma Capital Costs for Move In Only

Infrastructure, Equipment and Software: Pro-Forma Capital Costs	Move-in Only					
	Per Market					All Markets
	Small	Mid-Size	Large	Pre-Sort	X-Large	
Auction Market Infrastructure						
Land	$27,000	$47,250	$54,000	$32,400	$74,250	**$1,293,300**
Yard Infrastructure	$17,716	$36,538	$36,538	$24,643	$62,056	**$926,356**
Roofs and Outbuildings	$7,500	$20,000	$20,000	$7,500	$30,000	**$470,000**
Subtotal	*$52,216*	*$103,788*	*$110,538*	*$64,543*	*$166,306*	***$2,689,656***
Scanning-Specific Infrastructure						
Handling Facilities	$5,000	$12,000	$16,600	$7,500	$26,700	**$376,900**
Office and Sheds	$4,000	$5,000	$5,000	$5,000	$10,000	**$150,000**
Services	$4,500	$7,500	$7,500	$6,500	$11,500	**$194,500**
Subtotal	*$13,500*	*$24,500*	*$29,100*	*$19,000*	*$48,200*	***$721,400***
Scanning Equip. (incl Installation)						
Hi-Flow	$0	$50,000	$50,000	$50,000	$100,000	**$1,200,000**
Dual Panels	$10,000	$10,000	$10,000	$10,000	$20,000	**$300,000**
DP with data box	$0	$0	$0	$0	$0	**$0**
Subtotal	*$10,000*	*$60,000*	*$60,000*	*$60,000*	*$120,000*	***$1,500,000***
Mobile Equipment						
Short wands	$3,750	$3,750	$3,750	$3,750	$3,750	**$101,250**
Long wands	$6,500	$6,500	$6,500	$6,500	$13,000	**$195,000**
Miscellaneous	$500	$1,000	$1,000	$500	$1,500	**$24,500**
Subtotal	*$10,750*	*$11,250*	*$11,250*	*$10,750*	*$18,250*	***$320,750***
Network and Communications						
Internet Sticks	$350	$350	$350	$350	$700	**$10,500**
Wireless transmission	$3,526	$3,526	$3,526	$4,000	$7,052	**$106,728**
Miscellaneous	$1,150	$1,150	$1,150	$1,150	$2,200	**$34,200**
Subtotal	*$5,026*	*$5,026*	*$5,026*	*$5,500*	*$9,952*	***$151,428***
Scanning Software						
Scanning Software	$5,000	$10,000	$10,000	$10,000	$10,000	**$240,000**
Subtotal	*$5,000*	*$10,000*	*$10,000*	*$10,000*	*$10,000*	***$240,000***
Computer Hardware						
Scanning Office Computers	$5,000	$10,000	$10,000	$15,000	$15,000	**$265,000**
Scanning Office Printer	$500	$500	$500	$500	$1,000	**$15,000**
Net Books	$0	$0	$0	$0	$0	**$0**
LED Displays	$1,900	$3,800	$3,800	$1,900	$7,600	**$98,800**
Subtotal	*$7,400*	*$14,300*	*$14,300*	*$17,400*	*$23,600*	***$378,800***
CAPITAL COST SUMMARY						
Auction Market Infrastructure	$52,216	$103,788	$110,538	$64,543	$166,306	**$2,689,656**
Scanning-Specific Infrastructure	$13,500	$24,500	$29,100	$19,000	$48,200	**$721,400**
Scanning Equip. (incl Installation)	$10,000	$60,000	$60,000	$60,000	$120,000	**$1,500,000**
Mobile Equipment	$10,750	$5,026	$5,026	$5,500	$9,952	**$185,772**
Network and Communications	$5,026	$5,026	$5,026	$5,500	$9,952	**$151,428**
Scanning Software	$5,000	$10,000	$10,000	$10,000	$10,000	**$240,000**
Computer Hardware	$7,400	$14,300	$14,300	$17,400	$23,600	**$378,800**
Total	$51,676	$118,852	$123,452	$117,400	$221,704	**$3,177,400**
TOTAL CAPITAL COST	***$104,892***	***$222,640***	***$233,990***	***$181,943***	***$388,010***	***$5,867,056***

The Move-In/Move-Out Linked to Permit option in Table 26 below includes capital equipment required to complete all of the functions in the Move-In Only option plus additional scanning equipment and related infrastructure required to scan cattle being loaded out. This option links the scan-out information to the central scanning system so that a record of the shipped lot can be created and linked to the LIS permit. The capital impact of this expanded capability is limited to a small investment in additional scanning equipment installed in the load-out chute(s).

Table 26: Pro-Forma Capital Costs for Move In and Move Out Linked to a Permit

Infrastructure, Equipment and Software: Pro-Forma Capital Costs	Move-in Move-out Linked to Permit Per Market					All Markets
	Small	Mid-Size	Large	Pre-Sort	X-Large	
Auction Market Infrastructure						
Land	$27,000	$47,250	$54,000	$32,400	$74,250	**$1,293,300**
Yard Infrastructure	$18,716	$38,538	$38,538	$26,643	$66,056	**$980,356**
Roofs and Outbuildings	$7,500	$20,000	$20,000	$7,500	$30,000	**$470,000**
Subtotal	*$53,216*	*$105,788*	*$112,538*	*$66,543*	*$170,306*	***$2,743,656***
Scanning-Specific Infrastructure						
Handling Facilities	$5,000	$12,000	$16,600	$7,500	$26,700	**$376,900**
Office and Sheds	$4,000	$5,000	$5,000	$5,000	$10,000	**$150,000**
Services	$4,500	$7,500	$7,500	$6,500	$11,500	**$194,500**
Subtotal	*$13,500*	*$24,500*	*$29,100*	*$19,000*	*$48,200*	***$721,400***
Scanning Equip. (incl Installation)						
Hi-Flow	$0	$50,000	$50,000	$50,000	$100,000	**$1,200,000**
Dual Panels	$10,000	$10,000	$10,000	$10,000	$20,000	**$300,000**
DP with data box	$13,000	$26,000	$26,000	$26,000	$52,000	**$702,000**
Subtotal	*$23,000*	*$86,000*	*$86,000*	*$86,000*	*$172,000*	***$2,202,000***
Mobile Equipment						
Short wands	$3,750	$3,750	$3,750	$3,750	$3,750	**$101,250**
Long wands	$6,500	$6,500	$6,500	$6,500	$13,000	**$195,000**
Miscellaneous	$500	$1,000	$1,000	$500	$1,500	**$24,500**
Subtotal	*$10,750*	*$11,250*	*$11,250*	*$10,750*	*$18,250*	***$320,750***
Network and Communications						
Internet Sticks	$350	$350	$350	$350	$700	**$10,500**
Wireless transmission	$3,526	$3,526	$3,526	$4,000	$7,052	**$106,728**
Miscellaneous	$1,150	$1,150	$1,150	$1,150	$2,200	**$34,200**
Subtotal	*$5,026*	*$5,026*	*$5,026*	*$5,500*	*$9,952*	***$151,428***
Scanning Software						
Scanning Software	$5,000	$10,000	$10,000	$10,000	$10,000	**$240,000**
Subtotal	*$5,000*	*$10,000*	*$10,000*	*$10,000*	*$10,000*	***$240,000***
Computer Hardware						
Scanning Office Computers	$5,000	$10,000	$10,000	$15,000	$15,000	**$265,000**
Scanning Office Printer	$500	$500	$500	$500	$1,000	**$15,000**
Net Books	$0	$0	$0	$0	$0	**$0**
LED Displays	$1,900	$3,800	$3,800	$1,900	$7,600	**$98,800**
Subtotal	*$7,400*	*$14,300*	*$14,300*	*$17,400*	*$23,600*	***$378,800***
CAPITAL COST SUMMARY						
Auction Market Infrastructure	$53,216	$105,788	$112,538	$66,543	$170,306	**$2,743,656**
Scanning-Specific Infrastructure	$13,500	$24,500	$29,100	$19,000	$48,200	**$721,400**
Scanning Equip. (incl Installation)	$23,000	$86,000	$86,000	$86,000	$172,000	**$2,202,000**
Mobile Equipment	$10,750	$11,250	$11,250	$10,750	$18,250	**$320,750**
Network and Communications	$5,026	$5,026	$5,026	$5,500	$9,952	**$151,428**
Scanning Software	$5,000	$10,000	$10,000	$10,000	$10,000	**$240,000**
Computer Hardware	$7,400	$14,300	$14,300	$17,400	$23,600	**$378,800**
Total	$64,676	$151,076	$155,676	$148,650	$282,002	**$4,014,378**
TOTAL CAPITAL COST	***$118,892***	***$256,864***	***$268,214***	***$215,193***	***$452,308***	***$6,758,034***

The Move-In/Move-Out – Data Direct to CLTS option in Table 27 below includes the capital in the Linked to Permit option and requires a modest investment in additional network/communications and a dedicated computer for each installation. Though the capital investment is higher there is a reduction in the scanning labour compared to the previous case because staff are not required to be on site during the Move-Out process.

Table 27: Pro-Forma Capital Costs for Move IN and Move Out Data Directly to CLTS

Infrastructure, Equipment and Software: Pro-Forma Capital Costs	Move-in Move-out - Data Direct to CLTS Per Market					All Markets
	Small	Mid-Size	Large	Pre-Sort	X-Large	
Auction Market Infrastructure						
Land	$27,000	$47,250	$54,000	$32,400	$74,250	**$1,293,300**
Yard Infrastructure	$18,716	$38,538	$38,538	$26,643	$66,056	**$980,356**
Roofs and Outbuildings	$7,500	$20,000	$20,000	$7,500	$30,000	**$470,000**
Subtotal	*$53,216*	*$105,788*	*$112,538*	*$66,543*	*$170,306*	***$2,743,656***
Scanning-Specific Infrastructure						
Handling Facilities	$5,000	$12,000	$16,600	$7,500	$26,700	**$376,900**
Office and Sheds	$5,000	$5,000	$5,000	$5,000	$10,000	**$150,000**
Services	$4,500	$7,500	$7,500	$6,500	$11,500	**$194,500**
Subtotal	*$14,500*	*$24,500*	*$29,100*	*$19,000*	*$48,200*	***$721,400***
Scanning Equip. (incl Installation)						
Hi-Flow	$0	$50,000	$50,000	$50,000	$100,000	**$1,200,000**
Dual Panels	$10,000	$10,000	$10,000	$10,000	$20,000	**$300,000**
DP with data box	$13,000	$26,000	$26,000	$26,000	$52,000	**$702,000**
Subtotal	$23,000	*$86,000*	*$86,000*	*$86,000*	*$172,000*	***$2,202,000***
Mobile Equipment						
Short wands	$3,750	$3,750	$3,750	$3,750	$3,750	**$101,250**
Long wands	$6,500	$6,500	$6,500	$6,500	$13,000	**$195,000**
Miscellaneous	$500	$1,000	$1,000	$500	$1,500	**$24,500**
Subtotal	*$10,750*	*$11,250*	*$11,250*	*$10,750*	*$18,250*	***$320,750***
Network and Communications						
Internet Sticks	$700	$1,050	$1,050	$1,050	$1,750	**$28,350**
Wireless transmission	$3,526	$3,526	$3,526	$4,000	$7,052	**$106,728**
Miscellaneous	$1,150	$1,150	$1,150	$1,150	$2,200	**$34,200**
Subtotal	*$5,376*	*$5,726*	*$5,726*	*$6,200*	*$11,002*	***$169,278***
Scanning Software						
Scanning Software	$5,000	$10,000	$10,000	$10,000	$10,000	**$240,000**
Subtotal	*$5,000*	*$10,000*	*$10,000*	*$10,000*	*$10,000*	***$240,000***
Computer Hardware						
Scanning Office Computers	$5,000	$10,000	$10,000	$15,000	$15,000	**$265,000**
Scanning Office Printer	$500	$500	$500	$500	$1,000	**$15,000**
Net Books	$1,000	$2,000	$2,000	$2,000	$3,000	**$51,000**
LED Displays	$1,900	$3,800	$3,800	$1,900	$7,600	**$98,800**
Subtotal	*$8,400*	*$16,300*	*$16,300*	*$19,400*	*$26,600*	***$429,800***
CAPITAL COST SUMMARY						
Auction Market Infrastructure	$53,216	$105,788	$112,538	$66,543	$170,306	**$2,743,656**
Scanning-Specific Infrastructure	$14,500	$24,500	$29,100	$19,000	$48,200	**$721,400**
Scanning Equip. (incl Installation)	$23,000	$86,000	$86,000	$86,000	$172,000	**$2,202,000**
Mobile Equipment	$10,750	$11,250	$11,250	$10,750	$18,250	**$320,750**
Network and Communications	$5,376	$5,726	$5,726	$6,200	$11,002	**$169,278**
Scanning Software	$5,000	$10,000	$10,000	$10,000	$10,000	**$240,000**
Computer Hardware	$8,400	$16,300	$16,300	$19,400	$26,600	**$429,800**
Total	$67,026	$153,776	$158,376	$151,350	$286,052	**$4,083,228**
TOTAL CAPITAL COST	***$120,242***	***$259,564***	***$270,914***	***$217,893***	***$456,358***	***$6,826,884***

Pro-Forma Operating Costs

Working from the actual operating experience of the pilot study participants, the project team developed detailed estimates for operating costs for all cost areas under roll-out conditions. This analysis required consideration of the actual experience of the project team on-site, consideration of the expressed experience of the participating market operators, and consistency with the proposed capital configurations for all of the market types.

Pro-forma costs were developed for all market types, including the Small and Extra-Large markets, neither of which were represented in the study. These estimates were calculated for prototypical single markets of each type and extended to 28 markets to provide a view of the full roll-out potentially driven by the pilot study data.

Operating costs for all of the possible roll-out options were prepared and are presented in Tables 57 to 68 below. These iterative tables illustrate the five market types (by size), three scope options:

1. Move-In Only;
2. Move-In/Move-Out Linked to Permits; and
3. Move-In/Move-Out Data Direct to CLTS;

Four operational business models,

1. Market-Owned and -Operated;
2. Vendor-Operated/Market-Owned;
3. Third-Party-Operated/Market-Owned; and
4. Vendor-Owned and –Operated;

As described in detail in preceding sections of this report the pro-forma operating costs for each combination of options are presented in the 'Comparative Costs' section.

3.1.5 Summary of Total Operating Cost by Business Case, Market Type and Scope Option

It is important to note that in all cases these are estimates of the annual cost of operation for the markets based on current experience from the pilot study. In the 5-year forecast prepared for this report and presented in a later section, reductions in cost are anticipated to be achievable in scanning costs, as experience and efficiency grows, and some increases in equipment maintenance and replacement costs are incorporated. In addition, the actual cost of operation under contract conditions with a vendor-supply arrangement or a third-party operator may also include fees or other costs beyond those considered in the analysis.

