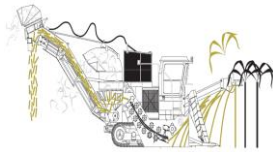


**SRDC Research Project  
Final Report**

**Development of a real time information  
system for Clarence harvesters**

Project Reference Number: CHC002



**Clarence  
Harvesting**  
Co-operative Limited



New South Wales  
Sugar Milling Co-operative



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**Australian Government**  
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## **Executive Summary:**

The Clarence Harvesting Co-operative was formed from the amalgamation of two existing harvesting co-operatives, which in the later years of the project consisted of four harvesters cutting a total of between 350,000 and 500,000 tonnes of cane each year. Soon after the formation of the co-operative the managers discovered that access to near real time information about the supply chain was required to realise the benefits of the larger harvesting operation.

The required information was available but stored in separate and proprietary systems within the sugar mill. This made it difficult to access, correlate and deliver the information in a meaningful and timely manner to assist harvesting crews. A data transfer system to provide this information was conceived to integrate with a mobile phone-based consignment system planned by NSW Sugar. SRDC provided funding to allow Agtrix Pty Ltd to develop the solution, which was called SHIRT (Supply and Harvester Information in Real Time). SHIRT provided harvesting crews with valuable information about what was happening in the transport and milling operations as soon as the information was available. The data was transferred from each proprietary system in real time to a single external database. The data was then linked and merged, enabling meaningful reports to be collated and delivered to harvesting crews through a web site. Accessing the information through the web site was restricted by employing an access and authorisation process that filtered the data available to users based on their roles (grower, manager etc.), affiliation (farm, harvesting group, mill etc.) and/or their method of access (mobile, touchscreen or computer). Various devices were employed to access SHIRT including (a) a large screen mobile phone used by the supervisor of the Clarence Harvesting Co-operative, (b) touchscreens and modems fitted to either a haulout or a harvester in each crew from which the crews were able to access SHIRT and (c) the NSW Sugar web site used to distribute information to growers. Feedback from an end of season questionnaire and workshop indicated that the information being supplied to the crews was very useful for their daily management. The questionnaire completed by members of the value chain showed an increase in the level of satisfaction compared to the same questionnaire completed 4 years earlier. A couple of crews could not find anything major to complain about and so did not complete a questionnaire. SHIRT was available for use at Harwood for most of 2009 and will be introduced to the other two NSW Mills in 2010. NSW Sugar has incorporated the maintenance of SHIRT into their Service Level Agreement with Agtrix Pty Ltd, thus ensuring that it will evolve with the business and the benefits from this project will remain available to members of the value chain.

## **Background:**

Clarence Harvesting Co-operative was founded in 2005 after the merger of two smaller operations and operates 4 harvesters that supplies about 60% of the cane to Harwood Mill.

In smaller harvesting co-operatives management is fairly limited and that which is undertaken is often on a near voluntary basis from the directors. As co-operatives get larger the directors no longer have the time (and perhaps not the skills) to undertake the day-to-day management. Hence, a supervisor needs to be employed, which is adding a layer of cost. Our experience in 2005 found that the supervisor added cost but very little value. To add value a supervisor needs to be able to shift the workload between the various machines as the conditions dictate. To do this effectively, the supervisor needs to know how each of the crews are performing, as well as other aspects of the value chain. Using a phone to continually check on how things are going with each crew is disruptive and inefficient. By providing information about the value chain in near real time, this project aims to provide tools to enable a larger co-operative to be managed more effectively.

## **Objectives:**

The original project proposal stated the following objectives:

*This project seeks to provide near real time information about the performance of the various stages of the value chain to all participants at Harwood Mill. The aim of the project is to better utilise data which is already being collected. This will centre around a web site and therefore will be available to all who have authorised access, eg growers, harvest supervisors and mill staff. In addition, this project will communicate this information to the harvest operators, so that they have up to date information to enable them to optimise the management of their daily operations. We expect that knowing what is happening, instead of wondering what could be happening to the rest of the chain, the harvest crews will become more productive and more satisfied. They will be more satisfied as bin delivery movements will become transparent and therefore easier to manage.*

