SRDC Reseach Project final report
Enhancing efficiency and integration from field to factory in the Herbert
SRDC Research Project
Final Report

Cover Page:

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Executive Summary:

The Herbert sugar region underwent major strategic change in the harvesting and transport sectors, which will involve $7M investment in siding rationalisation and a substantial reduction in the number of harvesting groups. These strategic changes have the potential for large cost savings to the local region (potentially over $2/tc as seen in the SRDC project CSE005) leading to greater sustainability in these two sectors, if optimally implemented to achieve the economic and social goals of each of the participants in the growing, harvesting and milling sectors. The goal of this project was to provide the region with a capacity to better manage operational and seasonal planning in harvesting & transport.

Because the project involved several organisations and broad R&D plan, four working groups have been formed around key deliverables of the project: SugarMax, Harvest/Transport Integration, Harvest Haul; and Evaluation. Each small working group comprised of researcher and local representatives, though the entire project team met in Ingham up to five times per year to report progress and plan next steps. Key deliverables for each sub-group are highlighted as follows:

**SugarMax** - The purpose of implementing SugarMax in the Herbert was to better manage harvester migration and transition to larger harvesting groups. The SugarMax application was further developed to be user friendly so that the ownership and use of the application can be transferred the extension services in the region. It was adopted in 2007 to develop harvesting effective plans for four groups with farms in several locations. It was particularly beneficial for expanding harvesting groups. Despite several communication activities, SugarMax was not implemented in 2008, mainly due to the perceived complexity of running the model for each individual farmer.

**Harvest/Transport Integration** – From an integrated harvest/transport perspective, the following tools were developed for use by CSR and the harvesters for the start of the 2008 harvest season: 1) enhanced version of the web based siding booking system developed by CQU and currently used at Proserpine; 2) user friendly version of the harvester roster model, linked with TOTools and implemented in 2008; 3) new transport roster to capture efficiency gains from the new sidings and harvester reductions; 4) and development of skills of transport staff to make use of the tools. Further work on schedules was conducted in preparation for the 2009 crushing season. Harvest and transport options associated with operating only Victoria Mill for the first several weeks of the 2009 season were considered. In addition, the concept of rostering harvest start times was examined in an effort to treat harvesters more fairly by distributing the early and late starts among all harvesters.

**Harvest Haul** – Its purpose was to serve three purposes in the project: evaluate scenarios for harvester rationalisation; evaluate impacts of new sidings on harvesters; optimise operations around the new sidings. The Harvest Haul work did not progress too far in the project, mainly due to the difficulty of obtaining up to date information on new sidings and the rapidly evolving harvesting groups. The Harvest Haul model is very data intensive, and requires up-to-date data sets to provide meaningful outputs.

**Evaluation** - The evaluation methodology has been developed and measures for an agile Herbert supply chain was established, which are based on mill crush rate, network, harvest wait time and trust. A survey for the latter has been developed and tested on the project working group, prior to application across the Herbert region. The trust survey was not able to be implemented.

Outcomes from the project are mostly from the Harvest/Transport Integration component of the project, through: reduction in harvesting costs from better management of harvester movements across sidings; reduced in transport costs through better matching of tactical schedules to new sidings and rationalised harvesting groups; and reduced harvesting and transport costs from a reduced variable daily cane supply to the mill and along branch lines, resulting from optimised harvester rosters. The economic benefits resulting from adoption are hard to measure so far, since: the benefits from the project are convoluted with other developments in the region such as new sidings; it is hard to relate efficiency gains to economic benefits; and such information can be quite sensitive. Adoption of the siding booking tool has been through CSR and Canegrower hosted workshops to promote its use in 2008. We expect that at least 50% of the harvesters will be using the siding booking web site by 2010.
Overall, the project only partly successful and was terminated after about 2 years. The partial success along with the project deliverables changing substantially from the original project goals, are the main reasons for termination. There are many other factors that contributed to the outcome, such as management complexity, project staff leaving, and lack of information availability.

Background:

The Herbert region has inefficient rail transport and a large number of harvesters operating within a small time window, leading to unnecessary high costs and social disruptions. In 2004, the SRDC CSE005 project explored opportunities for reducing costs in harvesting and transport. Their analysis showed significant opportunities to increase bin delivery reliability by removing the huge waiting time for bins and ensuring a continuous supply of bins. At the same time the mill could make better use of its infrastructure and remove a few locomotive shifts. The CSE005 big picture analysis included reducing the number of sidings down to about 200 whilst upgrading many of the remaining, increasing the time window of harvesting for a finish time of 6pm, 8pm or 10pm, geographical harvesting, partnering harvesting groups, siding rosters, and an increase in the size of harvesting groups. Cane rail transport reliability through bin derailments, loco breakdowns and troublesome sections of track has emerged since 2004 as an issue of increasing tension in the Herbert that directly impacts on mill performance and availability which in turn imposes costs to the cane supply sector.

In extreme cases (2005 and 2006 seasons) crop development potential for the following year is also limited with unduly long seasons. The transport system is now one of the key focal areas in CSR's performance improvement program. The project steering group is now collectively committed to implementing scenarios for efficiency enhancement across the supply and value chain and the industry will receive funding from the federal government to remove 100 sidings and upgrade 72, leading to a more efficient track network. To implement the scenarios effectively, a more intensive process will be required than the big picture analysis. Issues to be addressed include:

• Putting the sidings in the right spot accommodating the issues in haul routes, harvester preferences, proximity to local residences etc.
• Necessary size of rolling stock and how best to manage it once the sidings are upgraded
• Transition to larger or partnering harvesting groups, whilst accommodating individual harvester goals
• Capacity building in the growing, harvesting and milling sector to perform/communicate best at operational and tactical levels given the changes

Maximise operating efficiency given the restructured harvesting and transport

• Infrastructure requirements to allow reform and pursuit of opportunities to optimize industry profitability.

Objectives:

Past value chain projects (e.g. CSE005 and BSS264) within the Herbert have highlighted various options for reducing costs and increasing reliability across the harvesting and transport sectors of the Herbert value chain. Through federal government funding and industry leadership from the different sectors, there is commitment to implementing these options. This project goes beyond the big picture options produced in the past projects to address the issues for effective adoption. In particular, this project will:

1) Provide the most effective adoption of the siding rationalisation plan, infrastructure modifications, transition to larger harvesting groups or co-operating groups and rostered time window of harvesting, accommodating the different micro level issues and goals at the siding, harvesting group and grower level.

