Investments in water monitoring, water quality improvements and remote camera devices generate high returns on investment.

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In Brief

High returns on investment are readily achievable from investments in water and monitoring technology due primarily to the low investment cost relative to the value of the labour saved. Analysis of five investments in technologies including water monitoring devices, remote camera devices and water aeration devices has seen returns exceed 100% in four case studies and exceed 50% in one case study.

Background

Data from five case study farms where managers invested in technology to improve water monitoring or water quality were used to assess the return on investment. *See case studies.

Cost benefit or investment analysis is used to demonstrate the net return of a change to a business relative to the investment cost. The analysis is typically conducted using a partial budget. A partial budget looks at the changes to the financial outcome of a business due to an investment and expressed as the difference relative to the existing practice.

The series of case study investment analyses presented in this paper show the frequency of monitoring prior to investment in the new technology and the frequency of monitoring after implementing the technology. The difference between the two has been used to value the benefit of technology.

The investment analysis has been run over a five year period for each investment. As is the case with many investments in agriculture a sum of money is required to purchase capital equipment, and the benefits of the investment are seen over a period of subsequent years. In this analysis the up-front capital cost of the investment in the technology is incurred prior to the first year of the cashflow while the stream of costs and benefits occurs over the following five year period.

The internal rate of return (IRR) is a measure used to assess the return on the investment. The IRR indicates the maximum interest rate that a manager could pay for the resources used if the project is to recover its investment expenses and still just break even.

Valuing the benefits of the investment

The value of the difference in monitoring frequency is calculated by multiplying the time saved by the cost of labour. Other savings such as lower motor vehicle costs and costs in water savings have also been applied.

Standardised assumptions have been applied across case study farms to deliver consistency in the approach between businesses. Farm management labour is priced at $120,000 per annum reflecting the true value of a farm management labour unit and the opportunity cost of applying management skills within the business rather than applying the skills elsewhere. There are some minor differences in assumptions between this analysis and the case studies outlining the details of the technology and their advantages. These differences make little difference to the analysis outcome.

Vehicle costs have been calculated per kilometre based on an assumed average value of the vehicle ($40,000) and assumed depreciation rate (8%). Other vehicle-based assumptions include an assumed annual distance travelled, the frequency of servicing, the frequency of tyre changing or the vehicle fuel economy. These assumptions have then been applied to each case study to demonstrate the extent of the benefit of the reduction in labour or vehicle related expenses. Table 1 shows the assumptions made to apply economic values to the reduction in monitoring and maintenance time.

Table 1. Assumptions to the value of the benefits of time and motor vehicle savings from technologies.

Labour, fuel & motor vehicle assumptions	
Motor vehicle average value	$40,000
Depreciation rate	8%
Depreciation ($/yr)	$3,200
Distance travelled (km/yr)	35,000
Depreciation rate ($/km)	**$0.09**
Service frequency (km)	15,000
Service cost ($/service)	$600
Service cost ($/km)	**$0.04**
Tyre change frequency (km)	50,000
Tyre cost ($/set)	$1,200
Tyre cost ($/km)	**$0.02**
Distance travelled per trip (km)	1
Fuel consumption (L/100km)	10
Fuel cost ($/L)	$1.90
Fuel cost ($/km)	**$0.19**
Annual labour cost ($/year)	$120,000
Days worked per year	288
Hourly labour cost ($/hour)	**$52.08**
R&M and depreciation ($/km)	**$0.16**

In all case studies the benefits of the technologies related to labour saving and savings in fuel, vehicle depreciation and repairs and maintenance. Additional benefits in the case of water aeration devices related to water savings when cleaning troughs due to less wastage of water.

The high returns on investment occur due to the low investment cost of the technology and the high value of labour saved. Figure 1 shows that labour accounts for greater than 80 percent of the total value of the net benefit achieved by the investment.