The project team has fully achieved these objectives, with the successful implementation of a web based data distribution system that provides useful information about the supply chain to harvest operators, growers, harvest supervisors, truck supervisors and mill staff. This is fully functional at Harwood Mill and able to be implemented at the other two NSW Mills. NSW Sugar is in the process of incorporating the maintenance of this system into their agreement with Agtrix Pty Ltd, thereby ensuring that the results of this research is fully utilised in the ongoing supply chain management processes used at the three NSW mills. An identical questionnaire completed prior to the start of the project and at the end of the project showed an increase in the satisfaction levels, with some harvesting crews declining to fill out the later one, as they had nothing major to complain about.

## **Methodology:**

Details of the project are contained in the paper presented to the ASSCT (Australian Society of Sugar cane Technologists) conference in Ballina in May, 2009, which can be found in Appendix I.

As with most information technology projects, this project was resource intensive at the beginning, as new concepts had to be developed and then implemented. Early on it was decided to use a web site to disseminate the data, which has proved to be an excellent idea, as it means that the dataset can be accessed by authorised users, wherever internet access is available. The increased acceptance

of iPhones and other mobile computing devices over the past couple of years has verified this choice of information delivery. Furthermore, the other key advantage of a web based application is that software updates are not necessary, as only the application on the server needs to be modified. This allows for easy changes to the outputs.

The project team at Agtrix developed “data pumps”, which are used to extract the data required from the various proprietary data sources within the secure NSW Sugar network. This is one of the most problematic areas, as sometimes servers or data locations change making it a task at the beginning of each season to track down where all the data sources are currently stored. The other major challenge was to link together data that had not been designed to be matched. This is the result of various applications being developed to solve a particular problem, which they do excellently, but not necessarily using linking or transferrable concepts. The project team at Agtrix, however, did manage to find ways to link the data and store it all into a single database. From this it was then a matter of working out what data we wanted to look at and how it should be displayed.

The look of the data outputs evolved over a two year period, mainly being a two way exchange between a user (Peter Rose) and a developer (Stuart McRae, Agtrix). During the season, some feedback was obtained from the field and these ideas incorporated. At the end of the last two seasons, workshops were held and the feedback obtained has been incorporated. Due to the way that the data is collected and stored, it is usually possible to quite quickly provide any new data requests. Some take a bit longer, as the project team have to work out how to process the data to provide the necessary answer.

### **Outputs:**

The main outputs for this project are the screens that the users view the data and an overview of these can be seen in Appendix I. They are always evolving, with the latest set a bit different to those in Appendix I and the ones for the next season will be slightly different again, as the latest feedback from the users is incorporated, however, the ones in Appendix I show quite well the type of outputs that are possible.

### **Intellectual Property and Confidentiality:**

Most of the products used in this project are available on the market. This project has been about the implementation of an idea, using these products. Agtrix Pty Ltd has gained useful experience in the implementation of this idea and will use this experience for commercial benefit if possible. However, this will not stop any other entity from developing the ideas contained in this report.

### **Environmental and Social Impacts:**

The original proposal indicated that 40% of the benefits from the project would be social and 60% economic. The reason that the social benefit was put so high was due to the high level of frustration expressed at times by the crews at the lack of information from the mill and the perceived inequity of bin supply.

One of the questions in our questionnaire asked “What do you personally see as the main opportunity to improve...” The pre survey (Appendix II) had 76% of respondents indicating that either communication or bin management were an issue. In the post survey (Appendix III) these two topics had reduced to 37% of respondents. This improvement was highlighted in the process of trying to get crews to return their questionnaires at the end of the 2009 season as a couple of crews indicating that they had nothing to complain about and so had difficulty in filling it out.

Furthermore as the crews know in near real time what is happening with bin supply, there is less antagonism between the crews and cane supply staff resulting in a much improved working relationship. The Cane Supply Superintendent, has indicated that he has had virtually no complaints about bin supply during the last two seasons, this is in contrast to most other mills, where there is an ongoing battle between mill staff and harvest crews about bin supply.

