RMCG

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Update on Farm Water Case Studies - Executive Summary Extract

Final

Farm Water Program

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Executive Summary

This project considers the costs and benefits of irrigation modernisation by interviewing participants of the Farm Water Program (FWP).

In 2017/18 eighteen previous case studies from Rounds (R) 1 to 3 were re-interviewed and their numbers updated. This included six from R1, five from R2 and seven from R3. In addition, four new case studies were interviewed from R5. This has been used to provide a sample of 22 updated case studies which have been used to produce this report.

This analysis includes the farm benefits as a result of modernisation. Estimates of the change in benefits are compared with the change in farm costs using a partial budget analysis. It focuses on the performance of farm irrigation with the upgraded system compared to without the previous old system and is based on the experience of the case studies.

It is important to note that this is not a program evaluation of the FWP – it does not consider program administration costs or whether the upgrades would have occurred in the absence of FWP; or the timing, cost and scale of future upgrades in the absence of the program. It also does not include any non-farm environmental benefits (such as downstream salinity or nutrient benefits) that can be associated with improved irrigation efficiency. This report does not compare benefits and costs with and without the FWP; instead its focus is on the performance of farm irrigation with and without the upgrade.

This report identifies and estimates the relative scale of benefits and costs of on-farm irrigation modernisation as they have occurred in the case studies. It assumes the full cost of the works, regardless of who pays for the capital and also the full benefits including water saved, regardless of how much water was transferred to the environment. This is evaluated as if the farmer fully funded all works and retained all the water saved as a benefit.

Also, to illustrate the impact of the incentive program on adoption the case studies have been evaluated using the value of the high reliability water shares transferred[1], as the farmer's capital cost, plus an allowance of 20% of that cost as other farmer in kind and cash costs[2]. The benefits were compared with this cost to illustrate the difference the FWP makes to the farmer's net present value and payback period.

Identifying and measuring specific numbers for the benefits of water saved, time saved, and production gained for the upgrade area is difficult. Therefore, estimates of costs and benefits were made and tested with the landholders based on their experience with the old system prior to modernisation, and the new system following off-farm and on-farm modernisation.

The value of water has changed over time. In this report the benefit of water savings was calculated on a lease value of 5%[3] of the value of water[4] averaged over the life of the project assuming historic values to 2018 then 2018 values remaining constant. This resulted in a different value for each round.

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1 Calculated from the water savings calculator for the project multiplies by the % of savings transferred for the round.
2 The FWP requires a minimum of 10% of in kind, but frequently there are additional costs including crop disruption and other unexpected capital items; so 20% was assumed..
3 5% represents a typical commercial lease value for water.
4 From Victorian Water Register trade values for high reliability water shares (HRWS).

When comparing the same crop mix for the new system versus the old system for the sample of 22 (see Table 1-1) in summary:

- Estimates of water use savings varied from 0.6 to 5.0 ML/ha/y (average of 1.8), which compared with the water savings calculator value of 0.6 to 4.2 ML/ha/y (average of 1.9). However, few farms had good data that could confirm savings given the enormous variability in seasonal conditions, crop types, areas and change in metering and location of meter outlets.
- NPV of the projects varied from $-2,527/ha to +$6,675/ha (average of +$1,882/ha) using a 7% discount rate[5] over 20 years, assuming nil residual value. Benefit/cost ratios varied between 0.5 to 2.7.
- Sensitivity testing of total benefits by minus 25% showed that the benefit cost ratios ranged from 0.4 to 2.0. When benefits were plus 25% they were from 0.6 to 3.3.

At the time of project commencement, a percentage of the expected savings using the water savings calculator was transferred to the Commonwealth as Victorian high reliability water shares (HRWS). This was R1 being 50% of savings, R2 being 50%, R3 being 59% and R5 being 55%. To test the costs as experienced by FWP participants the value of this transferred water[6], plus an allowance for other farmer expenditure of 20% was modelled as the capital cost to the farmer under the FWP. This was around 40% of the full cost; i.e. averaged $2,270/ha capital cost under FWP compared to $5,113/ha for the full cost.

From a farmer perspective, this reduced cost, with the same benefits results in the payback period reducing from an average of 11 years to 5 years and increases the average internal rate of return from 11% to 30%. This illustrates how much the FWP incentive encourages earlier adoption of irrigation upgrades. This earlier adoption was consistently reported by participants, who stated that they undertook larger scale and sooner than they would have done in the absence of the program.