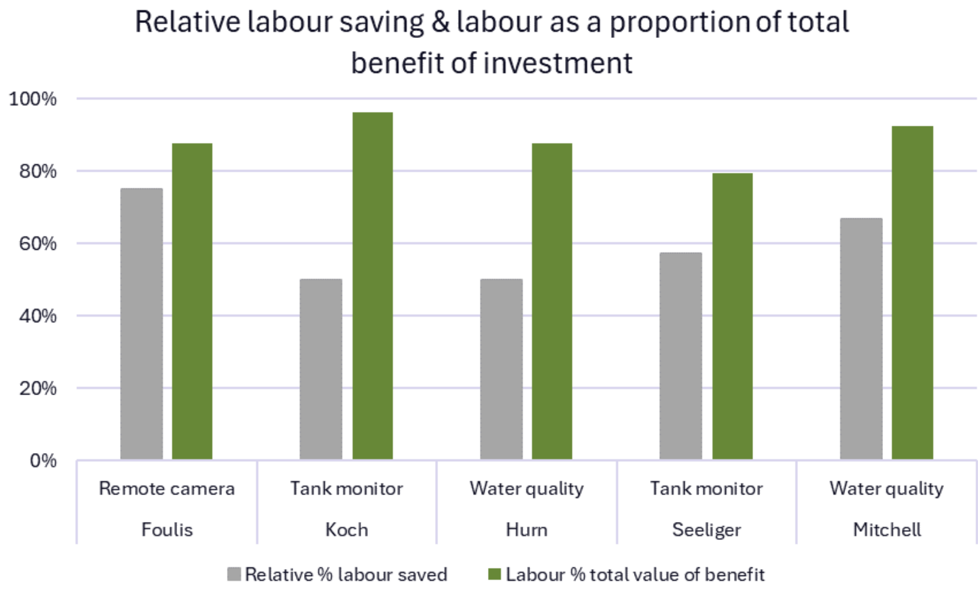

Figure 1. The high proportion of labour saved relative to a low cost of investment is the reason for the high returns on investment.

The devices have been assumed to have a useful life of five years. This means that at the end of the five year period no residual, or depreciated, value of the investment has been included in the cashflow. It is plausible that the useful life of the technology will exceed this period however the low value of the technology in this analysis means that a change in the residual value at the end of the cashflow period will have little impact on the return.

Discussion

The return on investment in technologies for water monitoring and maintaining water quality is high because:

1. The cost of the monitoring and maintenance infrastructure is low
2. The technology is automated, so it needs little costly human intervention
3. The value of the labour saved in physical monitoring is high

Figure 2 shows that the net annual benefit of investments in automated water monitoring and infrastructure is high relative to a very low cost of investment. Even if the value of the labour required for monitoring was halved the return relative to the investment would remain high.

The outcome of this analysis is dependent on the change in the frequency of monitoring over time. This analysis shows that the frequency of monitoring or maintenance has been halved at worst or been reduced by 75 percent at best. This large change in frequency of monitoring is afforded due to the ability of the automated monitoring device to alleviate the need for in-person monitoring and maintenance.

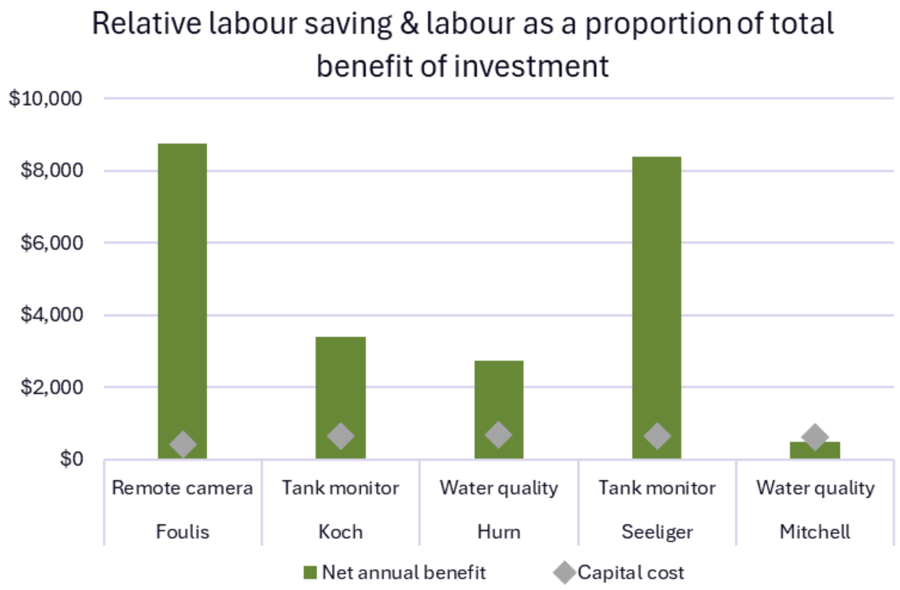

Figure 2 The net annual benefit of labour saving technological investments in water monitoring and maintenance is high relative to the cost of the automated technology.