Partly achieved. The Herbert region, particularly its harvesting and transport sector, has evolved faster in the last two years compared to any time period previously. Harvest rationalisation has occurred much faster than anticipated during the construction of the project proposal. Siding rationalisation took place with minimal direct influence from this project, though individual workshops at siding level were held.

2) Optimise the operational functioning of these restructured harvesting and transport arrangements to maximise economic gains and reliability

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Achieved. This is the objective where the project has primarily focused on. Several tools and technologies were developed to optimise the operational functionality of the revised infrastructure, and some will continue development beyond the life of the project. There is also rapid progress in the region’s drive towards automated management of harvesting and transport logistics through the harvest booking system, integrated with harvester rostering and improved transport planning. It is a high priority due to the need to better manage the rapid increase in harvester migration. From an integrated harvest/transport perspective, the following tools are ready for use by CSR and the harvesters: 1) enhanced version of the web based siding booking system developed by CQU and currently used at Proserpine; 2) user friendly version of the harvester roster model, linked with TOTools; 3) new transport roster to capture efficiency gains from the new sidings and harvester reductions; 4) and development of skills of transport staff to make use of the tools. The SugarMax tool was adopted in 2007 to develop harvesting effective plans for four groups with farms in several locations. It was particularly beneficial for expanding harvesting groups. In 2008, it was to be adopted by 11 harvesters, but the use of the tools was found to be too complex for the value it delivered.

3) Objectively evaluate the strategic and operational changes to measure the value created to each chain participant
Not Achieved. Detailed plans and methodologies were developed for evaluation but were not implemented. The evaluation methods are described in this report, including a measure of trust survey developed for growers.

**Methodology:**

The research methodology changed substantially compared to that stipulated in the original project plan, which was based on a three phase approach: implementing the strategic initiatives in infrastructure modifications; involve evaluation and fine-tuning; and delivery mechanisms for adoption optimised seasonal and operational activities, given the strategic plan of the first phase. This methodology became obsolete shortly after the project start, particularly due to the harvesting and transport sector evolving faster in the last two years compared to any time period previously. Harvest rationalisation has occurred much faster than anticipated during the construction of the project proposal. This meant that the first phase became unnecessary.

Instead of following the original methodology, the approach taken was to divide the project into four subprojects and form working groups for each of these. These working groups are shown in Figure 1. The entire project team formally met in the Herbert up to 5 times per year to plan at a whole-of-project level. In the remainder of the Methodology we specify the key methods for each sub-project.

The process flow linking working groups is contained in Figure 2, which shows the linkages through a process of inputs and outputs. The harvest/transport working group covers the “harvester and siding roster tools” and the “ACRSS model”.
Figure 1. Working group structure for the project
Figure 2. Process developed to show information flow linking working groups, focus areas and models.
SugarMax

The purpose of implementing SugarMax in the Herbert was to better manage harvester migration and transition to larger harvesting groups. SugarMax allowed harvesters to evaluate different rotation strategies for his farms or across the whole group. To set up SugarMax, CCS trends needed to be developed. The selection of the most appropriate trends for the Herbert region was to accommodate the wide range of climatic conditions across the region (i.e. very wet to very dry), as varieties needed to be matched to these varying conditions. CCS profiles were separated into 3 maturity groupings as per Figure 3 (Early to Mid maturing Varieties, Early Mid to Late maturing Varieties, and Mid to Late maturing Varieties). Varieties also showed differing trends in productivity across the 6 Soil groups in the region (Terrace Loamy, Seymour, Sandy, Hillslope, Clay and Alluvial). Therefore the final combination of trends to suit the region was 3 Productivity zones with 3 Variety groups and 6 Soil groups.

The SugarMax application was further developed to be user friendly so that the ownership and use of the application can be transferred the extension services in the region. The SugarMax model has been reprogrammed to be more generic in order to be transferable between regions with minimum changes required to the structure of the program and its database. Figure 4 shows the front end screen. SugarMax is now a modular unit which can take extra components to cater for specific requirements from other existing and potential regions. This evolution of SugarMax has made it a much more user-friendly package, although remaining robust. The final aim was to have the application web-enable and linked to the regions to live productivity and GIS data.

The SugarMax tool was adopted in 2007 to develop harvesting effective plans for four groups with farms in several locations. It was particularly beneficial for expanding harvesting groups. Several communications activities were held to promote the concepts and values of harvest scheduling (ie. Harvester Best Practice Workshop – 22\textsuperscript{nd} April 2008 – Ash Benson ; ASSCT paper 2008: Harvest Planning for growers – Prestwidge et al; and Cane Productivity Initiative Forums – 8-9\textsuperscript{th} May 2008 (5 Forums). Despite all of these communication activities, SugarMax was not implemented in 2008, mainly due to the perceived complexity of running the model for each individual farmer.
The purpose of the analysis was to assess the impact of the new sidings on: the amount of time that harvesters spend waiting for bins; and the amount of transport capacity required to service the harvesters. Five scenarios were developed, which are described as follows:

1. 2005 harvesting groups (94 harvesters) + 2005 transport network (326 sidings).
2. 2005 harvesting groups + 2007 transport network. The 2007 transport network contains 294 sidings, for which there are 27 new or rebuild sidings and 52 sidings removed to create these sidings. It does not include the proposed new sidings for 2008.)
3. 2007 harvesting groups (84 harvesters) + 2005 transport network
5. 2005 harvesting groups with original 72 proposed new sidings

The aim of the five scenarios above is to benchmark the impact of the new sidings against the 2007 harvest season and against the 2005 harvest season, which the latter had a large cane yield and more harvesting groups. We included a scenario of the original 72 planned sidings as per the submission. This provides a gauge to assess the impact of the siding changes so far.