Determining benefits becomes more complicated when the new system also resulted in a change in enterprise mix e.g. change from annual crops with the old system to summer/perennial crops with the new system. However, this can occur as a result of the improvement in water and labour efficiency facilitated by the new system. When this is considered, water savings can be reduced to negative levels as irrigators move to higher water use summer crops; but crop production gains are increased.

To illustrate the change in the mix of benefits caused by a change in crop type. Additional water use was modelled assuming that an additional summer crop of 6 ML/ha was implemented by case studies who had flexible cropping systems every third year[7] (. i.e. year 1 = annuals, year 2 = annuals, year 3 = annual & summer crop, then repeated. This pattern is relatively typical of those who changed crop type after they upgraded, but some had no change, while others moved from opportunistic/occasional annual irrigation to double cropping most years. For the sample of 22, five were modelled with no changed crop type as the upgrade did not sufficiently change the previous production system. The other 17 were modelled with the additional crop.

Adopting this assumption resulted in water savings benefits being replaced by additional productivity benefits (see Table 1-2) and so producing a similar NPV. The results for the sample of 22 (including the 5 that did not change) were that:

- Estimates of the average water use savings reduce from 1.8 ML/ha/y to close to zero due to the extra crop use.
- Estimates of the average labour savings are reduced[8] from around $135/ha/year to around $90/ha/year due to labour required to irrigate the additional crop.

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[5] 7% is relatively high used to reflect opportunity cost of alternative investment in non-appreciating assets
[6] Valued at the water market price at time of transfer,
[7] i.e. water savings were reduced by 2 ML/ha/y due to the additional crop.
[8] Labour savings were reduced assuming a labour cost of $30/ML for the additional water use, which is typical for gravity systems. This will be an overestimate of additional costs for irrigating a summer crop with automated or centre pivot/ lateral systems.

- Estimates of productivity increase improve from $240/ha/year to $600/ha/year due to the extra crop.
- NPV of the projects is similar to using the current crop mix for both old and new systems and varied from $-2,433/ha to +$7,180/ha (average $1,963/ha) using a 7% discount rate over 20 years. Benefit/cost ratios varied between 0.6 to 2.5.

The economic results were positive for most case studies, but the assumed benefits depend upon current irrigated crop use continuing into the future and that this has an ongoing positive gross margin. For example, if there is a future drought sequence and irrigation does not occur for some seasons, then the benefits derived are overestimated. The benefits are also sensitive to the water value, the volume of water savings, value of saved labour and the ability to convert production gains into income, either through additional milk/meat, reduced feed purchases or sales of feed/crop. There is considerable uncertainty around these values and how they change relative to the base case of no upgrade. A standard labour cost of $25/hour for saved labour was assumed, which is consistent with previous studies, but it should be noted that this is a low value and is a conservative assessment of the benefit.

Despite these uncertainties, the case studies do provide a useful picture of the types of change and the relative values of the different benefits that are possible with irrigation upgrades.

An important issue with the program is that participants have transferred high reliability water shares to the Australian Government. In recent years these have been appreciating in value. In its place they now have higher productivity, and a new system that is a depreciating asset. This infrastructure either wears out or becomes out dated over time, but for most provides a positive economic outcome. In this analysis the depreciation cost has been accounted for by assuming no residual value of the upgrade after twenty years. The level of lost appreciation associated with the water transferred has been accounted for by valuing water savings in line with the water market since the works have been implemented for each year the system has operated. However, any potential future capital gain, after 2018, over the remaining project life was not included.

Unlike land or water entitlement purchases that a farmer can make, few of the case study farmers believed that their property value would be increased by the size of the investment made in infrastructure. This illustrates a less risky investment in expansion of a profitable farm business can be to invest in additional land and/or water entitlement assets rather than an irrigation upgrade. This is because over the long term these assets tend to appreciate and provide security by being able to be sold; unlike new irrigation systems, which tend to depreciate and cannot be easily sold.

Expansion via investment in additional land assets, water assets or irrigation upgrades will depend upon the individual circumstances and their own appetite for risk. The FWP, by providing infrastructure grants in return for a share of the water savings, changes the balance in favour of irrigation upgrades with the objective of also providing wider environmental benefits and regional productivity gains that are associated with improved irrigation performance from the participants. This has to be balanced against loss of water transfers to the Commonwealth from the consumptive pool when upgrades are funded by FWP, which does not occur when upgrades are privately funded and all the savings are retained. This aspect is not covered in this report as the premise of the original FWP was to replace buyback that would have otherwise occurred from the consumptive pool.