It is important to state, however, that cost forecasts are based on reasonable, currently-available pricing from suppliers and estimates that are designed not to underestimate future costs. That said, it is quite likely that RFQ processes and negotiations with suppliers might result in lower costs than are estimated and forecasted here.

Tables 28 to 31 in the following four sub-sections summarize annual operating costs based on the experience during the pilot study, and are the estimates included for the base year in the five-year forecast. Future years in the forecast include the effect of operating efficiencies and the impact of increasing asset maintenance.

Table 28: Market-Owned and Operated

Annual Operating Costs	Individual Markets					All Markets
	Small	Medium	Large	Pre-Sort	X-Large	
Move-in Only	$47,346	$99,730	$147,416	$119,437	$314,162	$3,714,083
Move-in Move-out – Permit	$72,309	$156,481	$239,081	$175,120	$484,584	$5,893,093
Move-in Move-out – Data Only	$54,126	$114,290	$169,647	$135,814	$363,973	$4,272,070

The Market-Owned and Operated option is the least-cost option from an operating cost basis, primarily due to the use of market personnel to operate the scanning facility, rather than "contracted-in" personnel in the other three cases – hourly costs will be lower, and the travel and accommodation expenses required to provide temporary labour are avoided. In addition, the integration of the scanning activities with the markets' operations is assumed to allow more efficient use of staff, particularly being able to redeploy scanning staff when not actively needed, but when, in the other options, scanning staff would be waiting for sale activities to start or end.

Table 29: Vendor-Operated/Market Owned

Annual Operating Costs	Individual Markets					All Markets
	Small	Medium	Large	Pre-Sort	X-Large	
Move-in Only	$55,126	$110,537	$162,344	$127,722	$331,256	$4,070,904
Move-in Move-out – Permit	$76,005	$162,378	$250,613	$175,528	$495,982	$6,131,748
Move-in Move-out – Data Only	$61,066	$124,041	$183,742	$141,936	$379,065	$4,599,623

The Vendor-Operated/Market-Owned case is identical to the pilot model with the addition of comparable cost estimates for Small and Extra-Large units. On an out-of-pocket cost basis, this option is very similar to the Market-Owned and Operated option, with respect to individual market costs.

Table 30: Third-Party Operator

Annual Operating Costs	Individual Markets					All Markets
	Small	Medium	Large	Pre-Sort	X-Large	
Move-in Only	$61,446	$140,230	$180,278	$141,752	$367,828	$4,591,484
Move-in Move-out – Permit	$81,125	$174,309	$270,496	$188,181	$535,394	$6,607,452
Move-in Move-out – Data Only	$66,386	$135,143	$199,005	$155,593	$417,876	$5,004,509

The Third-Party-Operated case is the most expensive as it involves the payment of support and licensing services to the hardware and software vendors which cannot be absorbed through onsite or inter-company labour. It is simply an opportunity to consider differences between suppliers of the services, presumably through the issuance of a Request for Quotations from potential outsource operators and system suppliers. Differences in charges for software licensing might impact operating costs; the vendor's own cost might be different from a charge-out rate to a licensee. The impact of "bundling" products and services might also be seen.

Table 31: Vendor-Owned and Operated

Annual Operating Costs	Individual Markets					All Markets
	Small	Medium	Large	Pre-Sort	X-Large	
Move-in Only	$54,604	$107,299	$159,539	$124,377	$327,892	$3,999,844
Move-in Move-out – Permit	$74,473	$157,620	$245,287	$170,663	$489,079	$6,001,638
Move-in Move-out – Data Only	$59,534	$119,283	$178,416	$137,071	$372,162	$4,469,513

The Vendor-Owned and -Operated case is presented with all costs illustrated, for comparative purposes only. It is important to note, however, that the cost to each market and to the industry would be structured differently in the on-going business case. This option is very cost efficient as it puts all of the onus and responsibility on a single party which logically should have the technical competence and systems to support and maintain the software and hardware in the most cost effective manner.

That is, in the forecast, a combined charge would be negotiated to include both the use of the capital employed and the services provided that in aggregate might not match the totals in the table above.

3.1.6 Operating Costs Detailed

In each of the following sub-sections, the cost items are described and the method of their calculation for use in the financial analysis is explained where appropriate.

Scanning Labour

Scanning Labour is a calculation of the labour required to operate the scanning. It was calculated by taking the hours the project scanning staff were on site at the pilot auctions and deducting the hours when the staff were not scanning cattle.

Additional Labour

Additional labour is the labour supplied by the auction market to assist scanning crews in moving cattle to and from the scanners, waiting for cattle to be penned after scanning, and moving the cattle through the scanners during the Move-Out process. The additional labour was calculated using additional staff hours provided by the pilot markets.

Scanning Equipment Repair / Replacement

Scanning equipment repair and replacement covers the annual costs to maintain the readers in good working condition. This will vary from yard to yard depending on the facilitator of the equipment and how it is used; however, for purposes of the financial analysis, a standard estimate has been included, based subjectively on the capital cost. These costs will allow for visits by the hardware supplier's maintenance personnel for both repair and required adjustment.

Mobile Equipment Repair and Replacement

Mobile equipment repair and replacement provides for maintenance and repair/replacement of the wand readers and other mobile equipment. This will vary from yard to yard depending on the facilitator of the equipment and how it is used; however, a standard provision equal to 10% of the capital investment in this equipment has been applied to each option for purposes of developing the pro-forma estimates and forecast.

Equipment/Hardware Depreciation

Equipment and hardware depreciation was calculated based on the purchase value of the equipment paid by the markets. That is, any portion of the capital cost provided by government funds – in the pilot study, 80% – is excluded from the depreciation base. The depreciation rate was based on the project team's estimate of the useful life of each capital class, and not considering CAAP rates for tax or other purposes. The estimated useful life used for the depreciation allowance in each class of capital investment is shown in the table below:

Table 32: Depreciation Expense Calculation

Depreciation Expense Calculation	Yrs
Yard Infrastructure	20
Scanning Infrastucture	20
Scanning Equipment (incl.	5
Network	3
Mobile Equipment	3
Hardware	3

Scanning Hardware Maintenance and Support
Scanning hardware maintenance and support is part of a service contract from the equipment supplier. This includes;

- 24-hour technical support for the readers,
- monthly maintenance checks,
- site visits from the manufacturer representative to ensure scanning equipment is working properly,
- repair of equipment,
- upgrades to firmware in the readers, and
- initial user training in the proper use of the technology.

Software Licensing, Maintenance and Support
Software maintenance and subscription is part of a service contract from the software supplier. This includes technical support for the software inside normal business hours. It is also likely to include yearly software upgrades and initial user training in the proper use of the software.

Scanning System Support Costs
Scanning system support costs includes all of the additional support in relation to an auction market scanning cattle. This includes;

- on-site training for initial staff,
- support in the event of staff turnover,
- cattle handling techniques to maximise scanning rates,
- management of traceability requirements,
- integration to the auction market systems, and
- 24-hour technical support.

Scanning Opportunity Cost
Scanning opportunity cost recognizes the potential loss of revenue by market owners attributable to their commitment of space and facilities to the scanning operation. For purposes of the calculation, this includes a calculated return of 5% on the estimated current market value of real estate and the estimated value of attached hard assets, such as buildings, sheds and roof employed by the scanning activities. The loss of pen and/or alley space and a site access fee for scanning staff are included also.

Site Maintenance
Site maintenance includes an allowance for costs associated with snow and manure removal, application of sand to stop cattle from slipping on concrete, and repairs and maintenance to electrical, fencing, gates and alleys.

Internet
Internet fee covers the monthly subscription for internet service for internet sticks.

Electrical
Electrical expense is the additional electricity required to run panel readers 24 hours a day, seven days a week as recommended by the equipment suppliers, as well as charging all wand readers, running all office computers and printers, heaters, lights and all other electrical services.

Telephone
Telephone expense is to cover all phone expenses related to scanning. This includes contacting scanning crew members to notify them of cattle arrival and departure times and addition or cancelation of sales, and contacting CCIA in relation to tagging issues and data submission errors to the CLTS.

Supplies
Supplies includes such items such as;

- heaters for the scanning office,
- two-way radios for communication between scanning crew and market staff,
- white boards,
- sorting sticks,
- stock prods, and
- all other supplies necessary for daily scanning duties.

Insurance
Insurance expense is the yearly cost to insure the scanning equipment in the auction markets. It does not include costs for any Errors and Omissions coverage required for tag sales and (re)tagging.

Incremental Overhead
Incremental Overhead is the additional time spent by the market owner or manager on scanning issues with sellers and buyers, working through issues between market staff and scanning staff, meetings and scanning assessments, additional market staff time to upload and download data to the CLTS, and all other costs associated with scanning in an auction yard.

Miscellaneous
Miscellaneous includes such items as printer ink and paper to print birth certificates, buyer and seller reports, and all other tangible supplies and consumables required for scanning.

3.1.7 Operating Costs by Business Model

In each option presented in the following tables, with the exception of the Market-Owned and -Operated case, operating costs that accrue to the markets and to the scanning system operator are presented separately, together with a combined total for comparative assessment. Costs are presented for a single market of each type and for the 28 markets taken together, as anticipated in a potential roll-out across the province. It will be important also to review the per-head versions of this cost data, made available together with this report, for full comparative analysis.

For this comparative data, and for the forecasts of operating costs presented in section, in all cases except the Market-Owned and -Operated case, the anticipated cost of scanning services provided by the vendor or the third-party operator have been summarised.

Costs provided in this part of the analysis are based on the current experience from the Pilot Study, and are not subject to any efficiency gains or other reductions beyond the first nine months' experience or potential future amendments to Move In or Move Out requirements.

3.1.7.1 Market-Owned and Operated

In this case, the markets are assumed to have purchased all of the hardware and software required for operation of the scanning system, hire/employ their own operators, and directly incur all other operating costs. On a total cost and a per-head basis, this is one of the lower cost options, since operating costs and efficiencies are similar to the following "outsourced" cases, and the mark-up of acquiring labour and other services is minimised.

This is a simplified analysis, however, since incremental overhead related to scanning only is included in the markets' operating costs. Other likely costs have not been calculated, such as costs of scanning employee turnover, training and administration, and additional systems and network support. In order to operate a scanning system in the manner intended by the rollout, markets would need to have a well-rounded technology resource available on-site or at least on call to manage the combined elements of the system and its integration into market operations systems.

Table 33: Market Owned and Operated Operating Costs-Move In Only

Operating Costs - per market	Small	Mid	Large	Pre-Sort	X-large	Total
Costs to Market:						
Scanning Labour[1]	$22,334	$54,592	$93,519	$68,026	$223,316	$2,315,499
Additional Yard Labour[4]	$6,000	$10,560	$13,905	$15,450	$33,360	$378,435
Scanning Equip. Repair / Replacement[2]	$0	$1,000	$1,000	$1,000	$1,500	$24,000
Mobile Equip. Repair / Replacement[2]	$1,075	$1,125	$1,125	$1,075	$1,825	$32,550
Hardware Equip. Depreciation[3]	$2,612	$5,306	$5,420	$5,129	$9,845	$145,532
Scanning Hardware S & M[6]	$500	$2,500	$3,000	$3,000	$4,000	$71,500
Software L, S & M[7]	$500	$1,200	$1,200	$1,200	$1,200	$30,100
Scanning System Support Costs[8]	$2,000	$3,694	$5,422	$5,422	$9,054	$135,062
Scanning Area Opportunity Cost[5]	$4,725	$6,363	$6,700	$4,995	$8,213	$175,990
Site Maintenance[3]	$500	$1,350	$1,925	$1,100	$2,400	$43,775
Internet[3]	$1,000	$1,000	$1,000	$1,000	$2,000	$30,000
Electrical[3]	$250	$600	$600	$600	$700	$15,250
Telephone[3]	$1,500	$2,400	$3,000	$2,400	$4,000	$74,900
Supplies[3]	$800	$1,200	$1,500	$1,200	$2,000	$37,700
Insurance[3]	$750	$1,000	$1,250	$1,250	$1,800	$32,600
Incremental Overhead[3]	$2,000	$4,400	$5,150	$5,150	$6,950	$129,050
Miscellaneous Expenses[3]	$800	$1,440	$1,700	$1,440	$2,000	$42,140
Total Operating Costs	$47,346	$99,730	$147,416	$119,437	$314,162	$3,714,083
Total Operating Costs per Head	$4.11	$2.70	$1.90	$1.54	$1.74	

Notes:

[1] *Labour involved directly in scanning activities*

[2] *Estimated charges based upon the life expectancy of the products*

[3] *Estimated charge based upon costs experience in the pilot project*

[4] *Assessment of the additional labour required by the yard as a result of implementing scanning to the receival and sorting process.*

[5] *Estimated cost based upon present land valuations as at the date of this report*

[6] *Estimated support and maintenance charge based off equivalent services provided in the marketplace*

[7] *Estimated licensing, support and maintenance charge based off equivalent services provided in the marketplace*

[8] *Estimated charge based on training and ongoing generic support costs based of similar services provided to feedlots*

Definition	Small	Medium	Large	Pre-Sort	X-Large
Size (# Head)	<20K	20K-50K	50K-120K	50K-120K	>120K
Average Size	11,516	36,944	77,460	77,460	181,072
Number	5	4	15	2	2

For the Move-In/Move-Out Linked to Permit option, detailed in Table 34 below, additional equipment is installed at the move-out alley(s), resulting in additional expense for maintenance, depreciation and support. In this case also, additional scanning labour costs are incurred for staff to attend the move-out in order to create the permit/manifest for each load by transferring the scanned information to the central database and recording the movement on the system.

Table 34: Market Owned and Operated Operating Costs- Move In and Move Out Linked to a Permit

Operating Costs - per market	Small	Medium	Large	Pre-Sort	X-large	Total
Costs to Market:						
Scanning Labour[1]	$42,767	$103,088	$174,257	$113,075	$370,885	$4,207,951
Additional Yard Labour[4]	$9,000	$15,840	$20,858	$23,175	$50,040	$567,653
Scanning Equip. Repair / Replacement[2]	$1,000	$2,500	$3,500	$2,500	$5,000	$82,500
Mobile Equip. Repair / Replacement[2]	$1,075	$1,125	$1,125	$1,075	$1,825	$32,550
Hardware Equip. Depreciation[3]	$3,142	$6,781	$6,895	$6,539	$12,519	$184,373
Scanning Hardware S & M[6]	$500	$2,500	$3,000	$3,000	$4,000	$71,500
Software L, S & M[7]	$500	$1,200	$1,200	$1,200	$1,200	$30,100
Scanning System Support Costs[8]	$2,000	$3,694	$5,422	$5,422	$9,054	$135,062
Scanning Area Opportunity Cost[5]	$4,725	$6,363	$6,700	$4,995	$8,213	$175,990
Site Maintenance[3]	$500	$1,350	$1,925	$1,100	$2,400	$43,775
Internet[3]	$1,000	$1,000	$1,000	$1,000	$2,000	$30,000
Electrical[3]	$250	$600	$600	$600	$700	$15,250
Telephone[3]	$1,500	$2,400	$3,000	$2,400	$4,000	$74,900
Supplies[3]	$800	$1,200	$1,500	$1,200	$2,000	$37,700
Insurance[3]	$750	$1,000	$1,250	$1,250	$1,800	$32,600
Incremental Overhead[3]	$2,000	$4,400	$5,150	$5,150	$6,950	$129,050
Miscellaneous Expenses[3]	$800	$1,440	$1,700	$1,440	$2,000	$42,140
Total Operating Costs	$72,309	$156,481	$239,081	$175,120	$484,584	$5,893,093
Total Operating Costs per Head	$6.28	$4.24	$3.09	$2.26	$2.68	

The following option Table 35 below, Move-In/Move-Out Data only to CLTS, has similar additional equipment costs to the previous case, enhanced by an automated data communications device. It does not require the additional labour allowed in the previous option, however, since the scanning-out is unmanned.