For the scenarios with the 2005 harvesting groups, we used the tonnes for 2005 and the harvesting groups that operated in 2005. For the scenarios with 2007 harvesting groups, we used the tonnes estimate for 2007. All scenarios involved applying the Harvester Roster, Siding Roster and Transport Capacity Planning models developed by CSIRO using funding from the SRDC project CSE005. The harvester rosters were those actually used by CSR Sugar in 2005 and 2007, as produced by the model. The sidings rosters were based on the farm rotations for each harvesting group and the percentages cut in each round. Given the information about where each harvester was located each day of the harvesting season, the Transport Capacity Planning model estimated the transport requirements (locomotives, bins, cut-to-crush, harvester waiting time) for each day of the harvest season. These results are averaged across each day of the harvest season and are contained in Table 1.
Table 1. Comparison of the different transport scenarios for siding upgrades

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Loco shifts (morning)</th>
<th>Loco shifts (afternoon)</th>
<th>Loco shifts (night)</th>
<th>Waiting time for bins (%)</th>
<th>Cut to crush (hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Vic Mck</td>
<td>14.5 6.6</td>
<td>7.6 2.4</td>
<td>8.4 4.3</td>
<td>30.1 6.9</td>
<td>9.7 10.5</td>
</tr>
<tr>
<td>2 Vic Mck</td>
<td>12.9 6.4</td>
<td>7.1 2.4</td>
<td>8.4 4.2</td>
<td>24.0 6.4</td>
<td>9.5 10.6</td>
</tr>
<tr>
<td>3 Vic Mck</td>
<td>12.6 5.4</td>
<td>6.8 2.6</td>
<td>8.4 2.7</td>
<td>19.6 0.7</td>
<td>8.2 6.9</td>
</tr>
<tr>
<td>4 Vic Mck</td>
<td>11.5 5.2</td>
<td>6.3 2.6</td>
<td>8.3 2.6</td>
<td>17.4 0.7</td>
<td>8.5 7.1</td>
</tr>
<tr>
<td>5 Vic Mck</td>
<td>11.9 5.8</td>
<td>6.3 2.2</td>
<td>8.0 4.0</td>
<td>21.4 6.5</td>
<td>10.6 11.2</td>
</tr>
</tbody>
</table>

In Table 1, the difference between scenarios 1 and 2 show the benefits of the upgraded sidings of 2007 if they were applied to the 2005 harvest season. In 2005, the 27 new or upgraded sidings would have led to 1.5 locomotive shifts being required in the morning and the waiting time that harvesters wait for bins being reduced from 30 to 24% of the total time spent in the field. That’s about a 45 minute reduction in harvester shift length.

Scenarios 3 and 4 represent the 2007 harvest season. A big difference between the 2007 and 2005 harvest seasons is the reduced number of harvesters in 2007. This means that the remaining harvesters will work longer hours (on average) and there will be fewer delivery drop-off’s of bins over the season. This means the harvesting hours will be slightly more spread out which reduces the waiting time for bins. It also means there are less shunts leading to reduced number of locomotives required compared to 2005.

A comparison of scenario 4 and 3 shows that the siding upgrades has a significant reduction in locomotives and a moderate reduction in the amount of time that harvesters wait for bins. The benefits are not as large as with the 2005 harvest season due to the reasons listed in the previous paragraph.

A comparison of scenarios 1, 2 and 5 of Table 1 show that having the 72 sidings upgraded does lead to a further reduction in locomotive requirements and waiting time for bins. However it does show that the benefits from the sidings upgraded in 2007 (scenario 2) already go most of the way towards the benefits of the original 72 siding scenario. This shows that the new sidings built so far have been great selections in terms of achieving maximum industry benefit. Analysis of the transport scenarios is complete and presented to DAFF as part of evaluating the progress of building new sidings across the region.

**Evaluation of Transport Scenarios Using ACRSS**

The main focus of the transport study for the 2007 season was in assessing the impact of changes in harvesting groups and sidings between 2005 and 2007. In this time the number of harvesting groups reduced from 93 to 83 and the number of sidings reduced from 330 to 294. As a result of these changes, the average daily allotment for each harvester has increased from 130 bins to 156 bins and the average siding capacity has increased from 135 bins to 149 bins. The effect of the changes to the harvesting groups and sidings were assessed using the CSIRO transport capacity model and the SRI ACRSS automatic scheduler. The capacity model is a higher level model that estimates schedule requirements without generating schedules. ACRSS, on the other hand, operates at a more detailed level and does generate schedules. It defines locomotive runs and deliveries and collections for each locomotive run. While the capacity model can easily assess schedule requirements for each day of a season, ACRSS deals with only a single day. For this study, the average requirements for two randomly-selected days were calculated using ACRSS to compare against the capacity model results.

The results from both the capacity model and ACRSS are presented in Table 2. The locomotive shifts columns present the total number of locomotive shifts required per day at Victoria and Macknade factories. The waiting time for bins is the estimated number of hours that harvesters are waiting for bins as a percentage of the total harvesting hours. Unlike the capacity model, ACRSS was used to minimise the waiting time through the use of additional locomotive shifts. Between Victoria and Macknade mills, the
The total number of locomotive shifts per day is typically 46 and so the ACRSS simulations maintained this number of shifts in each simulation.

Table 2. Assessment of impact of harvesting group and siding changes

<table>
<thead>
<tr>
<th>Harvesters</th>
<th>Sidings</th>
<th>Locomotive shifts</th>
<th>Waiting time for bins (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Capacity</td>
<td>ACRSS</td>
</tr>
<tr>
<td>2005</td>
<td>2005</td>
<td>44</td>
<td>46</td>
</tr>
<tr>
<td>2007</td>
<td>2005</td>
<td>41</td>
<td>46</td>
</tr>
<tr>
<td>2007</td>
<td>2005</td>
<td>39</td>
<td>46</td>
</tr>
<tr>
<td>2007</td>
<td>2005</td>
<td>37</td>
<td>46</td>
</tr>
</tbody>
</table>

The trends predicted by the capacity model and ACRSS are reasonably consistent. Both models show that the changes in the harvesting groups had a larger impact on the transport schedule requirements than the changes in sidings. The capacity model shows a reduction of four to five locomotive shifts and 12% to 17% waiting time as a result of the changes in harvesting groups and a reduction of two to three locomotive shifts and 2% to 7% waiting time as a result of the changes in sidings. With the larger number of locomotive shifts in the ACRSS simulations, the waiting times for bins were all smaller. The changes in the harvesting groups all but eliminated the waiting time for bins while the changes in sidings had a small effect. By only looking at two days of operation, the siding effect is very sensitive to the sidings in use on those days. Based on the harvester locations in 2005, there was a small reduction in the waiting time but, based on the harvester locations in 2007, there was a small increase in the waiting time.

