AgEcon

Case study – irrigating smarter for higher profits

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Automated irrigation – N Qld Tablelands Region

Aim: To identify and measure potential economic returns from automation

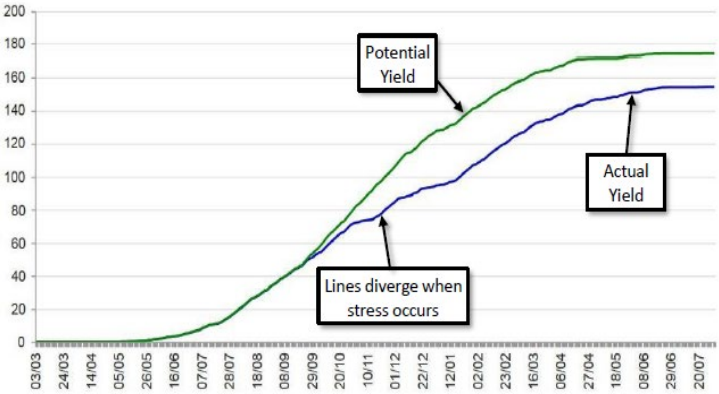
Background

Growing sugarcane is an input intensive and highly mechanised sector of Australian broad acre agriculture. The irrigation component of this industry is subject to high levels of seasonal demand for labour. At the farm level, productivity performance can be determined by the ease at which it can adjust its capital/labour input mix to new economic conditions and exploit new technological opportunities.

As global and domestic demand for food and other agricultural products increases, there is pressure for growers and irrigation professionals to understand and manage their irrigation methods and distribution systems with greater precision. They not only have to look at potential irrigation developments, but also turn to technology to better manage crop production using existing irrigation layouts. Overlaid with industry sustainability through careful use of fossil fuel-derived input such as nitrogenous fertiliser and direct energy use, automated furrow irrigation may potentially address these issues.

"overwatering and under watering are equally as bad for crop yield"

Smarter Irrigation for Profit R&D finding (2017)



When the soil moisture is maintained within 50mm of field capacity, a potential 19 t/ha yield is achievable (source: Irrigweb/SRA, 2017)

The study

An investment analysis will be used to evaluate the economic costs and benefits of automated furrow irrigation in the Tablelands region, N Qld. The decision to invest in automated technology can be determined by performance metrics generated from the analysis and compared with a business as usual scenario. Discounted cash flow (DCF) analysis and whole farm model returns were used for the economic assessment of the proposed automated irrigation. Because the intended investment involves streams of cash in and out over a number of years, the DCF approach is the preferred method.

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Key study inputs

Applying research findings and assumptions from Gillies, M. (2017) SRA Project, an updated list of assumptions has been tabled to better reflect changes in inputs, measured benefits and current technology costs. The following line items reflect current economic model contributions for the study. A discount rate of 5% signifies the opportunity cost of capital and is used to calculate the future value of project cashflows and return them to present day values[1].

Table 1 farm input assumptions

Item	$/ha
Avoided labour costs	$350
Avoided energy use	$50
Avoided water use/charges	$140
Sugarcane yield increase (~3%)	$100
Automation full installed cost (small management area ~Delta)	$1,500
Repairs and maintenance	$5
Discount rate	5%

Baseline assumptions manifest those of a typical sugarcane scenario, although in reality these numbers will vary. For example, a 10m pumping head and 4.5 kW per ML per M lift has been applied.[2] Those farms with poorer performing or more expensive pumping heads will achieve greater benefits from installing automation - due to increased savings. Similarly, field size and irrigated area will have a large impact on automation install cost. A small management area has resulted in a higher cost per hectare, with baseline equipment costs. Other key inputs such as farm labour costs and differences relating to pump lift heights are investigated in more detail in the economic sensitivity analysis following sections.

Expenses incurred from irrigation (water and energy) can contribute between 10-36% of all variable costs in the sugarcane gross margin – SRA (2018)[3]

The convenience of automated furrow irrigation has greatly reduced average water run times – Aaron Linton

Results

The analysis on a Tablelands (N Qld) sugarcane farm found automated irrigation installation yielded a ***44% Internal Rate of Return*** (IRR) and payback period of ***year two*** of the 10-year investment life of the project. The savings on irrigation water were based on reduced pumping time and volume applied, while still filling the profile. The results of the economic modelling suggest installing automated irrigation is a good investment due to significant savings across a range of inputs: water, energy and farm labour. The Net Present Value of project ***benefits equated to approximately $4,017/ha*** for the 10-year estimated project life. This is a very substantial per hectare return – showing the adjusted present-day values of all net future benefits and costs of the project, whereby the time value of money has been accounted for.

Scenarios and automation – what if?

The strength of the economic analysis was tested using a sensitivity analysis which changed the values of key input variables such as labour, water and cane yield and a reduced cost in automation technology installation. Changes from baseline assumptions (Table 1) in parameters for the sensitivity analyses were designed to replicate practical and potential commercial scenarios.