Returns

Figure 3 shows that all investments in water monitoring and maintenance delivered extremely high returns on investment. While the water quality device of Mitchell looks to have delivered low returns relative to the other investments the return itself is still very high. The reason this investment didn't generate a higher return was that the frequency of water monitoring trips and the distance travelled to monitor the water was far lower than the other investments.

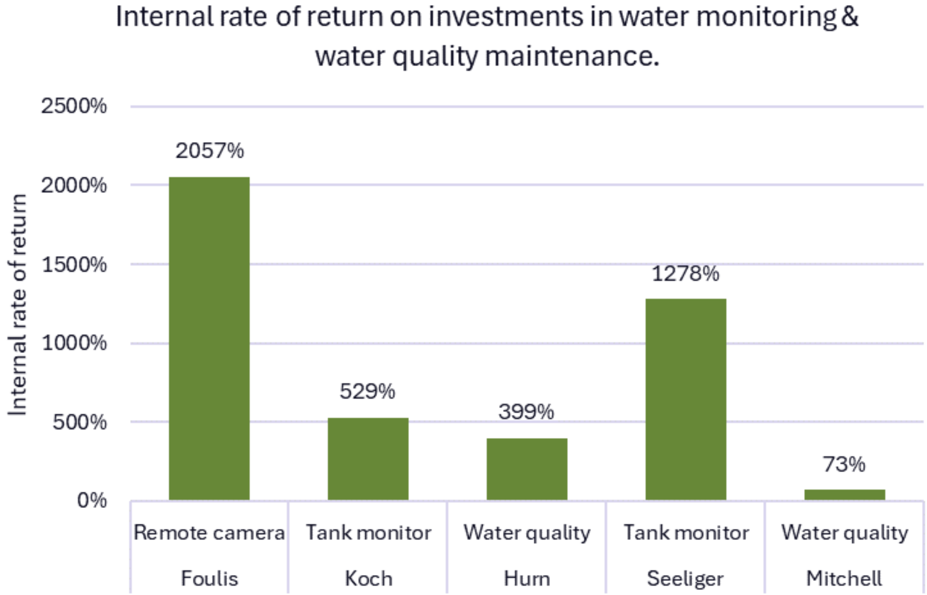

Figure 3. All investments in water technology delivered high returns

What this means to you

Investments in water monitoring and maintenance technologies generally deliver high returns on investment due to their low cost, their autonomous nature and the high value of the benefits they offer in reducing the time taken to check and maintain water.

Supplementary information and data to the analyses

	Foulis - Remote camera		
	Pre camera	Post camera	Difference
Trips per year	104	26	78
Distance travelled (km/year)	4160	1040	3120
Fuel used (L/year)	416	104	312
Fuel cost	$790.40	$197.60	$592.80
R&M+depreciation cost	$647	$162	$485
Driving time (hours @80km/hr)	52	13	39
Driving time (minutes/trip)	30	30	30
Monitoring time (hours)	104	26	78
Total driving & monitoring time (hours/ye	186	69	147
Value of time ($)	$9,688	$3,594	$7,656

Net annual benefit	$8,734
Net annual running costs	$96
Capital cost	
Solar powered camera + 70 GB sim	$420
Data costs ($/mth)	$8
Expected camera life (yrs)	5
Value at end of period ($)	$0
Discount rate	7%
Internal rate of return	2057%
Modified internal rate of return	160%
Net present value	$34,997

	Cashflow	Cumulative cashflow	Discounted cashflow	Cumulative discounted cashflow
0	-$420	-$420	-$420	-$420
1	$8,638	$8,218	$8,073	$7,653
2	$8,638	$16,856	$7,545	$15,198
3	$8,638	$25,494	$7,051	$22,249
4	$8,638	$34,132	$6,590	$28,839
5	$8,638	$42,770	$6,159	$34,997