Table 35: Market Owned and Operated Operating Costs- Move In and Move Out Data to CLTS

Operating Costs - per market	Small	Medium	Large	Pre-Sort	X-large	Total
Costs to Market:						
Scanning Labour[1]	$26,294	$63,884	$108,814	$78,223	$260,012	$2,695,689
Additional Yard Labour[4]	$7,200	$12,672	$16,686	$18,540	$40,032	$454,122
Scanning Equip. Repair / Replacement[2]	$1,000	$2,500	$3,500	$2,500	$5,000	$82,500
Mobile Equip. Repair / Replacement[2]	$1,075	$1,125	$1,125	$1,075	$1,825	$32,550
Hardware Equip. Depreciation[3]	$3,232	$6,961	$7,075	$6,719	$12,789	$189,143
Scanning Hardware S & M[6]	$500	$2,500	$3,000	$3,000	$4,000	$71,500
Software L, S & M[7]	$500	$1,200	$1,200	$1,200	$1,200	$30,100
Scanning System Support Costs[8]	$2,000	$3,694	$5,422	$5,422	$9,054	$135,062
Scanning Area Opportunity Cost[5]	$4,725	$6,363	$6,700	$4,995	$8,213	$175,990
Site Maintenance[3]	$500	$1,350	$1,925	$1,100	$2,400	$43,775
Internet[3]	$1,000	$1,000	$1,000	$1,000	$2,000	$30,000
Electrical[3]	$250	$600	$600	$600	$700	$15,250
Telephone[3]	$1,500	$2,400	$3,000	$2,400	$4,000	$74,900
Supplies[3]	$800	$1,200	$1,500	$1,200	$2,000	$37,700
Insurance[3]	$750	$1,000	$1,250	$1,250	$1,800	$32,600
Incremental Overhead[3]	$2,000	$4,400	$5,150	$5,150	$6,950	$129,050
Miscellaneous Expenses[3]	$800	$1,440	$1,700	$1,440	$2,000	$42,140
Total Operating Costs	$54,126	$114,290	$169,647	$135,814	$363,973	$4,272,070
Total Operating Costs per Head	$4.70	$3.09	$2.19	$1.75	$2.01	

3.1.7.2 Vendor Operated / Market Owned

This case is the configuration used in the pilot study. Infrastructure- and market-related operating costs are attributed to the markets, and the system operating costs are included in the vendor's scanning charge. Annual total costs and per-head costs are provided for both market-borne costs and for scanning costs, to allow more detailed comparison among the cases presented.

Table 36: Vendor Operated/ Market Owned Operating Costs - Move In Only

Operating Costs - per market	Small	Mid	Large	Pre-Sort	X-large	Total
Costs to Market:						
Scanning Equip. Repair / Replacement[2]	$0	$1,000	$1,000	$1,000	$1,500	$24,000
Mobile Equip. Repair / Replacement[2]	$1,075	$1,125	$1,125	$1,075	$1,825	$32,550
Hardware Equip. Depreciation[3]	$2,612	$5,306	$5,420	$5,129	$9,845	$145,532
Scanning Hardware S & M[6]	$500	$2,500	$3,000	$3,000	$4,000	$71,500
Software L, S & M[7]	$500	$1,200	$1,200	$1,200	$1,200	$30,100
Electrical[3]	$250	$600	$600	$600	$700	$15,250
Insurance[3]	$750	$1,000	$1,250	$1,250	$1,800	$32,600
Additional Yard Labour[4]	$6,000	$10,560	$13,905	$15,450	$33,360	$378,435
Scanning Area Opportunity Cost[5]	$4,725	$6,363	$6,700	$4,995	$8,213	$175,990
Incremental Overhead[3]	$2,000	$4,400	$5,150	$5,150	$6,950	$129,050
Sub-total Market	*$18,412*	*$34,054*	*$39,350*	*$38,849*	*$69,393*	*$1,035,007*
Market Costs per Head	***$1.60***	***$0.92***	***$0.51***	***$0.50***	***$0.38***	
Sub-total Vendor	*$36,714*	*$76,483*	*$122,995*	*$88,874*	*$261,863*	*$3,035,896*
Vendor Costs per Head	***$3.19***	***$2.07***	***$1.59***	***$1.15***	***$1.45***	
Total Operating Costs	**$55,126**	**$110,537**	**$162,344**	**$127,722**	**$331,256**	**$4,070,904**
Total Operating Costs per Head	$4.79	$2.99	$2.10	$1.65	$1.83	

As noted previously, the two Move-In/Move-Out cases following (and in the next two business model examples) have similar increases in capital-related expense, and the "Linked to Permit" case has additional labour costs for the move-out activities.

Table 37: Vendor Operated/ Market Owned Operating Costs - Move In and Move Out Linked to a Permit

Operating Costs - per market	Small	Mid	Large	Pre-Sort	X-large	Total
Costs to Market:						
Scanning Equip. Repair / Replacement[2]	$1,000	$2,500	$3,500	$2,500	$5,000	$82,500
Mobile Equip. Repair / Replacement[2]	$1,075	$1,125	$1,125	$1,075	$1,825	$32,550
Hardware Equip. Depreciation[3]	$3,142	$6,781	$6,895	$6,539	$12,519	$184,373
Scanning Hardware S & M[6]	$500	$2,500	$3,000	$3,000	$4,000	$71,500
Software L, S & M[7]	$500	$1,200	$1,200	$1,200	$1,200	$30,100
Electrical[3]	$250	$600	$600	$600	$700	$15,250
Insurance[3]	$750	$1,000	$1,250	$1,250	$1,800	$32,600
Additional Yard Labour[4]	$9,000	$15,840	$20,858	$23,175	$50,040	$567,653
Scanning Area Opportunity Cost[5]	$4,725	$6,363	$6,700	$4,995	$8,213	$175,990
Incremental Overhead[3]	$2,000	$4,400	$5,150	$5,150	$6,950	$129,050
Sub-total Market	*$22,942*	*$42,309*	*$50,277*	*$49,484*	*$92,246*	*$1,321,565*
Market Costs per Head	***$1.99***	***$1.15***	***$0.65***	***$0.64***	***$0.51***	
Sub-total Vendor	*$53,063*	*$120,069*	*$200,336*	*$126,045*	*$403,736*	*$4,810,183*
Vendor Costs per Head	***$4.61***	***$3.25***	***$2.59***	***$1.63***	***$2.23***	
Total Operating Costs	**$76,005**	**$162,378**	**$250,613**	**$175,528**	**$495,982**	**$6,131,748**

Table 38: Vendor Operated/ Market Owned Operating Costs - Move IN and Move Out Data to CLTS

Operating Costs - per market	Small	Mid	Large	Pre-Sort	X-large	Total
Costs to Market:						
Scanning Equip. Repair / Replacement[2]	$1,000	$2,500	$3,500	$2,500	$5,000	$82,500
Mobile Equip. Repair / Replacement[2]	$1,075	$1,125	$1,125	$1,075	$1,825	$32,550
Hardware Equip. Depreciation[3]	$3,232	$6,961	$7,075	$6,719	$12,789	$189,143
Scanning Hardware S & M[6]	$500	$2,500	$3,000	$3,000	$4,000	$71,500
Software L, S & M[7]	$500	$1,200	$1,200	$1,200	$1,200	$30,100
Electrical[3]	$250	$600	$600	$600	$700	$15,250
Insurance[3]	$750	$1,000	$1,250	$1,250	$1,800	$32,600
Additional Yard Labour[4]	$7,200	$12,672	$16,686	$18,540	$40,032	$454,122
Scanning Area Opportunity Cost[5]	$4,725	$6,363	$6,700	$4,995	$8,213	$175,990
Incremental Overhead[3]	$2,000	$4,400	$5,150	$5,150	$6,950	$129,050
Sub-total Market	*$21,232*	*$39,321*	*$46,286*	*$45,029*	*$82,508*	*$1,212,805*
Market Costs per Head	***$1.84***	***$1.06***	***$0.60***	***$0.58***	***$0.46***	
Sub-total Vendor	*$39,834*	*$84,720*	*$137,456*	*$96,908*	*$296,557*	*$3,386,818*
Vendor Costs per Head	***$3.46***	***$2.29***	***$1.77***	***$1.25***	***$1.64***	
Total Operating Costs	$61,066	$124,041	$183,742	$141,936	$379,065	$4,599,623
Total Operating Costs per Head	$5.30	$3.36	$2.37	$1.83	$2.09	

3.1.7.3 Third Party Operated / Market Owned

This case allows for the inclusion of a contracted system operator other than the Vendor to be considered. In preparing this option, few intrinsic differences were seen between a third-party operator and the vendor (assuming similar efficiencies of scanning equipment and software operation), except for the efficiencies offered by the vendor in having more fully-trained personnel on-site, and therefore fewer and more rapid responses to problems with the on-site systems, and lower service-call costs.

Table 39: Third Party Operated/ Market Owned Operating Costs - Move In Only

Operating Costs - per market	Small	Mid	Large	Pre-Sort	X-large	Total
Costs to Market:						
Scanning Equip. Repair / Replacement[2]	$0	$2,500	$3,500	$2,500	$5,000	$77,500
Mobile Equip. Repair / Replacement[2]	$1,075	$1,125	$1,125	$1,075	$1,825	$32,550
Hardware Equip. Depreciation[3]	$2,612	$5,306	$5,420	$5,129	$9,845	$145,532
Scanning Hardware S & M[6]	$500	$2,500	$3,000	$3,000	$4,000	$71,500
Software L, S & M[7]	$500	$1,200	$1,200	$1,200	$1,200	$30,100
Electrical[3]	$250	$600	$600	$600	$700	$15,250
Insurance[3]	$750	$1,000	$1,250	$1,250	$1,800	$32,600
Additional Yard Labour[4]	$7,200	$12,672	$16,686	$18,540	$40,032	$454,122
Scanning Area Opportunity Cost[5]	$4,725	$6,363	$6,700	$4,995	$8,213	$175,990
Incremental Overhead[3]	$2,000	$4,400	$5,150	$5,150	$6,950	$129,050
Sub-total Market	*$19,612*	*$37,666*	*$44,631*	*$43,439*	*$79,565*	*$1,164,194*
Market Costs per Head	***$0.32***	***$0.27***	***$0.25***	***$0.31***	***$0.22***	
Sub-total TPO	*$41,834*	*$102,564*	*$135,647*	*$98,313*	*$288,264*	*$3,427,290*
TPO Costs per Head	***$3.63***	***$2.78***	***$1.75***	***$1.27***	***$1.59***	
Total Operating Costs	**$61,446**	**$140,230**	**$180,278**	**$141,752**	**$367,828**	**$4,591,484**
Total Operating Costs per Head	**$5.34**	**$3.80**	**$2.33**	**$1.83**	**$2.03**	

Table 40: Third Party Operated/ Market Owned Operating Costs- Move In and Move Out Linked to a Permit

Operating Costs - per market	Small	Mid	Large	Pre-Sort	X-large	Total
Costs to Market:						
Scanning Equip. Repair / Replacement[2]	$1,000	$2,500	$3,500	$2,500	$5,000	$82,500
Mobile Equip. Repair / Replacement[2]	$1,075	$1,125	$1,125	$1,075	$1,825	$32,550
Hardware Equip. Depreciation[3]	$3,142	$6,781	$6,895	$6,539	$12,519	$184,373
Scanning Hardware S & M[6]	$500	$2,500	$3,000	$3,000	$4,000	$71,500
Software L, S & M[7]	$500	$1,200	$1,200	$1,200	$1,200	$30,100
Electrical[3]	$250	$600	$600	$600	$700	$15,250
Insurance[3]	$750	$1,000	$1,250	$1,250	$1,800	$32,600
Additional Yard Labour[4]	$9,000	$15,840	$20,858	$23,175	$50,040	$567,653
Scanning Area Opportunity Cost[5]	$4,725	$6,363	$6,700	$4,995	$8,213	$175,990
Incremental Overhead[3]	$2,000	$4,400	$5,150	$5,150	$6,950	$129,050
Sub-total Market	*$22,942*	*$42,309*	*$50,277*	*$49,484*	*$92,246*	*$1,321,565*
Market Costs per Head	***$0.28***	***$0.24***	***$0.19***	***$0.26***	***$0.17***	
Sub-total TPO	*$58,183*	*$132,000*	*$220,219*	*$138,697*	*$443,148*	*$5,285,887*
TPO Costs per Head	***$5.05***	***$3.57***	***$2.84***	***$1.79***	***$2.45***	
Total Operating Costs	**$81,125**	**$174,309**	**$270,496**	**$188,181**	**$535,394**	**$6,607,452**
Total Operating Costs per Head	**$7.04**	**$4.72**	**$3.49**	**$2.43**	**$2.96**	

Table 41: Third Party Operated/ Market Owned Operating Costs- Move In and Move Out Data to CLTS

Operating Costs - per market	Small	Mid	Large	Pre-Sort	X-large	Total
Costs to Market:						
Scanning Equip. Repair / Replacement[2]	$1,000	$2,500	$3,500	$2,500	$5,000	$82,500
Mobile Equip. Repair / Replacement[2]	$1,075	$1,125	$1,125	$1,075	$1,825	$32,550
Hardware Equip. Depreciation[3]	$3,232	$6,961	$7,075	$6,719	$12,789	$189,143
Scanning Hardware S & M[6]	$500	$2,500	$3,000	$3,000	$4,000	$71,500
Software L, S & M[7]	$500	$1,200	$1,200	$1,200	$1,200	$30,100
Electrical[3]	$250	$600	$600	$600	$700	$15,250
Insurance[3]	$750	$1,000	$1,250	$1,250	$1,800	$32,600
Additional Yard Labour[4]	$7,200	$12,672	$16,686	$18,540	$40,032	$454,122
Scanning Area Opportunity Cost[5]	$4,725	$6,363	$6,700	$4,995	$8,213	$175,990
Incremental Overhead[3]	$2,000	$4,400	$5,150	$5,150	$6,950	$129,050
Sub-total Market	*$21,232*	*$39,321*	*$46,286*	*$45,029*	*$82,508*	*$1,212,805*
Market Costs per Head	***$0.32***	***$0.29***	***$0.23***	***$0.29***	***$0.20***	
Sub-total TPO	*$45,154*	*$95,822*	*$152,719*	*$110,564*	*$335,368*	*$3,791,704*
TPO Costs per Head	***$3.92***	***$2.59***	***$1.97***	***$1.43***	***$1.85***	
Total Operating Costs	**$66,386**	**$135,143**	**$199,005**	**$155,593**	**$417,876**	**$5,004,509**
Total Operating Costs per Head	**$5.76**	**$3.66**	**$2.57**	**$2.01**	**$2.31**	

3.1.7.4 Vendor Owned and Operated

This option provides the opportunity for 'bundling' of capital and services by the vendor and the avoidance of an up-front capital expenditure, in what is a rather typical out-source approach. As noted previously, the option provides the potential of some efficiencies compared to other cases presented, based primarily on the integrated nature of the services with the hardware and software elements. The Scanning Expense in this business model includes a capital expense to cover the cost and use of the vendor's purchase of the scanning equipment, software and hardware used in each market.