Although some other factors may have contributed to this improvement, it is felt that this project has been the key driver for the improvement in these issues. Many issues that develop are perceived ones generated by poor communication and a lack of data. This project has shown that the provision of good data in a timely manner will minimise the development of these perceived issues.

At this point it is pertinent to thank Simon Hollis, Cane Supply Superintendent, Harwood, who without hesitation was happy to release any data that the project wished to have access to. This is in contrast to the Cane Supply Superintendents at the other two NSW mills, who are hesitant to allow a particular data display screen to be released in their mill areas. They fear that this will provide the crews with information to attack them even more. Our experience is the opposite and that as the system is transparent, it becomes obvious why the so-called “issues” have developed.

In reality the initial phase of this project has had an overwhelming social aspect, much greater than the 40% indicated in the proposal. Providing access to useful data about the supply chain has taken away some of the frustration that can build and allow for a more pleasant working experience. Happier workers will usually work more effectively, which will eventually result in a better bottom line and so we expect that as the project matures the economic benefit will flow through.

### **Expected Outcomes:**

The SRDC project managers have been keen that KPI’s (key performance indicators) should be recorded and reported upon. The author has always maintained that these will be quite meaningless, as there are so many other factors that contribute to them (eg weather, crop size, quotas etc).

However, the information that indicates that the project has been successful can be gleaned from the pre and post project questionnaire that various members of the supply chain completed, which has been mentioned earlier in this report. A summary of these questionnaires can be found in Appendix II & III.

However the table below shows some of the data that is recorded each year about the performance of Clarence Harvesting Co-operative.

Season	Tonnes			Yield		Season wages (\$/t)
	Harwood Mill	Clarence Harvesting	% of Mill	One year old	Two year old	
2005	721,371	440,641	61%			\$1.47
2006	832,535	502,226	60%	91	167	\$1.65
2007	728,788	452,290	62%	81	151	\$1.53
2008	611,710	334,818	55%	90	135	\$1.53
2009	576,926	351,345	61%	88	120	\$1.69

The first three columns show the tonnes of cane harvested at Harwood and the percentage of this that is harvested by Clarence Harvesting. A major frost in 2007 resulted in more one year old being cut in that year, which resulted in less 2 year old cane in 2008. This in turn reduced the proportion of supply in 2008 and so the daily quota was lower. The daily quota climbed back up again in 2009,

but due to the lower yields, the crews were needing to spend more time in the field to cut their quota and so the wages cost rose accordingly.

Wage costs are one of the few variables that are able to be managed during the season. The other major costs (repairs and maintenance, depreciation and fuel) are predetermined by board policy, slack season maintenance, crop size and outside influences (weather, oil prices etc). As a consequence wage costs are monitored during the season. The above listing shows the average wage costs towards the end of the season and does not include slack season wages, or holiday pay. This figure was chosen, as at the time of writing a complete year figure did not exist for the 2009 season, but it also fairly represents the wages costs during the actual season.

From the above table it can be seen that this project does not appear to have resulted in an improvement of the wages cost. It can be argued that average yield, daily quotas and weather has had a much greater influence than this project and any benefits are impossible to determine from these performance indicators.

The current supervisor has been in charge for the last three seasons. Another performance indicator that was mentioned was mobile phone usage. In theory, if this project has been successful, there should be a reduced need to be calling the other crews all the time to see what is going on.

During this period the phone plans were changed and so it is not possible to compare straight out cost of calls. However, a representative month (October) was chosen and the pages of outgoing calls from the Supervisors mobile phone were counted from the Telstra bill.

Season	Pages of calls
2007	15
2008	19
2009	25

The above data suggests the opposite to the theory as indicated above. Again it can be argued that the last few seasons have been tough ones from a harvesting operational and management point of view. However, as outlined in the previous section, the outputs from this project do provide a useful tool in aiding the day to day management of a large harvesting co-operative, but it is difficult to capture the benefits using KPI's.

### **Future Research Needs:**

The project has achieved its aim of setting up an information dissemination system that is accessible to authorised users. Due to the way that it was set up, it is relatively easy (ie low cost) to include other outputs or even to include data from other aspects of the value chain (ie for use by off site mill managers to view mill performance information).