Koch - Tank monitoring device

	Pre device	Post device	Difference
Trips per year	365	182.5	182.5
Distance travelled (km/year)	730	365	365
Fuel used (L/year)	73	36.5	36.5
Fuel cost	$138.70	$69.35	$69.35
R&M+depreciation cost	$113	$57	$57
Driving time (hours @60km/hr)	12.2	6.1	6.1
Driving time (minutes/trip)	2	2	2
Monitoring time (hours)	109.5	54.8	54.8
Total driving & monitoring time (hours/year)	124	63	63
Value of time ($)	$6,441	$3,273	$3,273

Net annual benefit	$3,399
Net annual running costs ($/year)	$15
Capital cost	
360 tanks Hardware/software	$640
Technology life (yrs)	5
Value at end of period ($)	$0
Discount rate	7%
Internal rate of return	529%
Modified internal rate of return	98%
Net present value	$13,234

	Cashflow	Cumulative cashflow	Discounted cashflow	Cumulative discounted cashflow
0	-$640	-$640	-$640	-$640
1	$3,384	$2,744	$3,162	$2,522
2	$3,384	$6,127	$2,955	$5,478
3	$3,384	$9,511	$2,762	$8,240
4	$3,384	$12,895	$2,581	$10,821
5	$3,384	$16,278	$2,412	$13,234

Seeliger - Tank level monitoring device

	Pre device	Post device	Difference
Trips per week	7	3	4
Trips per year	364	156	208
Distance travelled (km/year)	8,736	3,744	4,992
Fuel used (L/year)	874	374	499
Fuel cost	$1,660	$711	$948
R&M+depreciation cost	$1,358	$582	$776
Driving time (hours @60km/hr)	146	62	83
Driving time (minutes/trip)	24	24	24
Monitoring time (hours)	36	16	21
Total driving & monitoring time (hours/year)	206	102	128
Value of time ($)	$10,729	$5,313	$6,667

Net annual benefit	$8,391
Running costs ($/year)	$99
Capital cost	
Agbot hardware/software	$649
Technology life (yrs)	5
Value at end of period ($)	$0
Discount rate	7%
Internal rate of return	1278%
Modified internal rate of return	136%
Net present value	$33,350

	Cashflow	Cumulative cashflow	Discounted cashflow	Cumulative discounted cashflow
0	-$649	-$649	-$649	-$649
1	$8,292	$7,643	$7,750	$7,101
2	$8,292	$15,935	$7,243	$14,343
3	$8,292	$24,227	$6,769	$21,112
4	$8,292	$32,519	$6,326	$27,438
5	$8,292	$40,811	$5,912	$33,350

Hurn - Trough water aerator

	Pre device	Post device	Difference
Trips per week	6	3	3
Trips per year	312	156	156
Distance travelled (km/year)	624	312	312
Fuel used (L/year)	62.4	31.2	31.2
Fuel cost	$119	$59	$59
R&M+depreciation cost	$97	$48	$48
Driving time (hours @60km/hr)	10.4	5.2	5.2
Driving time (minutes/trip)	2	2	2
Monitoring time (hours)	78.0	39.0	39.0
Total driving & monitoring time (hours/year)	90.4	46.2	46.2
Value of time ($)	$4,708	$2,406	$2,406
Water emptied at cleaning (L/clean)	500	250	250
Volume water saved	156,000	78,000	78,000
Water cost ($/yr)	$468	$234	$234
Net annual benefit	$2,748		
Running costs ($/year)	$15		
Capital cost			
Croctrough	$685		
Technology life (yrs)	5		
Value at end of period ($)	$0		
Discount rate	7%		
Internal rate of return	399%		
Modified internal rate of return	87%		
Net present value	$10,521		

	Cashflow	Cumulative cashflow	Discounted cashflow	Cumulative discounted cashflow
0	-$685	-$685	-$685	-$685
1	$2,733	$2,048	$2,554	$1,869
2	$2,733	$4,781	$2,387	$4,256
3	$2,733	$7,514	$2,231	$6,487
4	$2,733	$10,247	$2,085	$8,572
5	$2,733	$12,980	$1,949	$10,521