Table 42: Vendor Owned and Operated Operating Costs - Move In Only

Operating Costs - per market	Small	Mid	Large	Pre-Sort	X-large	Total
Costs to Market:						
Additional Yard Labour[4]	$6,000	$10,560	$13,905	$15,450	$33,360	$378,435
Electrical[3]	$250	$600	$600	$600	$700	$15,250
Incremental Overhead[3]	$2,000	$4,400	$5,150	$5,150	$6,950	$129,050
Scanning Area Opportunity Cost[5]	$4,725	$6,363	$6,700	$4,995	$8,213	$175,990
Sub-total Market	*$12,975*	*$21,923*	*$26,355*	*$26,195*	*$49,223*	*$698,725*
Market Costs per Head	***$1.13***	***$0.59***	***$0.34***	***$0.34***	***$0.27***	
Sub-total Vendor	*$41,629*	*$85,377*	*$133,184*	*$98,182*	*$278,670*	*$3,301,119*
Vendor Costs per Head	***$3.61***	***$2.31***	***$1.72***	***$1.27***	***$1.54***	
Total Operating Costs	**$54,604**	**$107,299**	**$159,539**	**$124,377**	**$327,892**	**$3,418,691**
Total Operating Costs per Head	**$4.74**	**$2.90**	**$2.06**	**$1.61**	**$1.81**	

Table 43: Vendor Owned and Operated Operating Costs - Move In and Move Out Linked to a Permit

Operating Costs - per market	Small	Mid	Large	Pre-Sort	X-large	Total
Costs to Market:						
Additional Yard Labour[4]	$9,000	$15,840	$20,858	$23,175	$50,040	$567,653
Electrical[3]	$250	$600	$600	$600	$700	$15,250
Incremental Overhead[3]	$2,000	$4,400	$5,150	$5,150	$6,950	$129,050
Scanning Area Opportunity Cost[5]	$4,725	$6,363	$6,700	$4,995	$8,213	$175,990
Sub-total Market	*$15,975*	*$27,203*	*$33,308*	*$33,920*	*$65,903*	*$887,943*
Market Costs per Head	***$1.39***	***$0.74***	***$0.43***	***$0.44***	***$0.36***	
Sub-total Vendor	*$58,498*	*$130,417*	*$211,980*	*$136,743*	*$423,177*	*$5,113,696*
Vendor Costs per Head	***$5.08***	***$3.53***	***$2.74***	***$1.77***	***$2.34***	
Total Operating Costs	**$74,473**	**$157,620**	**$245,287**	**$170,663**	**$489,079**	**$5,269,558**
Total Operating Costs per Head	**$6.47**	**$4.27**	**$3.17**	**$2.20**	**$2.70**	

Table 44: Vendor Owned and Operated Operating Costs Move In and Move Out Data to CLTS

Operating Costs - per market	Small	Mid	Large	Pre-Sort	X-large	Total
Costs to Market:						
Additional Yard Labour[4]	$7,200	$12,672	$16,686	$18,540	$40,032	$454,122
Electrical[3]	$250	$600	$600	$600	$700	$15,250
Incremental Overhead[3]	$2,000	$4,400	$5,150	$5,150	$6,950	$129,050
Scanning Area Opportunity Cost[5]	$4,725	$6,363	$6,700	$4,995	$8,213	$175,990
Sub-total Market	*$14,175*	*$24,035*	*$29,136*	*$29,285*	*$55,895*	*$774,412*
Market Costs per Head	***$1.23***	***$0.65***	***$0.38***	***$0.38***	***$0.31***	
Sub-total Vendor	*$45,359*	*$95,249*	*$149,280*	*$107,786*	*$316,268*	*$3,695,101*
Vendor Costs per Head	***$3.94***	***$2.58***	***$1.93***	***$1.39***	***$1.75***	
Total Operating Costs	**$59,534**	**$119,283**	**$178,416**	**$137,071**	**$372,162**	**$3,855,733**
Total Operating Costs per Head	**$5.17**	**$3.23**	**$2.30**	**$1.77**	**$2.06**	

3.2 Sensitivity Analysis: Move-Out Scanning Not Performed for Feedlot and Packing Plant Shipments

A review and calculation of cost differences was requested to determine the impact of scanning cattle moved out of the market only if they were being shipped to a location that would not scan or otherwise report their subsequent arrival, the thought being that the scan-out could be seen as redundant.

Upon review, two significant findings were established. First, eliminating the scan-out of some of the cattle from the markets would limit the ability of the markets to rely on this data for balancing inventory and/or for confirmation of shipments to feedlots and packing plants, in the case requested. Secondly, the financial impact of this amendment would be a modest reduction in scanning staff labour, since less work would be required on move-outs.

The first of these findings is a negative impact on the potential value-add of the system to the markets, and will be addressed in a later section of this report. With respect to the second, the study team determined that:

1. Capital investment would not be impacted.
2. Operating costs for the Move-In Only case would not be impacted, since move-out scanning is not done in that scope option.
3. Scanning staff cost savings would not accrue to the Move-In Move-Out Data Direct to CLTS case, since the move-out scanning activity in that scope option is performed automatically, and therefore did not involve attributed labour costs.
4. Scanning staff cost reductions would potentially accrue to the Move-In Move-Out Linked to Permit case, since scanning staff would be actively involved in the scan-out function. Calculations based on reduction of on-site time for the scanning staff indicate that a cost reduction of up to $0.15 per head could be attributed to this alternative. However, since they would be required to be on-site for most of the move-out period, to deal with scan-outs for some animals, the savings would require scheduling and operational attention if it is to be achieved.

Conclusions Regarding Sensitivity Analysis

The analysis indicates that elimination the move-out scans for Feedlot and Packer shipments may reduce the cost of scanning by $282,650, or $0.15 per head; approximately 4.5% of scan-in/scan-out costs. While on a cost per head basis and on a cost per year basis this savings might be considered important for an industry squeezed for revenue and profits, the move would not save any capital investment and would eliminate the possibility of achieving some of the value-add benefits potentially available from full scan-in and scan-out. These potential benefits would relate to the availability of movement and inventory information for the market, to confirm daily transactions. In addition, the elimination of these move-out scans would eliminate key information about the location and status of those animals needed for tracking during a disease outbreak, thereby risking the control of the spread of disease and the additional attendant cost of treatment and recovery.

An alternative scenario may be to simply record the Buyer at point of sale against the lot of animals that were sold, the animals would need to be scanned in this 'sale lot' so as to maintain a linkage with the Vendor record and the RFIDs of the animals. The buyer themselves would be linked to a Premise ID to which a Move Out Transaction could be processed and would maintain a linkage to the LIS permit number issued post sale. If the stock are then re-routed to an alternate destination the cattle would need to have a Move In transaction completed to update their location.

If cattle remain at the facility for some time they would simply have a Move Out transaction recorded to a Premise ID that would be allocated to the onsite feed and holding pens. This would cater for the issues around traceability relating to slaughter cattle that remain in these pens for an unknown period of time as they would simply be recorded at the point of slaughter.

This alternate scenario would need to be tested in practice across a range of sites to determine the accuracy of scanning sale lots at the speed of commerce. If successful though this procedure could reduce the cost of Move Out scanning and data recording by at least 25%.

3.3 5-Year Forecast and Optimization

The 5-Year Forecast, summarized in Table 45 on the following page, includes the initial capital cost for the full roll-out to 28 auction markets (including the pilot locations) and incorporates two key differences from the analysis of current costs employed in the foregoing analysis of the pilot study results. One is the incorporation of cost changes that are expected to occur over the five years forecast: efficiencies in scanning processes, detailed in a following section, and increases in the expense to maintain the equipment and infrastructure in future years[2]. The other is the inclusion of retagging revenues as a reduction of the cost of the scanning activity, recognizing that the two activities are likely to be carried out as one process, and that retagging requirements will be identified at the point of scanning.

It also summarizes investment into two categories, market-related and scanning-specific. This is done to separate facility-related investment from scanning technology and infrastructure, and for purposes of illustrating one approach to funding – that markets might provide the former investment, through direct and in-kind contributions, and that the latter might be provided through public funds. While the markets have a stake in the roll-out of the scanning systems, there is also a significant industry- and public-good component in the program.

Costs used in the forecast are purposefully generous to ensure that capital and operating costs are not underestimated. While an understanding of total costs and the costs of specific options is required in the analysis, it is the comparative analysis that is important to support decision-making regarding the extension of scanning systems to all 28 markets.

Following a decision to proceed, the capital costs can be subjected to a competitive RFQ process to establish specific cost levels at the time of implementation of the decisions. The same process can be applied to the operating costs under the Vendor-Operated cases and the Third-Party Operated case, possibly changing the relationship between these cases and the Market-Operated case.

[2] This approach has been used to illustrate anticipated costs as they occur, rather than using an accrual basis in earlier years to provide for these future costs.

Table 45: 5 Year Forecast

Capital and Operating Cost Summary All Markets - 5 Years	Move-in Only	Move-in Move-out Linked to Permit	Move-in Move-out Data only to CLTS
Market-Owned and -Operated			
Capital Invested:			
Market Infrastructure & In-Kind	$2,689,656	$2,743,656	$2,743,656
Scanning Infrastructure & Equipment	$3,177,400	$4,014,378	$4,083,228
Total Capital Invested	**$5,867,056**	**$6,758,034**	**$6,826,884**
Operating Cost:			
5-Year Net Operating Cost	**$16,446,364**	**$27,080,349**	**$18,549,564**
Total Investment - 5 Years	**$22,313,421**	**$33,838,383**	**$25,376,448**
Vendor-Operated/Market-Owned			
Capital Invested:			
Market Infrastructure & In-Kind	$2,689,656	$2,743,656	$2,743,656
Scanning Infrastructure & Equipment	$3,177,400	$4,014,378	$4,083,228
Total Capital Invested	**$5,867,056**	**$6,758,034**	**$6,826,884**
Operating Cost:			
5-Year Net Operating Cost	**$19,711,580**	**$30,223,601**	**$22,655,081**
Total Investment - 5 Years	**$25,578,636**	**$36,981,635**	**$29,481,965**
Third-Party Operator/Market-Owned			
Capital Invested:			
Market Infrastructure & In-Kind	$2,689,656	$2,743,656	$2,743,656
Scanning Infrastructure & Equipment	$3,177,400	$4,014,378	$4,083,228
Total Capital Invested	**$5,867,056**	**$6,758,034**	**$6,826,884**
Operating Cost:			
5-Year Net Operating Cost	**$23,423,263**	**$34,866,745**	**$25,757,110**
Total Investment - 5 Years	**$29,290,319**	**$41,624,780**	**$32,583,995**
Vendor-Owned and -Operated			
Capital Invested:			
Market Infrastructure & In-Kind	$2,689,656	$2,743,656	$2,743,656
Scanning Infrastructure & Equipment	Nil	Nil	Nil
Total Capital Invested	**$2,689,656**	**$2,743,656**	**$2,743,656**
Operating Cost:			
5-Year Net Operating Cost	**$19,419,294**	**$30,813,785**	**$22,103,355**
Total Investment - 5 Years	**$22,108,951**	**$33,557,441**	**$24,847,012**

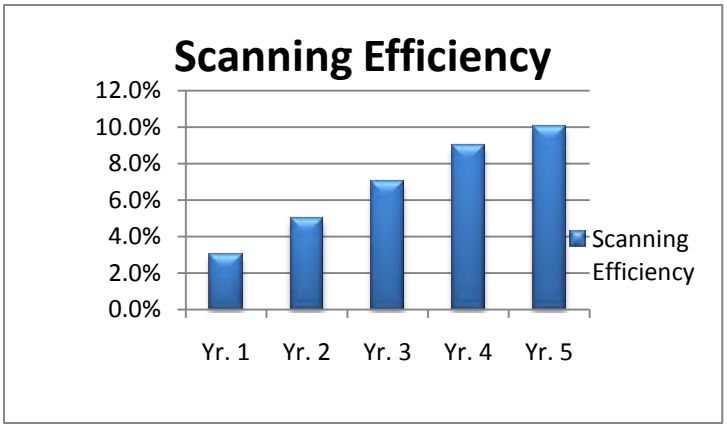
3.3.1 Forecast Assumptions

Detailed assumptions for each of the key drivers for the level of capital expenditure and operating costs over the forecast period are contained in Tables 25 to 27 and Tables 33 to 44 respectively. The range of examples and the very detailed analysis of the pilot study upon which the forecast is based provide a reliable operational base for the forecasts. As noted previously, the specific pilot study experience was generalized for use in the forecast for the potential rollout of the traceability system to all 28 markets, and the detailed assumptions are a guide to its generalization.

In addition, four factors that are anticipated to occur during the forecast period and that will impact operating costs have been built in to the five-year forecast. They are described in the following sub-sections. An explanation of the constant dollar forecast is also included in this section.

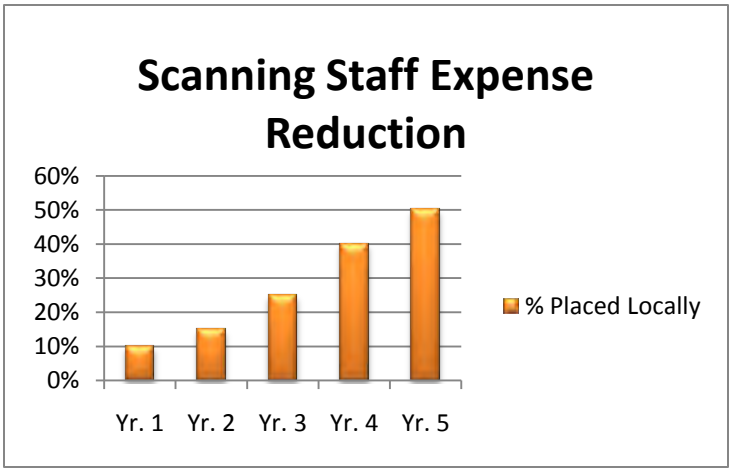
3.3.1.1 Operating Efficiencies

In all cases, the efficiency of the scanning system operators and the methods they employ are expected to improve with experience. It is assumed that the installations would be configured by the Vendor, and turned over to a trained crew, whether they be Market staff, Vendor staff or staff from a TPO. However, ongoing experience with the equipment, improved methodologies of scanning by staff, and improved integration of scanning activities into the market operations are expected to improve the efficiency of scanning activities by up to 10% by year 5. The year-by-year improvements are illustrated in Graph 1, inset.