Table 2 Scenario analyses and investment returns

Variable	Change from base	Payback
Avoided Labour costs	+25%	Year 2
Avoided energy/water costs	+25%	Year 2
Cane yield increase	+5%	Year 2
Install cost	-25%	Year 1
Install cost (likely for larger management areas)	-50%	Year 1
Water saved	+50%	Year 2

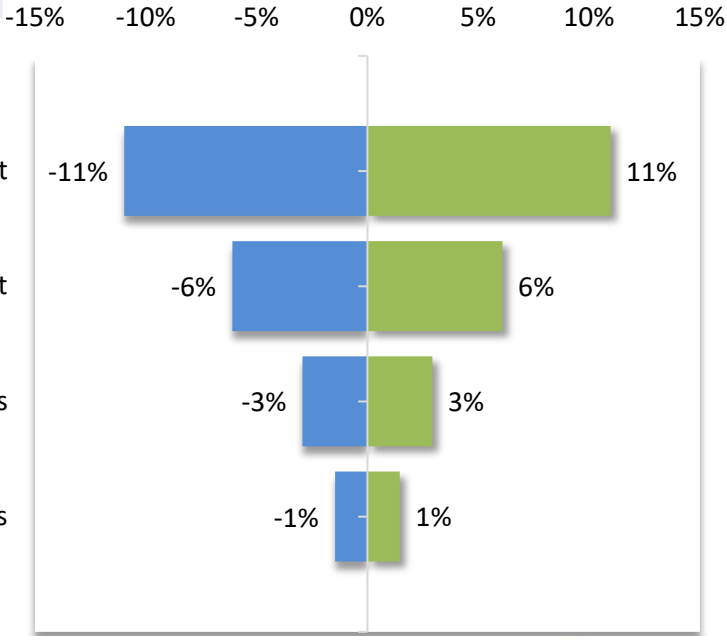
Automation system saves a potential 3 hours of flow per irrigation event, or 20% across the season. Larger automated irrigation systems offer lower $/ha install costs, faster payback and higher investment returns[4]

What's driving investment success?

The cyclone chart below shows the sensitivity of the model outcomes when a variable is tested independently against baseline assumptions. In this case, a 10% change in each variable found the installation cost, followed by farm labour to have the greatest impact on the success or otherwise of the investment.

The cost benefit analysis here has quantified labour – without valuing the actual benefits to the grower's quality of life and improved sleeping habits (key model assumption)

Change in IRR resulting from a 10% change in variable



Testing changes to pump lift height

Automation can lead to input savings which have been broadly accounted for in sensitivity, although attributing energy costs from delivering water to field is more difficult. Choosing a range of pumping lift heights (and cost) through changes in Total Dynamic Head (TDH) showed small changes in IRR and no change to investment payback of 2 years. This mini-analysis shows energy and pumping costs are minor contributor to project returns, when compared with labour / automation installation costs.

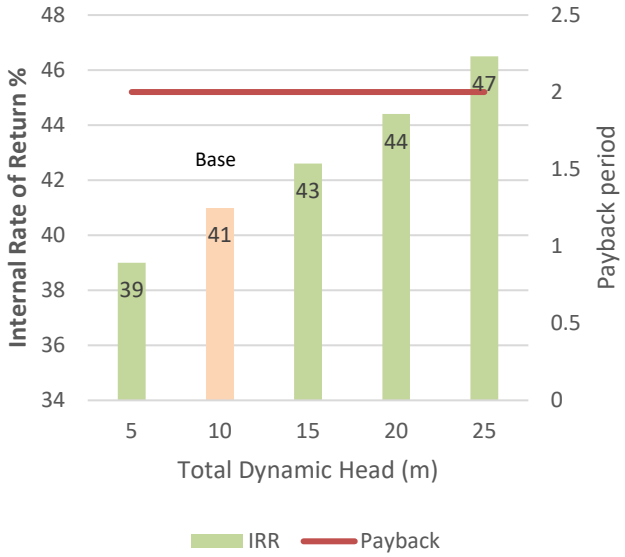


Figure 1 automation project investment sensitivity (IRR and payback) to pump lift or TDH (5-25m)

Reliability

Technology has become a routine part of farming and reliability of equipment in remote areas is a key consideration when product support services can influence irrigation timeliness and consequently crop yield. However, perceptions around irrigation technology and its reliability was recently measured in a study by Stringam et al. (2015) who found automated canal technology has been used successfully in the USA irrigation industry since 1959. Out of the 179 automated sites reviewed for success or failure, only three sites were deemed to have failed or operated with difficulty.

Success or failure can be largely linked to the level of support that is developed within a district as the project is initiated and the degree to which in-house capabilities are developed for maintaining the system once installed.

Control and software systems have been refined over a number of years and providers support the equipment under warranty. The experience of automation systems to date is that failure is minimal when adequate maintenance provisions have been augmented.

Labour

Labour is a growing input cost in agricultural production and scarcity of both skilled and unskilled labour remains a key issue. Historical data on broad acre irrigation farms in NSW and Qld has shown since 1997, the cost of employee wages is increasing at more than double the rate of inflation. Wages are a primary consideration of an investment in automation, based on continued pressure on regional labour supply and competition from other industries such as the resource sector, where skills are easily transferrable.

References

1. Discount rates - explainer here
2. Foley, J. (2017) Fundamentals of energy use in water pumping found here
3. Welsh, J.M & Powell, J.W. (2017) Opportunities for energy innovation in Australian irrigated sugarcane found here
4. Gillies, M. (2017). Modernisation of Furrow Irrigation in the Sugar Industry found here

For further information:

- Visit the Sugarcane Smarter Irrigation for Profit Project Summary Page **here** or **www.sugarresearch.com.au**
- Contact the economists at **www.agecon.com.au** for further details

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