Harvest / transport scenarios for the 2009 season

Two different issues were examined:

1) Operating in the first few weeks of the 2009 season with only Victoria Mill.
2) Implementing a harvest start time roster where the daily start time for harvest contractors is rostered so that each contractor has an equal number of early, normal and late starts throughout the season.

Simulations showed that the option of starting the 2009 season with just Victoria Mill operating is a viable option from the perspective of the transport system. By reducing harvesting quotas across the whole Herbert region to match the capacity of Victoria Mill, the transport system can service harvesters across the Herbert region from Victoria Mill. The option of running the Macknade transport system as a depot operation from Macknade Mill with Victoria Mill locomotives collecting the Macknade cane from Macknade Mill was also examined but was shown to require more transport resources (locomotives, locomotive shifts and cane bins).

The option of starting the 2009 season using only the more mature cane from the southern cane districts was also examined. The districts examined could not easily support sufficient harvesters to match the capacity of Victoria Mill. The simulations also showed that the rail network would limit the ability of the transport system to supply sufficient cane bins to the harvesters, due to the constraints associated with locomotive passing. It is recommended that further early season options for processing the more mature cane be considered such as operating Victoria Mill with only one milling train or operating only Macknade Mill.

Harvest start time rosters, where harvesters are rostered to have an equal spread of start times through the season, were examined and found to be feasible from a transport system perspective. Differences up to two shifts in the optimised schedules were found for the different harvest start time rosters that were examined and it is expected that these differences could be accommodated within the number of locomotives, locomotive shifts and cane bins that were available in the 2008 season.

Harvester Roster Optimisation

The Harvest Roster model, developed by CSIRO, optimises harvest rosters to reduce the variation of total daily allotments for the mill throughout the season, whilst catering for siding clashes and bin fleet usage. The model has been used for a number of years at various sites, including the Herbert, to set up the harvest rosters prior to each season.
Prior to this project, the model was always run by researchers using data supplied by mill staff. This project has developed an enhanced user interface and integrated the model into the TOTools system. This allows the model to be now be used directly by mill staff.

TOTools is currently being upgraded under a separate project, funded independently by the various TOTools Mills. Since the Herbert mills are planning to be the first users of the upgraded TOTools in the 2008 season, the Harvest Roster Interface has been added to this new version of TOTools. As other mills throughout the industry move to the new TOTools in future years, they will automatically gain access to the Harvest Roster Interface.

The major benefits of integrating the model into TOTools are:

- All data required for the model, such as harvesting groups, daily allotments, sidings etc, currently reside in TOTools.
- The resultant rosters are implemented via TOTools. By integrating into TOTools, the process of transferring the data to TOTools occurs automatically.

Whilst the enhancements to the model have concentrated on the user interface, some modifications were required to the underlying Fortran model to make its data format compatible with TOTools data. No changes have been made to the optimising code. Changes made to the Fortran code include:

- Removing hard-coded values for number of season days, number of bin types and number of mills. These are now read from the input file.
- Sizes of some internal arrays have been increased to allow for more flexible TOTools formats.
- Specification of the roster patterns is now more generic to allow it to handle the generic TOTools format.

The user interface to the model has been developed as a TOTools module, allowing it to be accessed from within the TOTools program. The main Harvest Roster Optimiser screen is shown in Figure 5. From this screen, the required data can be extracted from TOTools, edited and/or entered manually. The model can then be run and the output viewed and exported back to TOTools.
Since the interface has been incorporated into TOTools, the installation and updating of the interface occurs synchronously with the TOTools installation. For the 2008 season the harvest roster was optimised using the same process as previous years, i.e. sending the data to researchers at CSIRO, and well as by using the new interface. This provided a good means of validating the interface.

**TOTools**

For the 2008 crushing season, a reduction in the number of locomotive shifts each day was desired, in an effort to reduce transport costs. Coupled with this desire to reduce transport costs was a desire not to increase harvest costs. To achieve these objectives, use of SRI’s scheduling packages ACTSS and ACRSS were used.

Two of CSR’s traffic officers (Paul O’Sullivan and Kevin Phillips) were set up by researchers to use the ACRSS automatic scheduler. Time constraints prevented many useful outcomes from being achieved during this process although the experience gained is expected to be useful in preparation for the 2009 crushing season.

In 2008, the schedules were checked using SRI’s ACTSS schedule checker and simulator. The checking process enabled some refinement of the locomotive runs. The main criterion used to refine the schedule was to reduce harvester wait times (when harvesters are waiting for empty bins to be delivered). To achieve this objective, some locomotive run start times were adjusted and some harvester start times were adjusted. An example ‘harvester utilisation chart’ from ACTSS is presented in Figure 6. The sections of the bars filled in red represent times of harvest while the sections of the bars not filled represent harvest wait times.
Harvest/Transport Integration - Siding Bookings

The objective of the initiative included implementation of a web-based siding booking/planning system. A siding booking system not only provides a better means of improving harvest & transport logistics but also enhances the long-term capacity for capturing vital information for assessing performance of siding upgrades and partnering of harvesters.

Two systems currently used elsewhere in the sugar industry were considered for implementation in the Herbert. They are the system in use at Proserpine, which was developed by Central Queensland University, and the system in use at Mackay Sugar, which was developed in-house by Mackay Sugar. Both systems could be made available for use in the Herbert.

A meeting involving CSR transport representatives and researchers was held on 20 September 2007 to determine the advantages and disadvantages of each system. A brief summary of these discussions is shown in Table 4.
Table 4. Comparison of siding booking systems

<table>
<thead>
<tr>
<th>MSCA</th>
<th>CQU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pros</strong></td>
<td><strong>Pros</strong></td>
</tr>
<tr>
<td>CSD friendly</td>
<td>Web based</td>
</tr>
<tr>
<td>Full access to source code</td>
<td>Sophisticated rules</td>
</tr>
<tr>
<td>Certain future</td>
<td>Part development real time scheduler</td>
</tr>
<tr>
<td>Licence fee not an issue</td>
<td>Automatically transfers info to TOTools</td>
</tr>
<tr>
<td>Based on Higgins roster</td>
<td></td>
</tr>
<tr>
<td><strong>Cons</strong></td>
<td><strong>Cons</strong></td>
</tr>
<tr>
<td>Internal system (very limited web ability)</td>
<td>CSD needs system expert</td>
</tr>
<tr>
<td>Limited rule capability</td>
<td>What happens ‘Post Arthur’</td>
</tr>
<tr>
<td>Doesn’t currently transfer info to TOTools</td>
<td>Licence fees</td>
</tr>
<tr>
<td></td>
<td>No linkage to Higgins roster</td>
</tr>
</tbody>
</table>

At a subsequent meeting with CSR staff, it was decided to proceed with the CQU system. Some enhancements were made to the system to cater for the specific needs in the Herbert and it was installed and tested in the Herbert.