3.3.1.2 Scanning Labour Expense Reductions

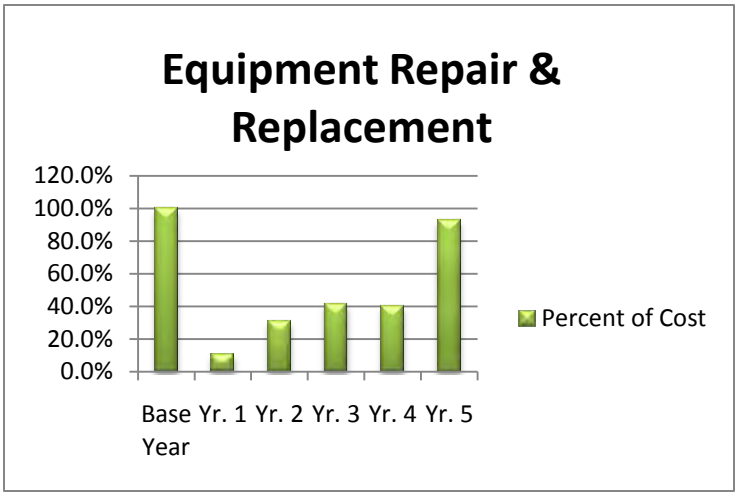
In all but the Market-Owned and -Operated business model, scanning labour expenses have been included in the base costs to allow for the movement of personnel to the market locations, and in some instances, for costs of accommodation near the market during multi-day sales. This was necessitated in the pilot study due to the lack of qualified personnel located near each of the six markets who were willing to work in a limited part-time position. However, in a roll-out of the scanning systems to twenty-eight markets in the province, it will be possible to offer scanning personnel longer



hours, by having them service more markets closer at hand. The result will be a reduction in travel and accommodation expense in each of these cases, over the forecast period, as more local staff are found, trained and hired, reducing by 50% over the five years of the forecast, as illustrated in Graph 2, inset.

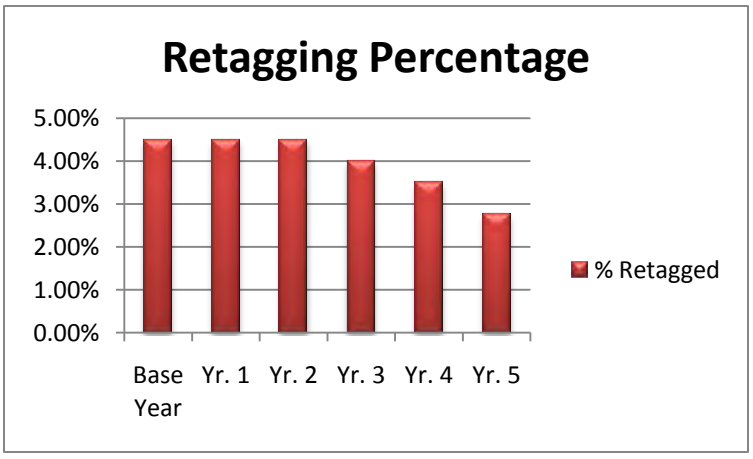
3.3.1.3 Equipment Maintenance

This cost area, in the analysis of the pilot study, was identified as an average cost that would apply to an operating scanning facility. However, in the interest of identifying costs with the periods in which they occur, the repair and replacement costs for scanning equipment and for mobile equipment have been reduced in the early years of the forecast and increased toward year 5. In Graph 3, inset, the percentages of the base year provision that is anticipated to be encountered in each forecast year are illustrated. The project team believes that these pieces of equipment will wear and fail in this pattern.



3.3.1.4 Retagging Revenue Calculation

The experience of the pilot study has been that retagging of cattle with inoperable or missing tags is ideally integrated with the scanning function. Animals with missing or unreadable tags are identified upon scanning, and can either be sequestered immediately and retagged or pursued to be retagged as soon as they are penned following scanning. Included in the financial analysis, therefore, are calculations of operating costs for scanning reduced by the forecast revenue for retagging – in addition to the gross cost of scanning in each case. Included in this adjustment to the forecast is an assumption of the expected percentage of retags required, illustrated in Graph 4, inset, as improved adherence to tagging by producers occurs and as tag performance is improved in both attachment reliability and read performance.



3.3.1.5 Use of Constant-Dollar for Forecast

For all of the forecast values, a constant dollar is used; that is, there is no attempt to forecast an inflation or deflation rate for the forecast period or any part of it. Given the current global economic circumstances and low interest rates in most economies, and effect of inflation is expected to be small. Also, with growth in technology markets, it is usual to anticipate that prices reduce with time. While the experience in the past year was that the added demand of the pilot study, along with other activity in the market, caused some price increases to occur, this situation is believed to have been more driven by the required timing of purchases rather than a demand-driven price inflation.

However, should general inflation occur such that average annual increases in goods and services, including capital goods, the total impact on each of the business models is between $1.2 million and $1.38 million over the five-year forecast period. The majority of these increases occur in the operating costs for the markets, and are cumulative; the capital purchases are made in year 1, and are therefore subject to only one year's increase.

3.4 Financial Comparison of Options

Over the five years of the forecast, the Market-Owned and -Operated alternative is one of the low-cost options, from an operating cost point of view. Its capital investment is equal to the other two market-owned options (Vendor-Operated and Third-Party-Operated), and despite the lower initial capital cost in the Vendor-Owned and -Operated case, it is still relatively low in total investment – operating plus capital.

The reasons for its lower operating costs are primarily the avoidance of travel and domiciling costs for scanning staff working for the Vendor or TPO, lower per-hour costs for market operators compared to outsource rates, and the assumed ability of the markets to use the unavoidable down-time for scanning crews in the other options in productive activity elsewhere in the market. On a five-year basis, the travel and domiciling costs for the Vendor and TPO cases, assuming the cost reductions discussed in Section 3.4.1.2, total $2.4 million.

Differences between the outsource options – Vendor or Third-Party Operated – are also significant due to the efficiencies that can be gained from the Vendor not need to outsource a range of activities. Operating costs on a five-year basis are within $3.0 million to $3.6 million between the vendor-operated and third-party-operated options. The Third-Party case has additional costs for scanning system support that would not be necessary in the Vendor-Operated cases, since the expertise resides in the scanning staff.

The Vendor-Owned and -Operated case has the advantage of a lower capital cost in the first year, since only market infrastructure would need to be purchased. Total outlay in year 1 is also lower for this case, And depending upon the costs of capital applied to all years makes this case more costly in years 2 to 5.

Scanning on move-out requires some additional capital and entails additional operating cost. On a 5-year basis for all markets, additional capital of approximately $990K is required to accommodate

scanning and the transfer of data directly to CLTS. Additional operating costs of approximately $7.5 million - $9.1 million would be incurred over the forecast period. On a similar basis, comparing move-in only to move-in and move-out and linking to a permit requires approximately $890K in additional capital, slightly less than the CLTS data transfer due to less communications equipment on scan-out. Additional operating costs of between $10.5 million and $11.4 million would be incurred over the forecast period compared to the move-in only case.

3.4.1 Total Cost Comparisons – Capital plus Operating Cost

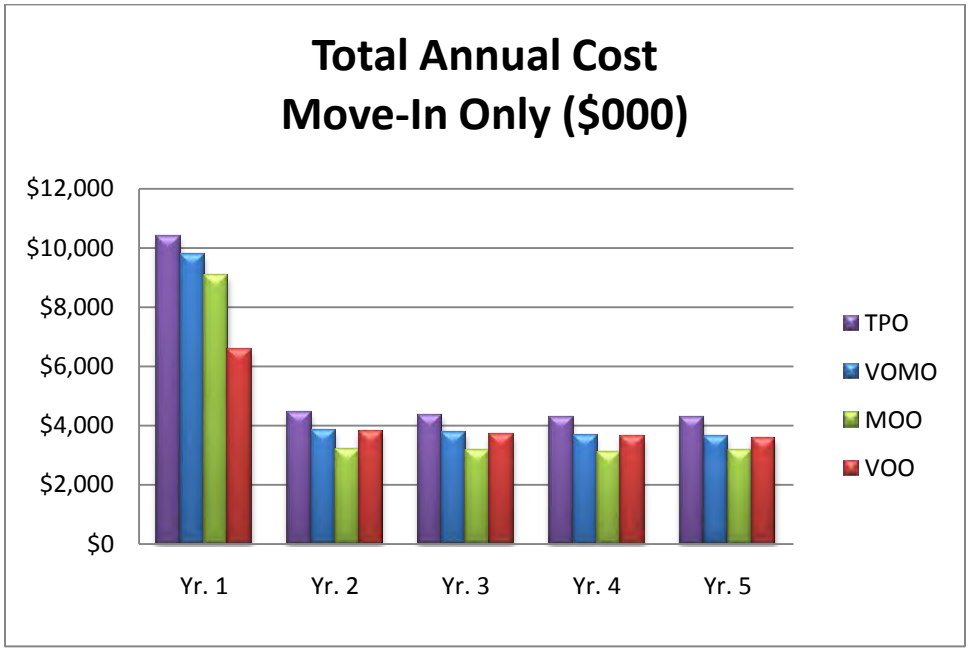
In Graphs 5 to 7 below, the total cost of implementing each option for all 28 markets in the province is illustrated in graph form. In all cases, the Year 1 capital cost is added to the operating cost for that year to show the total investment, and in the following four years, the operating costs are shown. In years 2 to 5, therefore, the amount shown is the annual operating cost, since all capital is assumed to be spent in year 1. This analysis is done for illustrative and analytical purposes only, given that six of the markets have already invested in their systems; in the forecast, therefore, these are consistent with the balance of the analysis in this report.

Note that capital costs in three cases are the same: the Third-Party Operator case, the Vendor Operated/Market Owned case, and the Market Owned and Operated case. In the Vendor Owned and Operated case, only the capital investment in market infrastructure is required, the Vendor having amortized the scanning equipment and infrastructure costs into a monthly fee. In the latter case, therefore, the annual costs in years 2 through 5 are higher for this reason. Further, it is important to note that in all but the Vendor Owned and Operating case, a reinvestment in scanning equipment and infrastructure would be needed during the few years following the forecast period, as equipment wears and is replaced by new equipment. The replacement cost would be included in the monthly fee charged by the Vendor.

In all cases, the Third-Party Operator case has the highest annual cost, in both the initial year and in the following four years, and the Vendor Operated/Market Owned case has the second highest total cost. The Vendor Owned and Operated case requires the lowest investment in year one, and is higher than the others in years 2 through 5. Overall and in all but year 1, the Market Owned and Operated case has the lowest potential cost among these cases, although costs for IT and network support and additional management costs for the administration, training and supervision of scanning staff may be incurred in markets not currently staffed to handle these requirements.

3.4.1.1 Move-In Only

Graph 5: Move In Only Total Annual Cost

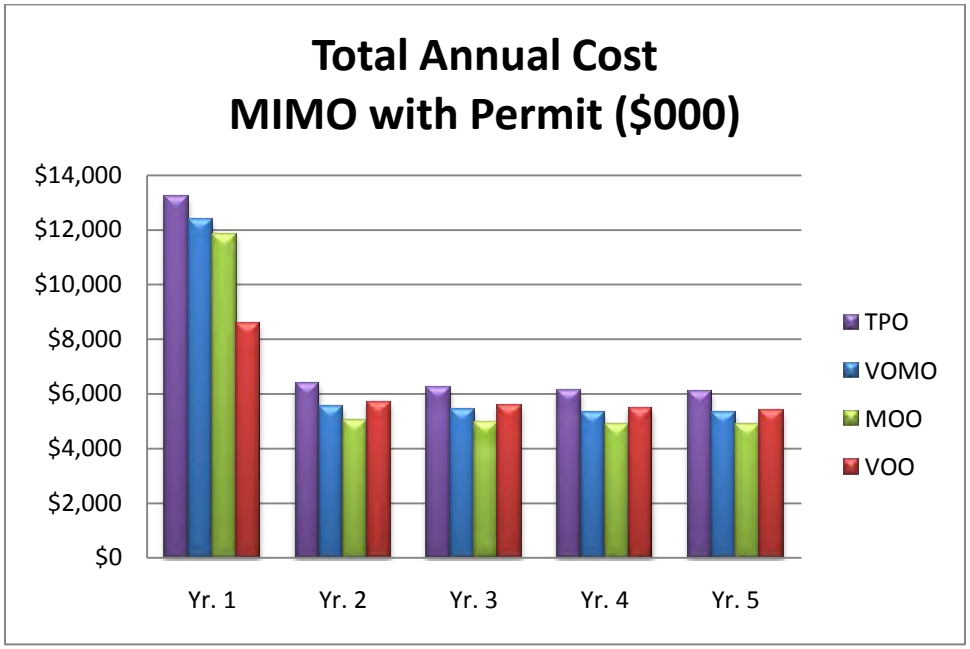


Total costs in Year 1 for the Move-In Only configuration range from $6.9 million to $10.3 million. Operating costs for the Market Owned and Operated case are from $800K to $900K lower than the other Market-Owned cases, and $800K lower than the Vendor-Owned and Operated case. Capital costs for the Vendor Owned and Operated option are approximately $3 million lower than the other three cases.

Total costs in Years 2 through 5 do decline slightly from year to year, although it is not strongly evident in the graph given its scale. In each year, however, the Market Owned and Operated case is $400K to $700K lower than the Vendor-Operated/Market Owned case and $600K to $900K lower than the Third-Party Operated case. The Vendor Owned and Operated case is approximately $300K to $700K more than the Market Owned and Operated case, due to both operating costs and the capital amortization fee.