SHIRT will be available at the other two NSW mills from the 2010 season. NSW Sugar has recently employed a dedicated field IT officer to maintain and support the mobile phone based consignment system of which SHIRT is now an integral part of. SHIRT has been incorporated into the NSW Sugar Service Level Agreement with Agtrix, thus ensuring that it will evolve with the business and that the benefits from this project will remain available to members of the value chain. In this way it is hoped to supply even more data to the harvesting crews, especially in regards to showing areas of improvement in efficiency.

Therefore, as such there are no further direct research needs only utilisation and improvement of the system.

### **Recommendations:**

One of the key findings from this project was the realisation that the value chain of the NSW Sugar Industry contains quite a lot of data that is often trapped in “silos” (ie created at some stage to solve a problem, but not linked into the overall system). The ideal endpoint would be to have an integrated internal value chain IT system, where all data was linked and accessible on the one system. This project has shown the benefits of linking value chain data such that NSW Sugar is striving to achieve a centralised database for all mill data with an aim to implement this in 2011.

### **List of Publications:**

Sunshine News Sept 2008 – “SHIRT offers more information”

Rose, P., McRae, S. and Codina, G (2009) SHIRT – real time supply chain information for harvester managers. Proc Aust Soc Sugar Cane Technol Vol 31 pp 365 - 371

The above article will also be published in Sugar Cane International in the March- April 2010 edition volume 28(2).

Interview on ABC Rural July 2009

## Appendix II

### Clarence Valley Supply Chain Perception Survey

December 2005 (17 replies)

**1. Please identify your part of the Clarence Valley value chain by highlighting one of:**

Growing    Harvesting    Transport & Cane Supply    Mill  
 (4)                    (13)                    (1)                    (1) (Two people identified with both grower & harvester)

**2. How well do you personally think the members of this chain work together now?**

Very Badly                    Not Well                    Not Bad                    Quite Well                    Extremely Well  
 (2)                    (1)                    (3)                    (11)                    (0)

**3. What aspect or task in the total supply process causes you personally the greatest frustration?**

- **Communication with Mill (7):** Mill breakdowns; Lack of info on Mill stops; Communication from Mill to Harvester in the field; Lack of prompt communication; Lack of communication from Mill; Crushing hiccups; Mill staff become frustrated at times
- **Bin issues (4):** Small daily bin quotas; Bins being delivered to harvesters with empty bins, while others are waiting; Waiting for bin supply; Bin weights
- **Rough tracks and pads (3):** Rough haul-out tracks – rough cane pads
- **Having to work in difficult conditions (2):** Night work, wet weather work, breakdowns; Lack of opportunity to shift cane in good weather conditions;
- **Obtaining accurate information (2):** Accurate information; Incorrect estimates
- Entrenched attitude on the cane growing / harvesting management side
- No place to leave tanker etc on farms besides in field
- Burning cane
- Nothing
- Ground job of harvesting crews

**4. What aspect or task in the total supply process do you think works really well?**

- **Transport logistics to Mill (8):** The Mill operates an excellent just-in-time transport system, but as it is not transparent it is not appreciated by growers and harvesters; Transport logistics; Mill rate control
- **Harvesting (6):** Harvester crews; Our organisation in the field works well; Cutting cane; Harvester's commitment to fill bins
- **Telemetry (3)**
- Extension officers service (BSES)
- Individually we work well, together we need to do better
- No response

**5. What do you personally see as the main opportunity to improve the performance of the supply chain to optimise the production output of the mill and/or to significantly reduce cost or time?**

- **Improve bin management (7):** More multi-bins, better weighing devices, better way of receiving bin weights (faster); More bins in the fleet; No reduction in multi-bins. Better scales on machinery for bin weights; Regular bin supply; Improved scales for bins & more even bin sizes; More bins
- **Better communication between all parts of harvesting supply chain (6):** Transparent communication along the chain from grower to Mill; More immediate and on time communication with the Mill; Improve control of harvesting groups; Rostering; Better management of harvesters and in-field transport
- **Extend harvesting hours (3):** Extended hours harvesting to increase tonnage through machines; Extended hours (two shifts) for harvesting; Green cane harvesting
- **Pads (2):** Larger pads; More pads