The CQU system allows sidings to be booked in advance for specific harvesting groups. It allows groups to use the Internet to see all the current siding bookings and to make their own siding bookings. Although groups will be able to book their sidings themselves via the web, this functionality won’t be enabled for the 2008 season and all bookings will be entered by CSR traffic staff. This will enable Herbert specific expert-system rules to be refined during 2008.

**Evaluation**

The first step in the process was to establish subjective and objective evaluation criteria. To explore the social criteria and data needs in greater detail. The project team decided to use 2005/6 as the baseline year. Table 5 shows a list of general evaluation criteria which were found to have relevance to the project. The most important evaluation criterion was agility. The redefinition of harvest groups may lead to improved ability to allow mill operation and harvesting to continue across the region irrespective of climatic conditions. Leanness would be measured in the system as efficiency. This will be an important aspect of the changes to the sidings in the region and a secondary aspect to agility. While it is a subjective criteria, the integration of the supply chain is an important aspect of supply chain function. It will likely be evaluated through some measure of trust across sectors. Resiliency of the chain has some relationship to agility and has been included here as a greater goal of the research team which can contribute to future evaluation of the Herbert and other regions.
Table 5. Categorical criteria for the Herbert region sugar supply chain evaluation.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Measure</th>
<th>units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agility</td>
<td>Flexibility; capacity to meet changing demand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leanness</td>
<td>Efficiency; Least cost of production</td>
<td>Information exchange (quantity, quality)</td>
<td></td>
</tr>
<tr>
<td>Integration</td>
<td>Cooperation among chain participants; trust; communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resilience</td>
<td>Redundancy</td>
<td>Capacity to function outside of normal (expected) range</td>
<td>?</td>
</tr>
</tbody>
</table>

With the criteria of Table 5 in mind the specific variables for the evaluation are defined as follows:

Changes in partnering/regrouping pilots versus not doing anything
- Cost savings or increases - quantitative
- Changes in delays and wet weather down time experienced by harvesters – quantitative
- Changes in flexibility to adapt to climate variability and ground wetness - qualitative and quantitative

Changes in attitudes towards harvester regrouping/partnering in the Herbert - qualitative
Changes in effectiveness of harvester logistics planning in the region – quantitative and qualitative
- Communication between harvest planning and transport planning
- Communication between harvesters
- Ability for harvesters to manage their movements across sidings
- Resources required from traffic office

Changes in ability to produce an effective transport schedule – quantitative and qualitative
- Reliability of bin deliveries
- Ability to plan ahead
- Ability to balance branch lines
- Ability to accommodate or recover from wet weather disruptions – qualitative
- Changes in mill and transport down time

The industry needs to effectively measure the system now as well as after implementation. This would have been data intensive and will likely require more than one year of implementation due to year to year variability. Often adoption will be evolutionary so that the full benefits or implementation may not be measurable after the first year of change.

One of the biggest obstacles to an effective quantitative implementation will be the changing baseline. That is, there are other changes in the value chain that confound the evaluation, and it is often extremely difficult to separate out the benefits that are attributed to the adoption versus the other simultaneous changes. The baseline is also confounded by changing climate and production patterns from year to year.

Figure 7 shows the attributes required to measure agility and the characteristics (from Lin et al., 2006) to assess the attributes. The agility characteristics are responsiveness, competency, flexibility and quickness. The main attributes are Collaborative relationships, Process integration, information integration and market sensitivity. These main attributes are measurable through sub-attributes that are measured in the harvest transport system.

We identified three quantitative and one qualitative sub-attributes of the attributes of an agile value chain function for the Herbert sugar region. These are mill crush rate, network, harvest wait time and trust. These sub-attributes are a subset of possible indicators of system agility. These sub-attributes should have the
capacity to be combined in measures of agile function that objectively measure positive or negative value chain changes with respect to agility.

Figure 7. Agility evaluation characteristics, attributes and sub-attributes

The sub-attributes can be qualitative and quantitative. The categories of the types of sub-attributes we want to measure are:

- **Qualitative**
  - Value to users of improved practice vs previous practice
  - Social capacity which can have transaction costs

- **Quantitative**
  - Measure existing waiting time
  - Variability of waiting times
  - Current harvesting cost
  - Transport costs.

Table 6 shows some of the data available to measure the sub attributes that were collected from Mill delays. The next step is to determine which of these data are available and in what quantities and qualities to perform an analysis on system agility.
Table 6. Data to measure the sub attributes of agility

<table>
<thead>
<tr>
<th>Sub attribute</th>
<th>Data</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mill Crush Rate</td>
<td>Weather event delay</td>
<td>(h)</td>
</tr>
<tr>
<td></td>
<td>Unscheduled Mill shutdown</td>
<td>(h)</td>
</tr>
<tr>
<td></td>
<td>Full yard bottleneck</td>
<td>(h)</td>
</tr>
<tr>
<td></td>
<td>Locomotive Faults</td>
<td>(h)</td>
</tr>
<tr>
<td></td>
<td>Delays at passing loops</td>
<td>(h)</td>
</tr>
<tr>
<td></td>
<td>Empties waiting delays</td>
<td>(h)</td>
</tr>
<tr>
<td></td>
<td>Maintenance delays</td>
<td>(h)</td>
</tr>
<tr>
<td></td>
<td>Siding changes delays</td>
<td>(h)</td>
</tr>
<tr>
<td></td>
<td>Harvester Breakdown</td>
<td>(h)</td>
</tr>
<tr>
<td></td>
<td>Harvester Variation from planned siding location</td>
<td>(h)</td>
</tr>
<tr>
<td></td>
<td>Harvester Deviation from start time</td>
<td>(h)</td>
</tr>
</tbody>
</table>

A goal in the quantitative evaluation will be to isolate some of the variables listed above from the confounding effects. Not all variables may be isolated. Generally, the more operational (versus strategic) the variable, the easier it will be to isolate confounding effects. For example, it may be difficult to isolate delays from wet weather from confounding effects of changes to season start time or dry years versus wet years. However, variables such as reliability of bin deliveries will be easier to isolate, particularly since similar types of days between two years could be compared. Overall, there will be a scientific challenge to provide a rigorous evaluation, but will be novel and essential for the Australian sugar industry and the Herbert region.