3.4.1.2 Move-In/Move-Out linked to Permit

Graph 6: Move In and Move Out with Permit

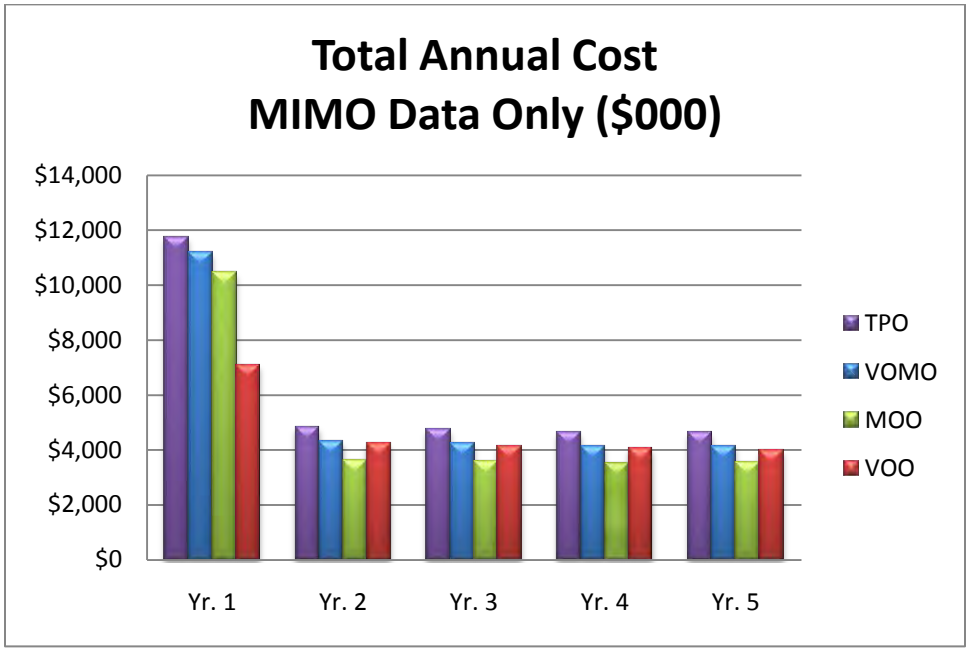


Total costs in Year 1 for the Move-In/Move-Out linked to Permit configuration range from $8.8 million to $12.8 million. These first-year totals are approximately $900K higher in capital cost than the previous configuration; and $1.4 million to $1.6 million higher in annual operating cost.

In years 2 through 5, this configuration continues to be approximately $1.4 to 1.8 million above the previous example for the Market Owned and Operated case, the Third-Party Operator case and the Vendor Operated/Market Owned case.

3.4.1.3 Move-In/Move-Out Data Only to CLTS

Graph 7: Move In and Move Out with Data Only



Total Costs in Year 1 for the Move-In/Move-Out Data Only to CLTS configuration are from $ 7.5 million to $11.5 million. These first-year totals are approximately $100K higher in capital cost than the previous configuration; and $900K to $1.2 million lower in annual operating cost.

In years 2 through 5, annual operating costs remain $1.0 million to $1.4 million lower than the previous example.

3.4.2 Operating Cost Forecast

In the following subsections, a summary of the operating cost forecast by year for all 28 markets is provided. In each option, the base year costs, calculated from the pilot study results as discussed in previous sections, are included in the "Standard Year" column of each table. Retagging revenue has been illustrated as a constant for each alternative, with retagging reducing in years 3 to 5. Operating costs are presented on both a gross and net basis, i.e. before and after retagging revenue, and costs are provided both on a total annual and per-head basis.

3.4.2.1 Market Owned and Operated

As previously described, this case sees the markets taking over operation of the scanning system after a run-in year operated by the system vendor or an accredited third party. During the run-in year, the markets are expected to be able to integrate the scanning operation into their regular market activities. Existing and new yard staff is anticipated to be used for the scanning operation, and can be used for other tasks between move-in and move-out, the busy scanning periods. Hence, a lower cost-per-hour, higher productivity and the avoidance of travel and accommodation expense for out-sourced staff are included in the cost structure.

Table 46: Market Owned and Operated Operating Cost Forecast- Move In Only

Market Owned and Operated	Move-in Only					
	Std. Year	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue						
Retagging Revenue	$ 593,558	$ 593,558	$ 593,558	$ 527,607	$ 461,656	$ 362,730
Operating Costs						
Market Costs	$ 3,714,083	$ 3,210,159	$ 3,197,299	$ 3,167,239	$ 3,123,729	$ 3,166,524
Market Cost per Head	$1.97	$1.70	$1.70	$1.68	$1.66	$1.68
Net Operating Cost (after Retagging)	$ 3,120,526	$ 2,616,601	$ 2,603,741	$ 2,639,631	$ 2,662,072	$ 2,803,794
Net Operating Cost per Head	$1.66	$1.39	$1.38	$1.40	$1.41	$1.49

Table 47: Market Owned and Operated Operating Cost Forecast -Move In and Move Out Linked to Permit

Market Owned and Operated	Move-in Move-out Linked to Permit					
	Std. Year	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue						
Retagging Revenue	$ 593,558	$ 593,558	$ 593,558	$ 527,607	$ 461,656	$ 362,730
Operating Costs						
Market Costs	$ 5,325,441	$ 5,087,177	$ 5,036,268	$ 4,968,159	$ 4,886,800	$ 4,909,171
Market Cost per Head	$2.83	$2.70	$2.67	$2.64	$2.59	$2.61
Net Operating Cost (after Retagging)	$ 4,731,883	$ 4,493,619	$ 4,442,710	$ 4,440,552	$ 4,425,144	$ 4,546,441
Net Operating Cost per Head	$2.51	$2.38	$2.36	$2.36	$2.35	$2.41

Table 48: Market Owned and Operated Operating Cost Forecast- Move In and Move Out Data to CLTS

Market Owned and Operated	Move-in Move-out Data only to CLTS					
	Std. Year	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue						
Retagging Revenue	$ 593,558	$ 593,558	$ 593,558	$ 527,607	$ 461,656	$ 362,730
Operating Costs						
Market Costs	$ 3,817,948	$ 3,625,053	$ 3,604,389	$ 3,566,525	$ 3,515,411	$ 3,552,904
Market Cost per Head	$2.03	$1.92	$1.91	$1.89	$1.87	$1.89
Net Operating Cost (after Retagging)	$ 3,224,390	$ 3,031,495	$ 3,010,831	$ 3,038,918	$ 3,053,755	$ 3,190,175
Net Operating Cost per Head	$1.71	$1.61	$1.60	$1.61	$1.62	$1.69

3.4.2.2 Vendor-Operated/Market-Owned

In this case, the system supplier provides staff and expertise to operate the scanning system on behalf of the market owner. Staff are assumed, from the experience in the pilot study, to be sourced on a part-time basis and selected for their training and predisposition to systems and cattle management, and therefore have been difficult to recruit locally to each yard. Per-hour costs have been higher than rates for yard staff in the markets, utilization is a challenge, and as previously discussed, travel and accommodation expenses have been included in the operating costs. These factors are addressed in the assumptions for the full roll-out.

Table 49: Vendor Operated/Market Owned Operating Cost Forecast- Move In Only

Vendor-operated/Market-owned	Move-in Only					
	Std. Year	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue						
Retagging Revenue	**$ 593,558**	**$ 593,558**	**$ 593,558**	**$ 527,607**	**$ 461,656**	**$ 362,730**
Operating Costs						
Market Costs	$ 1,035,007	$ 990,157	$ 990,157	$ 990,157	$ 990,157	$ 990,157
Vendor Costs	$ 3,035,896	$ 2,923,171	$ 2,840,805	$ 2,758,439	$ 2,676,074	$ 2,624,067
Total Operating Costs	**$ 4,070,904**	**$ 3,913,329**	**$ 3,830,963**	**$ 3,748,597**	**$ 3,666,231**	**$ 3,614,224**
Total Operating Costs per Head	**$2.16**	**$2.08**	**$2.03**	**$1.99**	**$1.95**	**$1.92**
Net Operating Cost (after Retagging)	**$ 3,477,346**	**$ 3,319,771**	**$ 3,237,405**	**$ 3,220,990**	**$ 3,204,575**	**$ 3,251,494**
Net Operating Cost per Head	**$1.85**	**$1.76**	**$1.72**	**$1.71**	**$1.70**	**$1.73**

Table 50: Vendor Operated/Market Owned Operating Cost Forecast- Move In and Move Out linked to a Permit

Vendor-operated/Market-owned	Move-in Move-out Linked to Permit					
	Std. Year	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue						
Retagging Revenue	**$ 593,558**	**$ 593,558**	**$ 593,558**	**$ 527,607**	**$ 461,656**	**$ 362,730**
Operating Costs						
Market Costs	$ 1,321,565	$ 990,157	$ 1,017,057	$ 1,023,757	$ 1,022,457	$ 1,080,357
Vendor Costs	$ 4,810,183	$ 4,644,230	$ 4,526,378	$ 4,408,526	$ 4,290,675	$ 4,220,925
Total Operating Costs	**$ 6,131,748**	**$ 5,634,387**	**$ 5,543,435**	**$ 5,432,284**	**$ 5,313,132**	**$ 5,301,282**
Total Operating Costs per Head	**$3.25**	**$2.99**	**$2.94**	**$2.88**	**$2.82**	**$2.81**
Net Operating Cost (after Retagging)	**$ 5,538,190**	**$ 5,040,829**	**$ 4,949,877**	**$ 4,904,676**	**$ 4,851,476**	**$ 4,938,552**
Net Operating Cost per Head	**$2.94**	**$2.68**	**$2.63**	**$2.60**	**$2.57**	**$2.62**

Table 51: Vendor Operated/Market Owned Operating Cost Forecast- Move In and Move Out Data to CLTS

Vendor-operated/Market-owned	Move-in Move-out Data only to CLTS					
	Std. Year	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue						
Retagging Revenue	**$ 593,558**	**$ 593,558**	**$ 593,558**	**$ 527,607**	**$ 461,656**	**$ 362,730**
Operating Costs						
Market Costs	$ 1,212,805	$ 1,109,455	$ 1,136,355	$ 1,143,055	$ 1,141,755	$ 1,199,655
Vendor Costs	$ 3,386,818	$ 3,263,566	$ 3,174,181	$ 3,084,797	$ 2,995,413	$ 2,939,896
Total Operating Costs	**$ 4,599,623**	**$ 4,373,020**	**$ 4,310,536**	**$ 4,227,851**	**$ 4,137,167**	**$ 4,139,551**
Total Operating Costs per Head	**$2.44**	**$2.32**	**$2.29**	**$2.24**	**$2.20**	**$2.20**
Net Operating Cost (after Retagging)	**$ 4,006,065**	**$ 3,779,462**	**$ 3,716,978**	**$ 3,700,244**	**$ 3,675,511**	**$ 3,776,821**
Net Operating Cost per Head	**$2.13**	**$2.01**	**$1.97**	**$1.96**	**$1.95**	**$2.00**

3.4.2.3 Third-Party Operator

Conceptually, this option matches the previous example, with a third-party operator other than the vendor, taking over the operation of the scanning system from the vendor following the run-in year. Although a contractor operating on or near the market facilities might be able to avoid some of the travel and accommodation costs of the previous option, identical labour costs have been used for the forecast on the assumption that the contractor might be sought on a competitive basis independent of any current involvement in the markets. As previously noted, it is anticipated that additional support services would be required by a third-party operator, and a provision for these additional costs has been included in the forecast.

Table 52: Third Party Operator Operating Cost Forecast- Move In Only

Third-Party Operator	Move-in Only					
	Std. Year	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue						
Retagging Revenue	**$ 593,558**	**$ 593,558**	**$ 593,558**	**$ 527,607**	**$ 461,656**	**$ 362,730**
Operating Costs						
Market Costs	$ 1,299,257	$ 1,200,907	$ 1,223,207	$ 1,234,507	$ 1,233,207	$ 1,291,107
TPO Costs	$ 3,427,290	$ 3,302,823	$ 3,212,629	$ 3,122,436	$ 3,032,242	$ 2,976,321
Total Operating Costs	**$ 4,726,546**	**$ 4,503,730**	**$ 4,435,836**	**$ 4,356,942**	**$ 4,265,448**	**$ 4,267,427**
Total Operating Cost per Head	**$2.51**	**$2.39**	**$2.35**	**$2.31**	**$2.26**	**$2.26**
Net Operating Cost (after Retagging)	**$ 4,132,988**	**$ 3,910,172**	**$ 3,842,278**	**$ 3,829,335**	**$ 3,803,792**	**$ 3,904,698**
Net Operating Cost per Head	**$2.19**	**$2.08**	**$2.04**	**$2.03**	**$2.02**	**$2.07**

Table 53: Third Party Operator Operating Cost Forecast- Move In and Move Out Linked to a Permit

Third-Party Operator	Move-in Move-out Linked to Permit					
	Std. Year	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue						
Retagging Revenue	**$ 593,558**	**$ 593,558**	**$ 593,558**	**$ 527,607**	**$ 461,656**	**$ 362,730**
Operating Costs						
Market Costs	$ 1,456,627	$ 1,353,277	$ 1,380,177	$ 1,386,877	$ 1,385,577	$ 1,443,477
TPO Costs	$ 5,285,887	$ 5,105,662	$ 4,978,296	$ 4,850,931	$ 4,723,565	$ 4,649,058
Total Operating Costs	**$ 6,742,514**	**$ 6,458,939**	**$ 6,358,474**	**$ 6,237,808**	**$ 6,109,142**	**$ 6,092,535**
Total Operating Cost per Head	**$3.58**	**$3.43**	**$3.37**	**$3.31**	**$3.24**	**$3.23**
Net Operating Cost (after Retagging)	**$ 6,148,956**	**$ 5,865,381**	**$ 5,764,916**	**$ 5,710,201**	**$ 5,647,486**	**$ 5,729,805**
Net Operating Cost per Head	**$3.26**	**$3.11**	**$3.06**	**$3.03**	**$3.00**	**$3.04**

Table 54: Third Party Operator Operating Cost Forecast- Move In and Move Out Data to CLTS

Third-Party Operator	Move-in Move-out Data only to CLTS					
	Std. Year	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue						
Retagging Revenue	**$ 593,558**	**$ 593,558**	**$ 593,558**	**$ 527,607**	**$ 461,656**	**$ 362,730**
Operating Costs						
Market Costs	$ 1,347,867	$ 1,244,517	$ 1,271,417	$ 1,278,117	$ 1,276,817	$ 1,334,717
TPO Costs	$ 3,791,704	$ 3,656,305	$ 3,558,823	$ 3,461,341	$ 3,363,859	$ 3,304,294
Total Operating Costs	**$ 5,139,571**	**$ 4,900,822**	**$ 4,830,240**	**$ 4,739,458**	**$ 4,640,676**	**$ 4,639,011**
Total Operating Cost per Head	**$2.73**	**$2.60**	**$2.56**	**$2.52**	**$2.46**	**$2.46**
Net Operating Cost (after Retagging)	**$ 4,546,013**	**$ 4,307,264**	**$ 4,236,682**	**$ 4,211,851**	**$ 4,179,020**	**$ 4,276,281**
Net Operating Cost per Head	**$2.41**	**$2.29**	**$2.25**	**$2.24**	**$2.22**	**$2.27**

3.4.2.4 Vendor Owned and Operated

This option is a departure from the two other outsource approaches described, and might be termed a "turn-key" model. The vendor provides the equipment, the system and the operating staff and bundles it together into a single service fee. It allows the markets to avoid much of the initial capital cost, requiring funding only of the on-site infrastructure investment, and frees them from investment in replacement hardware and equipment during the full term of an agreement. Operating costs include the capital financing of this option and build in the operating efficiencies discussed earlier.