- Copy best harvesting team
- Better mechanical reliability of both Mill and harvesting equipment

**6. What do you personally see as the main way that your part or role could improve the process overall?**

- **No room for improvement, We are the best; No response (5)** Cannot do better without damaging equipment
- **Better farm layout (3):** Farm layout by increasing block size for high capacity harvesting, easy access to both ends of blocks, and dual rows and control traffic to reduce harvester travel
- **Introduce change (3):** Introduce ‘best harvesting practises’; Induce harvesting management and growers to adopt new methods; Can implement any required changes at Mill
- **Improve suspension on machinery (3):** Suspension under all haul-outs
- **Improve communication (2):** Communication of how transport logistics to be carried out
- Internal tracks to pads so buggies can keep off roads in wet weather

**7. What do you see as the main barrier to improving the performance of the supply chain?**

- **Farm layouts (5):** Farm layouts – not enough cane pads; Poor farm layout – farms with low productivity; Money! Farm layout (small blocks etc) and not enough pads. Internal tracks should be provided for wet weather use to keep off main roads; Farmers should make more effort to link blocks together to reduce short rows and keep drains shallow enough to enable harvester to cut through
- **Bin management (5):** Regular supply of bins; Computer distribution of bin supply; Not enough bins in system; Not enough haulouts per harvester
- **Harvest scheduling & management (3):** Poorly managed harvesting groups; Rostering of harvesting to suit demands of harvesting; Influencing third party (harvesting groups)
- **Communication (2):** Communication between mill and harvesters
- **Change (2):** People’s reluctance to change; Negativity
- There are not too many barriers – funding could be an issue
- Overhead costs
- No response

**8. What pieces of information, maybe not readily available to you at present, would make your job a lot easier and at the same time help you improve overall chain performance?**

- **Real time performance data (10):** Knowledge of previous night’s bin weights; Up-to-date grower estimates and tonne actuals for each round; Monthly cash flow to budget performance; Bin supply, mill performance and the status of other harvesters; Tonnage quotas of harvesting per day; Status and progress of harvesting and milling processes without having to make six phone calls; Notification of mill breakdowns
- Superior equipment
- Wide scope with telemetry and C bins supply to be worked off telemetry
- Placing the bins on pads correct distance apart would help our performance
- Consistent bin weight. Consistency in crushing. Correct estimates
- Operations of harvesting groups – what their issues are
- Nothing at this stage; No response (3)