The table below summarises the 22 case studies average results with that completed from previous years.

Table 1-1: Comparison of results for different rounds (assuming same crop as current system for both old and new system) – unweighted average values (calculated independently)

ATTRIBUTE	ROUND 1 VALUES CORRECTED WITH UP TO 3 YEARS EXPERIENCE (UP TO 3 UPDATES) AT 7% OVER 30 YEARS			ROUND 2 VALUES (1 YEAR OF EXPERIENCE) AT 7% OVER 30 YEARS	ROUND 3 VALUES (1 YEAR OF EXPERIENCE) AT 7% OVER 30 YEARS	ROUNDS, 1,2,3 AND 5 AT 7% OVER 20 YEARS	SUGGESTED TYPICAL VALUES ACROSS ROUNDS (NOTE VARIATION IS VERY LARGE)
Sample size.	19	10	8	10	9	22	Not applicable (NA).
Water value assumed on savings.	1,800 Capital value.	1,800 Capital value.	1,800 Capital value.	1,500 Capital value.	1,450 Capital value.	Adopted average water value from project completion to 2018 calculated from Vic Water Register with value of \$3,500/ML assumed for 2018 until end of year 20. At 5% lease rate[9].	NA depends on market price at time of transfer.
Capital cost \$/ha.	5,982	5,557	5,067	5,677	4,951	\$5,113	5,500 (2,000 to 10,000).
Total additional annualised cost per ha of upgrade.	523	459	421	624	434	545	500 (200 to 1,000).
Total additional annualised benefit per ha of upgrade.	879	729	635	915	417	704	700 (200 to 2,000).
NPV per ha.	4,420	3,354	2,653	3,509	-217 (increases to >1,000 if 10 ha crop failure ignored.	1,882	2,000 to 3,000 (-2,000 to +18,000).
BCR.	1.7	1.6	1.5	2.0	1.1	1.3	1.4 (0.6 to 3.5).
Detail on benefits							
Water saving ML per ha.	2.0	1.5	1.4	2.6	1.8	1.8	1.8 (0.5 to 3.6).
Change in t dry matter/ha.	2.1	Not calc.	Not calc.	2.7	2.3	Not calc.	2.3 (0 to 7).
Change in t DM/ML.	0.4	Not calc.	Not calc.	0.4	0.4	Not calc.	0.4 (0 to 1.1).
Change in production as change in gross margin \$/ha.	382	292	273	346	274	244	300 (0 to 600).
Labour savings \$ per ha (at \$25/hr).	143	137	140	188	69	135	140 (0 to 400).

9 R1 capital valued at \$2,091/ML for 8 years then \$3,500/ML for years 9 to 20. R2 valued at \$2,103 for 6 years then \$3,500/ML for years 7 to 20, R 3 valued at \$2,145/ML for 4 years then \$3,500/ML for years 5 to 20, R 5 valued at \$2,870/ML for year 1 then \$3,500/ML for years 2 to 20. Based on Victorian Water Register trade values for Goulburn and Murray HRWS.

Table 1-2: Comparison of results for different rounds including estimates for changed crop with new system

ATTRIBUTE	ROUND 1 VALUES AT 7% OVER 30 YEARS USING CASE SPECIFIC CHANGES	ROUND 2 VALUES AT 7% OVER 30 YEARS USING CASE SPECIFIC CHANGES	ROUND 3 VALUES AT 7% OVER 30 YEARS USING CASE SPECIFIC CHANGES	ROUNDS, 1,2,3 AND 5 AT 7% OVER 20 YEARS ASSUMED ADDITIONAL SUMMER CROP EVERY 3RD YEAR	SUGGESTED TYPICAL LONG TERM VALUES
Total additional annualised cost per ha of upgrade.	523	624	434	545	500 (200 to 1,000).
Total additional annualised benefit per ha of upgrade.	872	729	448	746	700 (200 to 2,000).
NPV per ha.	4,339	1,148	169	1,963	2,000 (-2,600 to +19,000).
BCR.	1.7	1.2	1.2	1.4	1.3 (0.6 to 3.5).
Detail on benefits					
Water saving ML per ha.	-0.5	-0.6	0.9	0.3	nil (-8 to +3.4).
Change in gross margin $/ha.	808	608	274	592	600 (0 to +2,100).
Labour savings $ per ha (at $25/hr).	95	135	51	89	90 (0 to 300).