Table 55: Vendor Owned and Operated Operating Cost Forecast- Move In Only

Vendor Owned and Operated	Move-in Only					
	Std. Year	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue						
Retagging Revenue	**$ 593,558**	**$ 593,558**	**$ 593,558**	**$ 527,607**	**$ 461,656**	**$ 362,730**
Operating Costs						
Market Costs	$ 698,725	$ 698,725	$ 698,725	$ 698,725	$ 698,725	$ 698,725
Vendor Costs	$ 3,301,119	$ 3,180,437	$ 3,092,767	$ 3,005,096	$ 2,917,426	$ 2,862,767
Total Operating Costs	**$ 3,999,844**	**$ 3,879,162**	**$ 3,791,492**	**$ 3,703,821**	**$ 3,616,151**	**$ 3,561,492**
Total Operating Costs per Head	**$2.12**	**$2.06**	**$2.01**	**$1.97**	**$1.92**	**$1.89**
Net Operating Cost (after Retagging)	**$ 3,406,286**	**$ 3,285,604**	**$ 3,197,934**	**$ 3,176,214**	**$ 3,154,495**	**$ 3,198,762**
Net Operating Cost per Head	**$1.81**	**$1.74**	**$1.70**	**$1.69**	**$1.67**	**$1.70**

Table 56: Vendor Owned and Operated Operating Cost Forecast –Move In and Move Out Linked to Permit

Vendor Owned and Operated	Move-in Move-out Linked to Permit					
	Std. Year	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue						
Retagging Revenue	**$ 593,558**	**$ 593,558**	**$ 593,558**	**$ 527,607**	**$ 461,656**	**$ 362,730**
Operating Costs						
Market Costs	$ 887,943	$ 887,943	$ 887,943	$ 887,943	$ 887,943	$ 887,943
Vendor Costs	$ 5,113,696	$ 4,938,637	$ 4,814,715	$ 4,690,793	$ 4,566,871	$ 4,494,086
Total Operating Costs	**$ 6,001,638**	**$ 5,826,579**	**$ 5,702,657**	**$ 5,578,735**	**$ 5,454,813**	**$ 5,382,028**
Total Operating Costs per Head	**$3.19**	**$3.09**	**$3.03**	**$2.96**	**$2.89**	**$2.86**
Net Operating Cost (after Retagging)	**$ 5,408,080**	**$ 5,233,021**	**$ 5,109,099**	**$ 5,051,128**	**$ 4,993,157**	**$ 5,019,299**
Net Operating Cost per Head	**$2.87**	**$2.78**	**$2.71**	**$2.68**	**$2.65**	**$2.66**

Table 57: Vendor Owned and Operated Operating Cost Forecast – Move In and Move Out Data to CLTS

Vendor Owned and Operated	Move-in Move-out Data only to CLTS					
	Std. Year	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue						
Retagging Revenue	**$ 593,558**	**$ 593,558**	**$ 593,558**	**$ 527,607**	**$ 461,656**	**$ 362,730**
Operating Costs						
Market Costs	$ 774,412	$ 774,412	$ 774,412	$ 774,412	$ 774,412	$ 774,412
Vendor Costs	$ 3,695,101	$ 3,562,600	$ 3,467,050	$ 3,371,500	$ 3,275,950	$ 3,217,351
Total Operating Costs	**$ 4,469,513**	**$ 4,337,012**	**$ 4,241,462**	**$ 4,145,912**	**$ 4,050,362**	**$ 3,991,763**
Total Operating Costs per Head	**$2.37**	**$2.30**	**$2.25**	**$2.20**	**$2.15**	**$2.12**
Net Operating Cost (after Retagging)	**$ 3,875,955**	**$ 3,743,454**	**$ 3,647,904**	**$ 3,618,305**	**$ 3,588,705**	**$ 3,629,033**
Net Operating Cost per Head	**$2.06**	**$1.99**	**$1.94**	**$1.92**	**$1.90**	**$1.93**

3.5 Risks and Sensitivities in the Business Case

All forecasts have inherent risks in their individual or combined assumptions. The analysis in this report is intended to provide both a study of the comparative costs of the available options for a full roll-out of the scanning system across the province and a directional assessment of the total cost of such a roll-out, independent of organizational or scope options. In reviewing the forecast from both perspectives, the project team has identified seven factors that could impact either the costs of a decision to proceed with a rollout of the system and/or the selection of a delivery option. They are discussed in the following sub-sections.

3.5.1 Retagging Volume

Several factors are currently impacting the number of cattle at each market and in each sale type at present[3]. For the forecast, the percentage of retags currently identified as necessary during the pilot study was used as a base, and an assumption of the reduction in retags required annually over the forecast period was incorporated into the revenue forecast.

In order to provide the basis for estimating the significance of a change in the retagging volume in any of the business cases presented, an analysis of the impact of a 10% change was generated, and is illustrated in Table 58 below.

Table 58: Retagging Revenue Risk Analysis

Risk Analysis	Year 1	Year 2	Year 3	Year 4	Year 5
Retagging Revenue	**$ 593,558**	**$ 593,558**	**$ 593,558**	**$ 527,607**	**$ 461,656**
10% Change	$ 59,356	$ 59,356	$ 59,356	$ 52,761	$ 46,166
Per-Head Impact	**$0.032**	**$0.032**	**$0.032**	**$0.028**	**$0.025**

A 10% change in retagging revenue would increase or decrease the total net operating cost in any of the business cases by $0.032 in the early years of the forecast and by $0.025 to $0.028 in the final years.

3.5.2 Inflation Impact

For ease of understanding, the possible effect of inflation in capital and operating costs was eliminated from the analysis by working with a "constant dollar". However, with uncertainty about the strength and consistency of an economic recovery in Canada and among our trading partners, the future cost of capital and general inflation are also uncertain, although within a limited band. It may also be necessary to account for the possible impact of significant demand for equipment and expertise for scanning and traceability during the forecast period. A brief sensitivity has been prepared to provide a gauge to the impact of inflation during the five years of the forecast.

In Tables 59 through 63 below, the impact of a persistent 2% inflation during the forecast period has been illustrated[4]. Inflation in year 1 (only) has been applied to the capital investment in each case, and the compound effect is illustrated in the operating costs.

Table 59: Market Owned and Operated Inflation Impact

Market Owned and Operated			
Total Operating Costs	$ 974,304	$ 1,552,531	$ 1,103,312
Total Operating Costs per Head	$0.52	$0.82	$0.59
Capital Costs	$ 117,341	$ 135,161	$ 136,538
Total Impact 5 Years	**$ 1,091,646**	**$ 1,687,692**	**$ 1,239,849**

[3] See the accompanying Reading Metrics Report for a full discussion of the factors affecting retagging volumes.
[4] The impact of inflation in a single year can easily be calculated by applying a percentage to any of the costs identified in the tables in Section 3.5.2.

Table 60: Vendor Operated/ Market Owned Inflation Impact

Vendor-Operated/Market Owned			
Total Operating Costs	$ 1,140,868	$ 1,711,921	$ 1,311,612
Total Operating Costs per Head	$0.61	$0.91	$0.70
Capital Costs	$ 117,341	$ 135,161	$ 136,538
Total Impact 5 Years	**$ 1,258,209**	**$ 1,847,081**	**$ 1,448,150**

Table 61: Third Party Operator Inflation Impact

Third-Party Operator			
Total Operating Costs	$ 1,331,729	$ 1,958,360	$ 1,470,123
Total Operating Costs per Head	$0.71	$1.04	$0.78
Capital Costs	$ 117,341	$ 135,161	$ 136,538
Total Impact 5 Years	**$ 1,449,071**	**$ 2,093,520**	**$ 1,606,661**

Table 62: Vendor Owned and Operated Inflation Impact

Vendor Owned and Operated			
Total Operating Costs	$ 1,126,233	$ 1,755,196	$ 1,287,538
Total Operating Costs per Head	$0.60	$0.93	$0.68
Capital Costs	$ 53,793	$ 54,873	$ 54,873
Total Impact 5 Years	**$ 1,180,026**	**$ 1,810,070**	**$ 1,342,411**

Operating costs per head would increase between $0.55 and $0.97 for the business cases and operating scope options in the forecast. Capital costs would be increased by between $117K and $137K for the market-owned cases and by $54K to $55K for the vendor-owned case.

3.5.3 RFQ Process

It is likely, in any of the outsource options – Vendor-Operated, Third-Party-Operated, and Vendor-Owned and -Operated – that a RFQ or similar competitive process would be employed to secure the capital and services for the anticipated rollout. For any of the individual items or services, and for the provision of the equipment and services overall, a competitive sourcing program may reduce the costs used in this analysis. It may also uncover areas of risk or competitive circumstances that could increase the investment and costs presented here.

Since the possibilities for changes to costs are so extensive, quantifying their individual or collective impact has not been undertaken.

3.5.4 Additional Costs, Labour Rate, and Efficiencies (Market-Owned and -Operated)

Operating costs for the Market Owned and Operated case may be understated by $1.1 to $1.5 million annually for costs not included in the analysis in three areas – on-site technical support, management of scanning staff and unrealized labour rate targets.

3.5.4.1 Technical Support

The extensive and advanced systems employed in the scanning process, while quite reliable and self-contained, do require on-site technical expertise. In the vendor-operated cases, it is anticipated that scanning staff will have the ability and access to make small-scale adjustments and updates when required. When more support is required, supervisory and management vendor staff will be close at hand either on-site or on-line. As integration and interoperation of scanning and market systems are undertaken, this requirement will increase. Assuming 25% use of a technical resource would add $12K to $15K to the annual operating cost for an average market - $335K to $420K across all markets

3.5.4.2 Management of Scanning Staff

Scanning staff will require active management by the market owners. While some may be recruited from existing market and yard staff, and therefore have the opportunity to work more regularly at a site, many will be recruited as part-time workers with irregular schedules. Scanning staff are relatively skilled workers with higher degrees of computer literacy, and might be prone to moving to other positions away from the market. Therefore, there may be a recruiting and management cost attached to these staff on an ongoing basis.

Assuming a recruiting and management requirement equal to 10% of a mid-level manager, the potential additional cost of these factors is estimated to be $5K to $7K per year for an average market. Larger markets, and those with a well-controlled management complement, will feel a larger cost impact, while smaller markets and those with available management time will experience less. Across all 28 markets, this requirement could add $140K to $195K to the total cost of operation.

3.5.5 Provision for Future Capital Costs

In all but the Vendor-Owned case, all markets will need to provide for future capital costs. While infrastructure can be assumed to have a long useful life, technology and equipment are likely to be replaced within five to ten years of initial operation. Therefore, shortly beyond the forecast horizon additional capital commitments will begin to be made. These anticipated replacements of capital items have been provided for in the forecast by a depreciation expense, as illustrated earlier in this report. Any variation from those useful-life estimates will need to be funded as an ongoing cost. In the Vendor-Owned and -Operated case, however, it would be incumbent on the vendor to find these expenditures.

3.5.6 Independent Selection of Options

As presented, the analysis and forecast presents cases as universally accepted – that is, all markets in a roll-out select the same business option and scope. However, it may be that each operator will want to decide on his/her own criteria which of the options to select. These individual selections might be random across all markets, or larger or more specialized markets may act more in common. Therefore the total capital investment and operating cost for the proposed rollout may not fall into any of the specific cases presented, but will be elsewhere in the range of costs.

3.5.7 Cattle Volume

The analysis and forecast have assumed a constant volume of cattle sold through the markets, set at the 2009-2010 volume. With uncertainty in the market overall, and with other changes that may impact the choice of sale venue by producers and others, volume through the markets may vary from the level used in the model. Additional volume may be generated and sold in the Alberta and Canadian market generally during the forecast period, as economic changes are experienced and as markets open and grow. Within the market volume, also, volume may be redirected to electronic or other markets, to the detriment of the auction markets themselves.

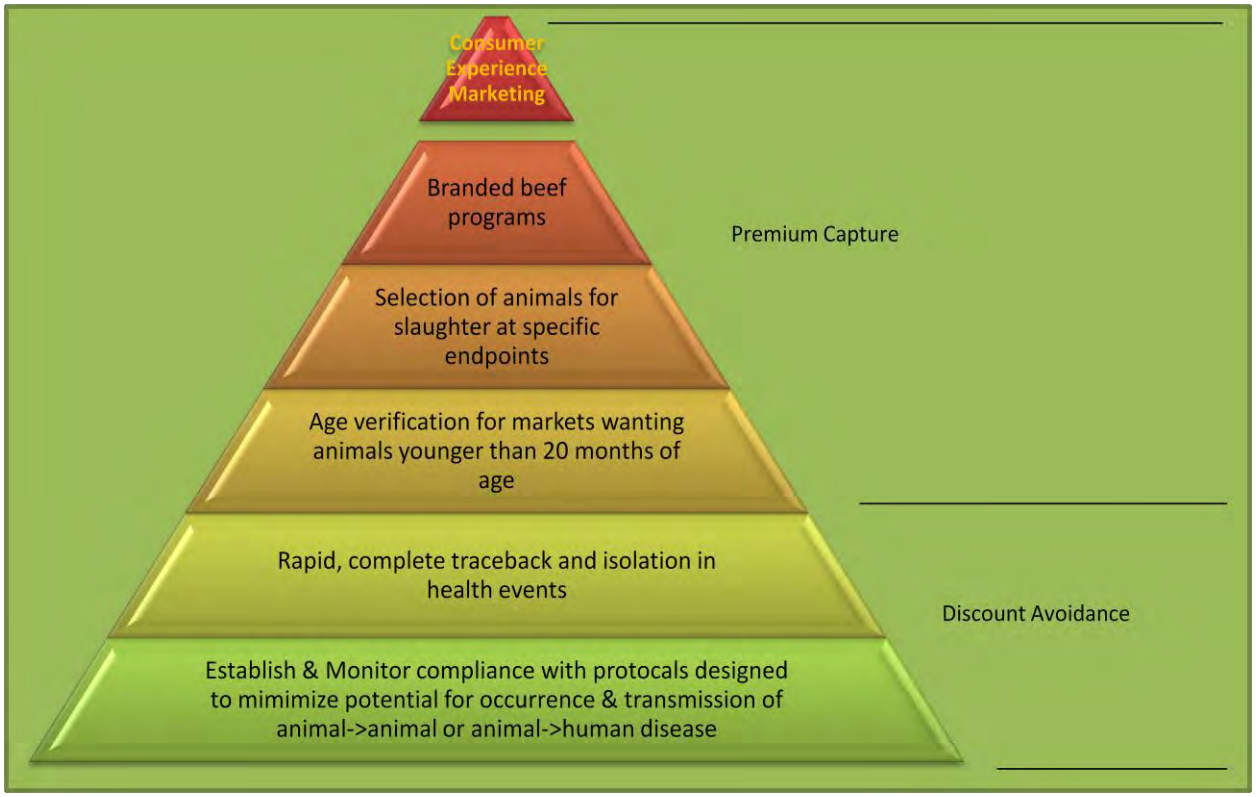
Given that a constant volume has been used for the forecast, any change in volume through the Alberta auction markets will have a directional impact on the per-head values shown in the analysis. That is, the impact may not be linear, since efficiencies of scanning labour and many other factors will adjust in the face of volume change, but an increase in volume will reduce the investments and costs per head on a proportional basis, and reductions will increase per-head costs in the same manner. The project team does not have a sensitive enough model to analyze the elasticity of these factors in any reliable way.