## Appendix III

<b>Harwood Mill Supply Chain Perception Survey Results</b> <b>November 2009</b> <span style="float: right;"><b>(Replies = 16)</b></span>				
<b>9. Please identify your part of the Clarence Valley value chain by highlighting one of:</b>				
Growing <b>3</b>	Harvesting <b>6</b>	Transport & Cane Supply <b>8</b>	Mill <b>(Two respondees both Grower &amp; Harvester)</b>	
<b>10. How well do you personally think the members of this chain work together now?</b>				
Very Badly	Not Well	Not Bad <b>2</b>	Quite Well <b>11</b>	Extremely Well <b>1</b>
<b>11. What aspect or task in the total supply process causes you personally the greatest frustration?</b>				
<ul style="list-style-type: none"> <li>• <b>Bin placement (3):</b> Bin placement on pads; Bins in the wrong position on the pad; When harvest operators are unsure of bin placement for the next day and the reason for this is that the farmer has not burned when he was required to and then weather conditions are not favourable</li> <li>• <b>CSO contact (3):</b> Some CSO not taking enough interest in the job and thinking of others; CSO (cane supply officers) sometimes not answering phone, as they are elsewhere – could they have a cordless phone?; When certain lab staff don't take the time to work truck trips out properly</li> <li>• <b>Less the full cooperation in the chain (3):</b> Full cooperation between all parties; False information – not based on fact; Grower lack of interest</li> <li>• <b>Mill breakdowns (2):</b> Lack of reliable mill; When mill breaks down there is a serious gap in communication with cane supply - engineers very slow at giving out information eg the day the pans sprung a leak</li> <li>• <b>Communications (2):</b> Two way radio system; Poor communication between growers and crews</li> <li>• Mill management not listening to operators in regards to quotes etc ie layout of pads</li> <li>• Difficulty getting maintenance done on trucks</li> <li>• Problems with the tracker program</li> <li>• This season the run sheets were not all that accurate – difficult to plan ahead</li> <li>• Waiting for bins</li> <li>• No answer</li> </ul>				
<b>12. What aspect or task in the total supply process do you think works really well?</b>				
<ul style="list-style-type: none"> <li>• <b>Harvesting &amp; transport (5):</b> Harvesting, transport &amp; cane supply; Communication between harvesting crew and transport has improved; I think Cane Supply / Transport and Harvesting are working very well these days. There has been steady improvement between these 2 over the last few years; Automatic weighing and trip allocation system; The SHIRT program</li> <li>• <b>All OK (5):</b> It all works quite good; All but mill; Current process just needs fine tuning; Most</li> <li>• <b>Adaptability when things go wrong (2):</b> Ability to adapt to adverse situations; The patience shown by everyone in the supply chain when it goes pear shaped</li> <li>• No answer (2)</li> </ul>				
<b>13. What do you personally see as the main opportunity to improve the performance of the supply chain to optimise the production output of the mill and/or to significantly reduce cost or time?</b>				
<ul style="list-style-type: none"> <li>• <b>Harvester rotation (4):</b> Harvester rotation better organised; More balanced rotation between harvesters; If it could be worked that there is only one harvester at any time on a long haul; Harvester roster</li> <li>• <b>Utilisation of roads (3):</b> Removal of council imposed restrictions on roads; Utilise all roads for cane transport; Unless the road is closed to heavy vehicles, use it</li> <li>• <b>Information transfer (3):</b> Working as one – not segmented; Information relay and communication; Full cooperation</li> <li>• <b>Bin supply (3):</b> Reduce the time waiting for bins; Quota bin allocation; Bin supply</li> <li>• <b>Mill maintenance (2):</b> Better maintenance of Mill; More mill maintenance – less breakdown (2)</li> <li>• Proper maintenance – hopefully avoid so many breakdowns (of harvesters?)</li> <li>• Pad design &amp; placement</li> <li>• No answer (2)</li> </ul>				

**14. What do you personally see as the main way that your part or role could improve the process overall?**

- **Education and training (3):** Education and training in transport and supply logistics; To have an excellent understanding of the whole process of supply, from farmer to cutter to hauler to milling train; Improve current methods by talking to other operators to discuss their techniques
- **Layout & design (2):** Having input into design of new pads; Supplying good crops & farm layout
- **It's OK as it is (2):** I'm OK with the processes overall; Not bad the way it is
- **Better control (2):** Oversee / manage crews better; More hands-on control
- Ensure outcomes of survey and meetings are achieved
- More cooperation from SCT management
- No answer (4)

**15. What do you see as the main barrier to improving the performance of the supply chain?**

- **Communication (5):** Communication & a general understanding of what each person in the supply chain has to deal with; Lack of full cooperation; Harvester drivers not communicating and acting as a joint venture; Lack of communication in the supply chain keeping information to themselves
- **Financial resources (3):** Money; Budget; Lack of money for improvements in general
- If you could have trips changed on knockoff runs to suit the truck changeover time
- Mill management
- Route restrictions
- Burning cane
- We will keep improving
- There shouldn't be any barriers
- No answer

**16. What pieces of information, maybe not readily available to you at present, would make your job a lot easier and at the same time help you improve overall chain performance?**

- **More specific/reliable communication (5):** An interactive communication system, both voice and text with GPS and navigation aids – this system would be personal rather than a general all ears and eyes approach; Live updates; More SMS info; Telemetry – SHIRT has enough information – needs to be more reliable; Quick communication from the Mill when it stops about how long, enables crews to use the stop time to their benefit instead of doing small tasks waiting for start up – this is the area that has seen the least improvement
- A return to the old pay system eg mill (\$/t) grower (\$/t) – this allows growers to evaluate variety and farm performance easier. Pays should be in tonnes of cane supplied.
- More cooperation from growers
- Maybe something to help knock-off trips
- I'm OK with the information overall
- No answer (5)