Some of the data required for the quantitative evaluation has not been historically collected by the mill and by harvesters. A process for this data gathering (or pilot monitoring) was established prior to the pilot implementation in 2007 and 2008. Because of the limitations of actual records kept, as described by industry members, it was decided that agility with respect to a very limited number of possible interruptions would be presumed. For example climate interruptions such as rain events or major mechanical malfunctions of locomotives. The effect of such events would be coordinated across the three attributes that represented the different sectors in the chain. The climate data, from 2003 to 2006, was collected from growers from different rain stations across the Herbert region. Data from train network and mill deliveries were collected from mill records on all stoppages across the Vitoria mill region from 2003 to present. Diaries were acquired from a single harvester as the best representation of the data available in this sector.

At this initial processing stage some problems were encountered. After reviewing the diaries from the harvester we concluded that not enough data existed to develop a linear model for this attribute (harvest time). While these attributes were to be individually developed, a requirement of the overall system analysis was a linking through or across the individual sectors. It was still possible to proceed with an analysis of delays from weather events and stoppages to the mill; however the value of the output may come into question. The greater problem for this analysis was a lack of resources to process the data. Because of the large amount of data from the mill it would be necessary to hire someone to do with the data analysis and processing the data from the mill (stoppage data). We initiated a process of hiring a student from the University of Queensland to undertake the data analysis and processing the data into a database, however budgetary restraints limited that option. Given the required time investment and that only part of the findings could actually be achieved it was decided that we should not continue to pursue the quantitative analysis at this time.

Trust Survey

A survey was designed to capture knowledge about the qualitative sub-attribute of trust, and would provide a qualitative indicator of health of collaborative relationships that exist in the region. There is some indication from the scientific literature that measuring trust relates to the transaction costs associated with processes in networks (Faulk and Gunter, 1999). The survey was adapted from Lewis (1999). The survey was
administered to the project team as a pilot group to determine suitability and acquire a small data set which could be used to make a preliminary analysis. It is contained in Appendix A. The questions surveyed the extent of trust and integration among mill-region members within and across sectors. The survey looked at trust and mistrust as well as incorporating an element of the progression of attitudes of members in the region about trust building in their community. The survey was prepared to be given for the regional workshop on 7 May, 2008. A statistically significant sample size was chosen and participants were randomly selected to attend. However due to a very low turn-out among producers, the survey could not be given at that time.


**Harvest Haul**

The Harvest Haul model was to serve three purposes in the project:

1) Evaluate scenarios for harvester rationalisation
2) Evaluate impacts of new sidings on harvesters
3) Explore options for harvesters to optimise their operations around the new sidings.

The Harvest Haul work did not progress too far in the project, mainly due to the difficulty of obtaining up to date information on new sidings and the rapidly evolving harvesting groups. The Harvest Haul model is very data intensive, and requires up-to-date data sets to provide meaningful outputs.

Where we got up to in the data collection is as follows. Data requirements can be divided: productivity data (block data such as yield and area), capital equipment data, and, GIS (or spatial). Block productivity data for the 2007 season was obtained from the mill. Capital equipment data was obtained from two sources: Harvester data was held by HCPSL as part of their GPS program which detailed the make, model and type for each harvester in the Herbert region. A capital value schedule was used to derive capital and salvage values for this equipment. Haul-out equipment data was used from the 2004 study of the Herbert region. Capital and salvage values remained unchanged to reflect that the overall value of the haul fleet remained unchanged and machine depreciation was balanced against machine replacement.

By obtaining all of the above data a regional-level analysis can be constructed which will reflect the net value of changes across the region. However it does not necessarily reflect the exact case for each individual group because broad-brush assumptions are necessarily used and do not account for all anomalies and idiosyncrasies of each group. Through the process of negotiation of siding location results (including inputs and assumptions) of the Harvest Haul model have been made available to the stakeholders in each group. However this process was slow, and the GIS information for the new sidings (including block to siding allocations) was not available until late in the project. This restricted the application of the harvest haul model.

**Outputs:**

1) A web-based siding booking/planning system for harvesters that provides a better means of improving harvest & transport logistics
2) A user-friendly version of the harvester roster model implemented at the mill, and used form 2008 onwards.
3) A documented methodology for objectively evaluating the impacts (including exposure to risks and uncertainty) to chain participants from the implemented changes in harvesting and transport, which can then be readily adapted to help promote beneficial value chain changes in other sugar regions.

4) A set of tools available to optimise the operational efficiencies (e.g. transport schedules, rolling stock management) given the strategic change in sidings and harvesting groups.

There has been a wide range of communication activities, including: 1) HCPSL workshop on Harvest Management, Quality, Equity and Transportation Information System; 2) Herbert River Express article 30th October 2007: From field to factory; 3) ABC North QLD Rural Report, 25th October 2007: After Action Review 10th December 2007 of Harvest Management and Transport Operations outcomes from the 2007 season; Enhancing efficiency from field to factory; 4) ASSCT paper 2008: Harvest Planning for growers – Prestwidge et al; 5) Industry workshop on 6th May with an anticipated 100 participants; 6) Industry Cane Supply & Transport Steering Group meeting, Brisbane 29 November 2007; 7) Cane Productivity Initiative Forums – 8-9th May (5 Forums); 8) Harvester Best Practice Workshop – 22nd April 2008– Ash Benson.

Intellectual Property and Confidentiality:

The IP developed in the project is around enhancements to the siding booking system, transport tools, and enhancements to SugarMax. The IP will be owned by the individual organisations developing the tools. Whilst there is no formal IP protection, the Herbert sugar industry will have full access. The CSIRO tools (SugarMax, harvester rosters, transport modelling) have been transferred across to the local industry, through adoption by BSES the HPCSL and SRI. Where necessary, the full source code has been provided to these sugar industry organisations to recreate (and maintain) the tools in a way that is more integral to other tools used within the industry.

No information in the final report is confidential.