4 Value-Add and Benefits

The “pyramid” diagram below is recognized as containing the six areas of benefit that can be derived from the scanning activity being introduced through the pilot program in Alberta, once the techniques are fully developed and exploited by participants in the supply chain.

At the lower end of the scale, benefits are characterized as “avoiding discounts” – assuring healthy and safe animals entering and passing any point in the supply chain, and providing for rapid identification of animals that are potentially affected by a disease event – and by exception, those that are not.

Diagram 1: Value Add and Benefits



Towards the higher ranges of the diagram are benefits that promise the potential of premium capture by supply chain participants – assuring age verification to allow full trade potential, providing information to allow more discrete management to slaughter, and eventually branded beef programs sporting specific product attributes.

In the fully-developed potential of this activity, differentiation of product at the consumer level is possible. The potential value-add benefits of a fully-developed system, originally described in the first Interim Report, are included in Table 63 below to further the discussion of the achieve-ability of each potential benefit, with a view to establishing the priorities for action in the final stages of the assignment and in ongoing work.

Table 63: Potential Value Add Benefits

Potential Benefits	Benefits Achievable (Y/N)	Actions to Achieve	Priority for Actions	Benefits Accrue to: (Seller, Market, Buyer, Industry, Government)
48-Hour Trace-Back	Y	1. Protocol for scanning on Move-Out 2. Protocol for scanning animals not for sale and held over	H H	Seller, Buyer, Industry, Government
Electronic Permits	Y	1. Process of scanning EIDs to confirm shipment	M	Seller, Buyer
Age Verification	Y	1. Third-party verification when scanned or retagged 2. Editing of birthdates for retagged cattle 3. Method of verification when cattle arrive on day of sale	H H H	Seller, Market, Buyer, Industry, Government
LED Display at Auction Ring	Y	1. Third-party verification when scanned or retagged	M	Seller, Market, Buyer
Re-Tagging	Y	1. Protocol for retagging that does not impede speed of commerce (in large lots and high throughput periods)	M	Market, Buyer, Industry, Government
Non-Reading Tags	Y	1. Non-reading tags are replaced and cross-referenced by scanning staff	M	Seller, Market, Buyer, Industry, Government
Integration to Auction Software	Y	1. Document software used at all markets; identify any data-transfer issues and resolve	M	Seller, Buyer
Inventory Control	Y	1. Use scan-in and scan-out data for inventory adds and deductions 2. Assure interoperation with	M	Seller, Buyer

		market software (see above)	M	
Data Collection	Y	1. Develop a method to transfer Move-In data on a closer-to-real-time basis	H	Seller, Market, Buyer, Industry, Government

It is important to note that most of the benefits identified here are possible only with the integration of scanning systems with the markets' management systems. It is understood that most of the management systems currently employed by the auction markets in Alberta cannot be integrated with other systems, due to their technical configuration. Therefore, in order to achieve the business benefits potentially available to market owners through the use of modern scanning technology and methods, additional expenditures for more compatible management systems will be required. In this regard, the investment in scanning technology and systems should not be considered – nor evaluated – as a stand-alone initiative.

5 Conclusions and Next Steps

5.1 Conclusions from the Pilot Study Analysis and Forecast

5.1.1 Business Model Assessment

Overall, the financial models and the forecast have resulted in a consistent dollars-and-cents illustration and analysis of the pilot study and its potential rollout to all 28 markets in Alberta. Ample financial data and information is available for a decision to move ahead, and for the determination of a preferred business model(s).

The analysis has provided a current and forecast investment and operating cost profile for the activity, both on an individual market basis and overall, and has identified areas for efficiency in any future activity. Along with a very large and reliable store of scanning data in the accompanying report and achievement of promising scan rates and reliability, the business case analysis presents a successful outcome from the pilot study.

The **Market-Owned and -Operated** case is one of the two lower cost options, although some additional costs may accrue to some markets for on-site technical know-how and for management of scanning crews. Market owners may be more highly committed to the success of the scanning system if it is fully within their control, and they would be solely responsible for the costs of the system. Owners would have no concern for confidentiality of their information, and would be in a good position to integrate the operation of the scanning system within their other market functions and systems. As in all cases except the Vendor-Owned example, markets would be faced with cycles of reinvestment to replace and upgrade system components and hardware. Without a coordinating body working with all markets, integrity of reporting scanning data would potentially be compromised. However, in the longer term, full adoption of the scanning process into the operations of the markets, as a normal business function, would be a strongly-positive outcome.

The **Market-Owned/Vendor-Operated** case matches the pilot study approach most closely. A single responsible supplier brings a high level of commitment and expertise to the work, and shares in the success of the system along with the market owners. The vendor is a single point of contact between the markets and the suppliers of all components of the scanning system allowing the market owners and operators to go about their daily business with minimal impact. The vendor has, and maintains, a high level of expertise in all aspects of the system and can guide owners through initial design and implementation and run-in most efficiently. This expertise is available to the markets at all times. The selection of hardware is open to the owners from a set of pre-screened brands, and there is limited mixing of assets between the vendor and the markets.

In a roll-out situation, it is anticipated that efficiencies will accrue to the vendor due to local labour sourcing and increased utilization of scanning staff. Use of staff on multiple sites allows for service consistency that provides best practices and consistent industry-wide reporting.

The **Market-Owned/Third-Party-Operated** case is similar to the Vendor-Operated example in many respects. The TPO is a common focus for the operations of the system in all markets, and efficiencies of operation can be anticipated with this model. The market owners would have multiple points of contact, however, for the system components, and will require the time and expertise to coordinate their involvement. If a TPO can find a way to integrate service functions for the markets, including the scanning system, this option may provide added benefits in simplicity of operations in support of the markets.

The **Vendor-Owned and -Operated** case offers the lowest initial capital investment, since scanning system software, hardware and equipment is combined with the operating costs into a contracted fee. It also has the majority of the advantages of the Market-Owned/Vendor-Operated case in the commitment of the operator and the concentration of its functions. There is a benefit to the vendor, and therefore to the market owners, to continually improve efficiencies and refine methods of operation, and it would be incumbent on the operator to upgrade software and equipment for the system. While outsourced/turn-key arrangements of this type are employed frequently in other industries, this approach will require acceptance by market owners.

5.1.2 Nature of the Pilot

The pilot project became operational in a very short time, and the RFP stated that these may be temporary installations. At the time of implementation, there were no mandatory requirements for traceability. Therefore, the conditions for owners' acceptance of system components and installation configuration were hurried and were largely based on recommendations solely from ITS project management staff.

While these recommendations were solid and very functional in operation for the purposes of this pilot project, moving forward more attention to detail in the layout onsite, and protection and shelter for the scanning areas to aid in the longevity of the infrastructure and equipment need to be taken into consideration. Based on the pilot project's experience, more optimized installations can be planned for the rollout, including some adjustments to pilot market systems.

5.1.3 Optimization of Installations

Alberta auction markets were set up to sell cattle not to scan cattle. While the installations in most pilot locations were well designed for their initial purpose, including in some cases significant modifications to existing yard infrastructure, efficiencies can be gained by additional initial investment in changes to the markets' facilities to optimize traceability.

With optimization, additional value-add attributes of traceability may be more accommodating and available to market owners. ITS estimates that approximately $200,000 of additional capital spent on redesigning a small section of the markets around traceability may have reduced operating costs by as much as $0.60 per head.

Additionally, it may be more economically viable to take the scanning systems to the livestock rather than the livestock to the scanning systems in some instances due to limitations within the existing designs and operations of the markets.

5.1.4 Business Services at Markets

An opportunity exists to streamline traceability services at the markets. Brand Inspectors checking brands, Scanning staff reading cattle and conducting age verification checks at the markets and onsite MFR staff all have redundant services, and operationally could be combined into a market support service.

Centralised management of audit related services would assure consistent and efficient operation, and integrated reporting would provide a more complete and useful information flow for the markets and for regulatory agencies. Additionally, it would reduce the current perception of over governance at the auction markets by producers, operators and buyers by having multiple government agencies onsite.

All significant value added opportunities come from being able to cleanse the errors in the data at the point of scanning and receiving so that the CCIA data set progressively becomes more accurate. There is no point interfacing current age verification data at the point of auction until a 'cleansing' process is implemented.

5.2 Next Steps

The successful completion of the pilot study leads to the recommendation of a number of ongoing activities, both to refine the model for roll-out and to continue along an implementation path.

5.2.1 Detail the Market-Owned and -Operated and Vendor-Owned and -Operated Cases

Given that these are the two lowest cost options, and that self-determination, in the longer term, may be the most compatible business model for many auction market operators, it is necessary to detail what would be required of market owners to operate the scanning system as an integrated part of their core business.

A separate scenario needs to be tested in the vendor owned and operated scenario that involves a reduced amount of upfront capital cost through the use of mobile equipment. This scenario may be the most palatable for the auction market owners in the long term as it reduces their financial requirements.

This is an opportunity to further assess these options, and also to discover the options and specific requirements at each market and market type.

5.2.2 Integration with Markets' Business Systems

A program to evaluate, select and install new market management systems in the pilot locations is recommended, including a monitoring and evaluation process to determine the costs of the program and to assess the markets' success in achieving the benefits believed to be available from the integrated systems.

Again, it should be remembered that minimal value adds will be achieved here if the data is not 'cleansed' through the Move In scanning process prior to be passed through to the auction market management system.

5.2.3 Technology Standards and Performance

The pilot project identified significant differences in the performance of the different products currently accredited by CCIA for use in Alberta. The significant fact is that a number of products consistently performed at an exceptionally high level of read performance (over 99%) whilst others were consistent under achievers. The placement of the tags in the ear of the animal had an enormous impact on retention and readability of the different products throughout all pilot sites which could have been easily avoided.

An assessment needs to be made of the required tag performance to allow automation and efficiency's to be gained through the scanning and data transfer process. This assessment should include the minimum acceptable read distances and read speeds for tags, in both best and worst orientation, to a panel reader positioned vertically on a chute.

The outcome of this assessment will identify the real cost to industry in dealing with an underperforming tag which producers need to consider when making a purchasing decision as the cheapest or most expensive tag may not be the same when all factors are considered.

5.2.4 Prepare a More Optimized Model

In order to apply the learning from the pilot study and to establish a model for additional installations, the development of a template for laying out the scanning area under certain market configurations and business models is recommended. Both the existing facilities and a new set of markets could be used to build the template(s), and investment, operational and cost impacts could be evaluated.

5.2.5 Optimize and Measure Future Installations

The current set of pilot sites represent a benchmark in operational efficiency, and therefore in costs. Additional pilot sites are recommended to be established and configured for scanning efficiency and maximum integration of the scanning function into their operations, using the template(s) recommended in 5.2.3 above. This would entail both the physical location and configuration of the scanning facilities and the integration of scanning into the operational processes of the markets.

5.2.6 Pursue the Efficiencies in the Forecast

The forecast includes several areas of efficiency that would be available to participating markets, some of which would benefit from further investigation – scanning efficiency, scanning expense reduction, and retagging requirements. In preparation for further expansion of the scanning system in Alberta auction markets, studies to detail reliable solutions for these efficiencies are recommended.

To establish the approach to improved scanning efficiency, identification of the impact and potential of operator experience with the equipment, methods development by scanning staff, and improved integration of scanning activities into the market operations should be documented and tracked during the ongoing operation of the current scanning facilities. Findings can be used as training material and operating practice guidelines for future participants.

5.2.7 Move-out Scanning and Permits

The cost of scanning cattle on move-out was financially assessed in the study. However, the *value* of scanning-out to market operators, transporters and purchasers was not in scope, and therefore was not established. The cost of matching shipped lots with permits on move-out was also assessed financially, again without a study of their potential benefits to supply chain partners. A study of these factors is recommended, so that a fully-informed decision on the future scope of installations can be made. The recommended approach is a pilot study of limited scope – two or three markets – and a business assessment of the potential benefits of move-out scanning and the availability of a permit matching loads for the markets' major customer groups.

Appendix One: Terms and Acronyms

- AARD – Alberta Agriculture & Rural Development
- CCIA– Canadian Cattle Identification Agency
- CLTS – Canadian Livestock Tracking System
- FTE – Full Time Employee
- ITS – Integrated Traceability Solutions
- LIS – Livestock Identification Services
- Manifest – is completed by the producer and is used to transport livestock in Alberta. It is used to inspect livestock at designated inspection sites (auction markets, assembly stations, inspected country sales, feedlots and abattoirs) across the province.
- MFR – Mobile Field Representative
- Permit – is issued by an inspector from LIS and is used to provide destination information from designated inspection sites (auction markets, assembly stations and abattoirs).
- RFID – Radio Frequency Identification (also generically known as EID or Electronic identification)
- RFP – Request for Proposals
- RFQ – Request for Quotes

Project Participants

Primary Contributor:

Yancy Crosier
Project Manager - Integrated Traceability Solutions Ltd.

Contributors:

Garry Edwards
CEO - Integrated Traceability Solutions Ltd.

John Stevenson
General Manager - Integrated Traceability Solutions Ltd.

Ian Richardson
Business Analyst - eBiz Professionals Inc.

With Thanks to;

Scanning Managers

Bill Wilson:
Southern Alberta Livestock Exchange, High River, AB
Dave Volker:
Stettler Auction Mart, Stettler, AB
Gene Wiart:
Provost Livestock Exchange, Provost, AB
Heidi Rasmussen:
VJV Foothills Livestock Auction, Stavely, AB
Mike Rasmussen:
Perlich Bros. Auction Market Ltd., Lethbridge, AB
Rocky Rice:
Sekura Auctions Ltd., Drayton Valley, AB

Livestock Auction Markets

Bob Perlich and Ken Perlich (Steering Committee):
Perlich Bros. Auction Market Ltd.
Jerry Hewson (Steering Committee), Jack Lawes and Dean Lawes:
Provost Livestock Exchange
Greg Hayden and Jim Abel:
Stettler Auction Mart
Corey Sekura (Steering Committee):
Sekura Auctions Ltd.
Jackie Sawley:
Southern Alberta Livestock Exchange
Rob Bergevin:
VJV Foothills Livestock Auction

Integrated Traceability Solutions
1.877.856.1199

P 403.646.1131 F 1.866.801.1137
2010 20th Avenue Nanton, Alberta T0L 1R0