	Mitchell - Trough water aerator		
	Pre device	Post device	Difference
Trips per week	1	0.33	0.67
Trips per year	52	17	35
Distance travelled (km/year)	104	35	69
Fuel used (L/year)	10	3	7
Fuel cost	$20	$7	$13
R&M+depreciation cost	$16	$5	$11
Driving time (hours @60km/hr)	2	1	1
Driving time (minutes/trip)	2	2	2
Monitoring time (hours)	11.3	3.8	7.5
Total driving & monitoring time (hours/year)	13	4	9
Value of time ($)	$677	$226	$451
Water emptied at cleaning (L/clean)	500	250	250
Volume water saved	8,658	4,329	4,329
Water cost ($/yr)	$26	$13	$13
Net annual benefit	$488		
Running costs ($/year)	$0		
Capital cost			
Croctrough TPS 50 unit	$627		
Technology life (yrs)	5		
Value at end of period ($)	$0		
Discount rate	7%		
Internal rate of return	73%		
Modified internal rate of return	35%		
Net present value	$1,375		

	Cashflow	Cumulative cashflow	Discounted cashflow	Cumulative discounted cashflow
0	-$627	-$627	-$627	-$627
1	$488	-$139	$456	-$171
2	$488	$349	$427	$256
3	$488	$838	$399	$654
4	$488	$1,326	$373	$1,027
5	$488	$1,814	$348	$1,375

This analysis uses a number of financial processes and metrics to assess the returns from investments in technologies. The following glossary of terms has been sourced from a report using similar methodology authored by Bowen and Chudleigh 2018 (https://era.daf.qld.gov.au/id/eprint/6516/1/DCAP-DAF6_Fitzroy_Management-strategies-for-drought-resilience_December-2018.pdf)

Depreciation (as applied in estimating operating profit) A form of overhead cost that allows for the use (fall in value) of assets that have a life of more than one production period. It is an allowance that is deducted from gross revenue each year so that all of the costs of producing an output in that year are set against all of the revenues produced in that year. Depreciation of assets is estimated by valuing them at either current market value or expected replacement value, identifying their salvage value in constant dollar terms and then dividing by the number of years until replacement. The formula used in this analysis is: (replacement cost – salvage value)/number of years until replacement.

Discounting is the process of adjusting expected future costs and benefits to values at a common point in time (typically the present) to account for the time preference of money. With discounting, a stream of funds occurring at different time periods in the future is reduced to a single figure by summing their present value equivalents to arrive at a 'Net Present Value' (NPV). Note that discounting is not carried out to account for inflation. Discounting would still be applicable in periods of nil inflation.

Discount rate refers to the interest rate used to determine the present rate of a future value by discounting.

Discounted cash flow (DCF). This technique is a way of allowing that when money is invested in one use, the chance of spending that money in another use is gone. Discounting means deducting from a project's expected earnings the amount which the investment funds could earn in its most profitable alternative use. Discounting the value of money to be received or spent in the future is a way of adjusting the future net rewards from the investment back to what they would be worth in the hand today

Internal rate of return (IRR). This is the discount rate at which the present value of income from a project equals the present value of total expenditure (capital and annual costs) on the project, i.e. the break-even discount rate. This indicates the maximum interest that a project can pay for the resources used if the project is to recover its investment expenses and still just break even. IRR can be expressed as either the return on the total investment or the return on the marginal capital – referred to as the IRR in this report.

Net present value. Refers to the net returns (income minus costs) over the life of an investment (in this case, provision of technology), expressed in present day terms. A discounted cash-flow allows future cash-flows (costs and income) to be discounted back to a NPV so that investments over varying time periods can be compared. The investment with the highest NPV is preferred. NPV was calculated at a 7% rate of return which was taken as the real opportunity cost of funds to the producer. NPV can be expressed as the total business returns or as the marginal return. NPV is the extra return received as a result of the investment. Annualised NPV converts the NPV to an amortised annual value and can be viewed as approximately equivalent to the change in profit per year.

Payback period is the number of years it takes for the cumulative present value to become positive. Other things being equal, the shorter the payback period, the more appealing the investment.