Environmental and Social Impacts:

The main social impacts are as follows:

1) Improved negotiation amongst harvesters when booking a siding, through the use of the siding booking tool.
2) Reduced waiting time of harvesters waiting for bins through the implementation of more effective planning tools for harvesting and transport.
3) Increased capacity for the local industry organisations to work together to address major opportunities for the region that require a collaborative approach

Expected Outcomes:

1) Reduction in harvesting costs through better management of harvester movements across sidings
2) Reduction in transport costs through better matching of tactical schedules to new sidings and rationalised harvesting groups.
3) Reduced harvesting and transport costs from a reduced variable daily cane supply to the mill and along branch lines, resulting from optimised harvester rosters

Future Research Needs:

Nil
**Recommendations:**

1) The region should learn from the success of SugarMax in the Tully, and look at adopting the web approach used in that region.

2) Implementing of the harvester booking work should be further supported beyond the life of this shortened project, as further development will progressively lead to a much needed improved integration between harvesting and transport activities.

Management was difficult due to the large number of organisations involved given the limited budget. In the future a project with this many organisations and research activities really needs a project manager.

**List of Publications:**


Appendix A

Trust Survey
Herbert Sugar Industry

Measure of Trust Assessment

Introduction:

SRDC have funded a project entitled *Enhancing Efficiency and Integration from Field to Factory in the Herbert*. This project is led by CANEGROWERS Herbert River, CSR, and the QMCHA. The aim of the project is to implement various options for reducing costs and increasing reliability across the harvesting and transport sectors of the Herbert value chain. Objectives of this project include:

- Providing the most effective adoption of the siding rationalisation plan, infrastructure modifications, transition to larger harvesting groups or co-operating groups and rostered time window of harvesting, accommodating the different micro level issues and goals at the siding, harvesting group and grower level.
- Optimising the operational functioning of these restructured harvesting and transport arrangements to maximise economic gains and reliability
- Objectively evaluating the strategic and operational changes to measure the value created to each chain participant.

One of the elements to measure the success, or otherwise, of this project is to assess the level of trust between each of the value chain participants. The value chain participants have been identified as: growers, harvesters, cane transporters, millers, and researchers (including extension). This assessment tool measures the level of trust that exists within the sugar industry value chain in the Herbert.

Instructions for Completing this Assessment:

You will need to identify which sector of the sugar industry you identify with.
You will need to then complete this questionnaire for each of the other value chain participants identified.
This means that you will fill out four assessments in total.
In this questionnaire:
- **We and Our** – means your sector and the other value chain participant being assessed.
- **They** – means the other value chain participant being assessed.

For each question, in Sections 2 and 3, circle one number between -5 and 5, depending on which statement you agree with, and how strongly.
The answers you give are anonymous. Data collected will be aggregated together for research purposes only. Keep the four forms together for data entry, by staple for example.

**Section 1: Rating Information**

Are you a (circle one):

- Grower
- Harvester
- Cane Transporter
- Miller
- Researcher

Which Value Chain Participant are you assessing (circle one):

- Grower
- Harvester
- Cane Transporter
- Miller
- Researcher

**Section 2: Conditions**

1. We have better alternatives _____________________________

   -5 -4 -3 -2 -1 0 1 2 3 4 5  Working together is the best

   [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
than working with them.

This is not a priority for parts of our firm who contribution will be essential.

2. Our conversations do not go beyond being cordial. I am often surprised by their behaviour.

| -5 | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 |

| | | | | | | | | | | |

We have strong interpersonal bonds that:
- Keep me informed on all matters
- Make it easy to raise tough issues
- Help us find constructive solutions

3. Our joint leaders are ineffective together.

| -5 | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 |

| | | | | | | | | | | |

Our joint leaders always provide needed resources, get the best out of everyone, and keep us on course.

4. Beyond a general mission statement, we have not defined any mutual objectives.

| -5 | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 |

| | | | | | | | | | | |

Our mutual objectives:
- Integrate our separate objectives
- Are clear enough to guide our day-to-day activities

5. They have no formal way to safeguard sensitive information.

| -5 | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 |

| | | | | | | | | | | |

They are airtight with out information.

6. There is little enthusiasm for our relationship on one or both sides.

| -5 | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 |

| | | | | | | | | | | |

There is a high level of commitment to, and enthusiasm for, our relationship.

We get high levels of strategic and operating level support from both parties.

7. Our cultures conflict with what our objectives require.

| -5 | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 |

| | | | | | | | | | | |

The style we need for success is identical to our normal behaviour.

8. Likely changes in their people, procedures, or policies will weaken our ability to rely on them.

| -5 | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 |

| | | | | | | | | | | |

Any changes they are likely to make will not disrupt our relationship.

Section 3: Practices

1. We cannot rely on what they say.

| -5 | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 |

| | | | | | | | | | | |

They always do what they say.
2. They often assign people with weak relationship or professional skills to joint projects.

We always get their best people for joint projects.

3. Joint teams are rarely effective between us.

Joint teams between us produce superior results.

4. Their conduct often suggests hidden agendas.

They always behave admirably.

5. We don’t get the information we need from them.

We get all the information we need from them.

We don’t share as much information as we might.

We extensively share information.

6. We are rarely creative together.

We often combine our expertise to produce truly superior results.

7. Many conflicts stay unresolved. Others are resolved through power, bargaining, or a reference to rights.

We always treat conflicts as a chance to understand each other better and be creative together.

8. Our relationship plans exceed the conditions for trust.

All activities within our scope meet the conditions for trust.

9. With our plans, we are reaching beyond our abilities to deliver.

Our plans can be implemented with a high probability of success.

10. People at and behind each interface (between us) are neither empowered nor encouraged to perform as needed.

They clearly and consistently support our objectives at all levels and at every interface between us.

11. Our structure prevents us from establishing the patterns we need, or from securing important benefits.

Our structure clearly reinforces our essential activities and allows us to capture all meaningful
12. There are no clear governing arrangements that support our relationship.

13. Our progress measures are vague or inconsistent with theirs.

14. Key people are excluded from our relationship.

15. We are often confused or surprised at joint meetings. Friction occurs too often at joint meetings.

16. Too many issues between us cause damage between us before they get settled.

17. They often try to get their way, at our expense.

18. We do not communicate our joint benefits widely.

19. The next problem they cause will be the last!

20. We seem to be stuck with...
them in this relationship.

21. **We have never made joint success visible.***

We regularly celebrate joint success together.

way to meet important objectives.
Section 4: Further Information

What is your gender? (circle one): Female Male

What is your age in years? _____ years

Do you believe the level of trust between you and the party being rated has changed in the past 12 months? (tick one):

☐ Is markedly worse now than 12 months ago
☐ Is worse than 12 months ago
☐ Has not changed
☐ Is better than 12 months ago
☐ Is markedly better than 12 months ago

Do you have any comments about the level of trust between you and the party being rated?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

How could the level of trust between you and the party being rated be improved?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Thank you for taking the time to fill out this assessment.

This instrument was adapted by Raymond De Lai HRIC for the SRDC project FPP109, from measures of trust in: Lewis, J.D. (1999) Trusted Partners: How Companies Build Mutual Trust and Win Together. The Free Press, New York, USA, pp.209-221
Appendix B  Workshop for Siding booking

Borello’s Siding

20.3.07

Mr. M. Pisano’s Group

Fact:
1. If more than one harvester in singing only 50 bins are placed in Borello siding.
2. Land is available for a larger siding.
3. Harvesting quotas are getting bigger – with compensation.
4. In wet year (1998) we are able to load 100 bins.
5. With strong SE winds the bins run out towards the mill.
6. Unable to push back 50 full bins due to haul outs driving on the full line.

Feelings:
1. As a loco driver I’m frustrated because I need to do multiple shunts.
2. Something has to be done – there is too much stress for all involved.
3. Unhealthy loco may of contributed to the problems.

Risks:
1. Increase in derailments and possibility of injury at siding.
2. Possibility of not having cane harvested at the correct time – all stakeholders losing out.
3. Unnecessary waiting time – increase in fatigue potential.

Positives:
1. “Position/Location”

What Worked:
1. Voting for best results.
2. Seeing the other person’s point of view.
3. Having all parties present.
4. Created recommendations.
5. Two working groups, with smaller group idea.

What didn’t Work:
1. Factual/Survey information.

Suggestions for Improvements:
1. This process should have been done first time.

Need to be done:
1. Commitments/Involvement

Option 1:-

Fact:
1. Big enough.
2. Good to service.
3. Good access.
4. Possible ability for two machines.

Feeling:
1. Less frustration for Harvesters and Loco’s.
2. Consideration for houses in proximity.
Risks:
1. Loco and tipper traffic in one working area.
2. Noise and dust for household.

Positives:
1. Minimises private land usage,
2. Flexibility for cane movement at given time.
3. No overflows required.
4. Quick service time for loco’s.
5. Less chance of derailments.
6. No shunting of road crossings.
7. Ability for two machines.
8. Ability to save loco delivery to siding.

Michael Pisano to:-
1. Meet with, Mr. Alan Altoft / Siding Coordinator at CSR, for Project Commencement on Friday 30th March 2007.
3. CSR to discuss with landholders or owners and homeowners.
4. Michael/Alan to convene a meeting of all stakeholders for Friday 30th April 2007.
5. Agreements in place by Wednesday 30th May 2007 and signed.
6. Implements & Completion no later than May 2008 season.

1. 9. Third line towards Mandam Road.
   Centre line in accordance with tipper Pad.
   Line stays on road reserve and extends to 150 – 200 bins.

2. 7. Three line siding Pad in centre min 150 bins.

3. 1. Compensate Landholder with three day Preference.

4. 9. Capacity for two harvesters to operate in one siding together.

5. 0. Single line loop with loco escape. If land is a problem.

6. 4. Three lines with Pads on each side.

Mr. J. Cantamessa’s Group
• Quick fix for this year:
  - Permission to tip close to road for this year.
  - CSR’s willingness to extend tipper pad.
  - Tractor to pull bins in if needed.

• Action:
  - Check with Council – Alan Cazzulino.
  - Check with CSR – Paul G
  - Check implications to use tractors – Ray

• Facts:
  1. Can only use one line (for delivery).
  2. Can’t push back because line is dirty from dirt build up creating resistance.
  3. Need to remove bins to another location and run around them – time consuming.
  4. 35 bins most can be pushed back, without causing bins to derail.
  5. This siding was purpose built for RoRo.
6. It is summarised that a smaller loco is inadequate to service this siding.
7. Fact is larger loco’s are not always available to be sent here.
8. Half of drivers are inexperienced!!
9. This siding is also always dirty.
10. Bin fleet is ancient and not good for pushing back – not 100%.
11. That siding is used in wet weather and contributes to making it hard to push bins back.
12. Siding holds 107 bins per line and we only put 50 in at a time – the curve contributes to the problem.

- **Emotions:**
  1. Time it takes to service the siding – frustrations for Harvester Crew.
  2. Frustrating for loco crews also.
  3. For all concerned.
  4. Farmers frustrated because it has taken more than 2 years for something to be done about it.
  5. Farmers can’t cut in rotation due to capacity and access issues.
  6. Drivers become frustrated at the time required to service this siding.
  7. Stubborness of OP Centre.
  8. Stress in the workplace.

- **Risks:** (of doing nothing)
  1. More stress

- **Positives:**
  1. These are none is nothing is done.

**100 bin tipper line and loading close to road.**

**Facts:**
- Permission
- Capacity to hold more bins
- Less shunting
- Better harvester efficiency

**Emotions:**
- Quick fix solutions
- Less anguish
- Safety concerns

**Risks:**
- Public liability

**Positives:**
- Increase capacity
- Better for everyone

**Contractor to help shunt.**

**Facts:**
- Speed up shunting
- Less time in paddock for harvester

**Emotions:**
- Quick fix solutions
- Less anguish
- Safety concerns
Risks:
- Public liability
- Communication between loco and tractor

Positives
- Less time taken

Agreed to clean line (dirt)

Fact:
- Clean line easier for shunting

What worked.
1. Right mix of people in attendance.
2. Kept on track.
3. All opinions were discussed/considered.
4. Variety of ideas.

What didn’t work.
1. The people who control the ‘Purse strings not here’.
2. Time factor – too late in the season.
3. ‘Hypnotism Feeling’ in the beginning.
4. The ‘but’ factor still comes up.

Suggestions for improvements.
1. Follow-up meetings.
2. Communication between each group member.
3. Share with other teams.

Ideas.
1. Restrict number of groups in area.
2. Tipper pad on all 100 bins.
3. Check it can tip on to close line to road.
4. Use contractors to help with shunting.
5. Communication with loco.
6. 4 trains instead of 2 trains.
7. Uniforming of shunting.
8. Leave empty bins at Kemp’s Loop.
9. Agree who is to clean siding (dirt).