Irrigation development in Australia’s remote north revisited

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Abstract

When the Ord River scheme was debated more than 50 years ago, some of the motivations for development in a remote region were dated. Others were spurious. Dated reasons included Australia's defence of the north, less than a generation after World War II. Spurious reasons included an apparent belief that any land or water not subjected to economic development was a waste. Moreover, according to some proponents of the scheme, the envious eyes of heavily population nations to the north would be drawn to un-utilised natural resources in Australia.

Now, the push is on again. This time, there are rapidly growing food markets in Asia. Northern Australia is much closer to them than agricultural regions in the south of the continent. There is the spectre of climate change: annual rainfall in the south west has dropped substantially over the past 40 years, and in the south east average winter rainfall appears to be dropping. Are these changed circumstances enough to justify expansion of irrigation in remote northern Australia?

This study uses a dynamic, multi-regional CGE model, TERM (The Enormous Regional Model), to examine the CGE impacts of direct output possibilities estimated by CSIRO. Although the modelling under defensible assumptions confirms received economic wisdom that development of irrigation in the north is not viable, variations in assumptions lead to scenarios in which such development may be worthwhile.
Introduction

World War II bombings of Australia by Japan resulted in efforts to make the continent nation more defensible in the future. Economic development of the north was regarded as one means of meeting defence objectives. The Forster Committee in the late 1950s was formed to examine options for development of agriculture in the Northern Territory. Among the committee members was a former farmer, Bert Kelly, a politician of the time who would later become a Federal minister. For Kelly (1978), his experiences on the committee were a source of endless frustrations. He witnessed attempts to grow rice in which water was abundant for several months of the year when irrigation was unnecessary, but too salty to use when irrigation was required. He became involved in pilot projects to raise cattle on irrigated feed, which demonstrated technical feasibility but failed on the basis of costs and returns.

There was sufficient political will to get the Ord River scheme in the Kimberley region of Western Australia under way, with an official opening by Prime Minister Menzies in July 1963. Prior to its opening, Campbell (1962) noted the declining importance of agriculture in developed economies, a prescient comment given that agriculture’s share of GDP is now one-quarter of what it was when he penned his article. By the 1950s, when most available agricultural land in the developed world was being tilled, analysts were starting to understand the importance of productivity growth rather than additional land clearing in raising food output. Campbell countered visions of the cost advantages of farm production in the north by referring to productivity gains to maintain the competitiveness of existing farmland.

Campbell (1962) outlined five means by which more rapid regional economic growth could occur:

1. expanded demand outside the region for products produced within the region;
2. expanded demand within the region for the products of the region;
3. discovery of previously unknown resources which can be economically exploited;
4. technological change which enhances the comparative advantage of the region relative to other areas in the production of various goods; and
5. purposeful capital investment in the region from outside. (p. 25)

In summary, in the modelling outlined in this paper, additional output in the Flinders-Gilbert sub-catchments of Queensland (in the North West Queensland statistical division) arise from (5), with the potential for a contribution from (4) if the land and water to be exploited are cheap. A second and third variant of the modelling deal with (1), in which demand for the region’s output increases, either through accelerated export demand growth or through climate change in the south.

Reasons for developing the north past and present

The past

It may be rather unkind to examine arguments of 50 years or more ago given in favour of remote irrigation schemes. Cannegieter’s (1964) thought that by settling 10,000 people on the Ord River plains over the next century, Australia would show the “over-populated Asian countries looking for land of high fertility” that it valued its productive resources (Cannegieter 1964, p. 384). Musgrave and Lewis (1965) thought little of Cannegieter’s
arguments. Healey (1966) asserted that usual economic analysis would fail to take account of the indirect economic, political and ethical impacts that would arise from the scheme.

Campbell’s (1962) analysis remains the most relevant to the modelling approach taken in this study, by providing a framework that we more or less follow. But Cannegieter (1964) was in some respects the most adventurous analyst of the time, with his vision of 10,000 people working the Ord River scheme. What he failed to account for was the impact of changing technology on the labour-intensity of farming. Nor could he or anyone else have anticipated that farm from being a source of indigenous jobs in the community, the Ord River scheme now relies heavily on itinerant back-packers to do seasonal labour.

This points to what has happened in the first half of Cannegieter’s century-long vision. The population of Wyndham-East Kimberley statistical sub-division, which covers the Ord River scheme, has risen at least as quickly as Cannegieter envisaged, but for different reasons. This is evident form Table 1. The Argyle mine is a larger employer than irrigation. But 80% of the workforce is employed in utilities and services.

One more insight from the Ord River scheme: we need to distinguish between what is technically possible and what is economically viable. For example, sugar cane used to be a mainstay in the Ord River. It grows well there. But falling prices and a high AUS dollar resulted in production virtually ceasing from 2008.

Table 1 Employment in Wyndham-East Kimberley, 2011 census

<table>
<thead>
<tr>
<th>Sector</th>
<th>No.</th>
<th>%</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>179</td>
<td>4.8</td>
<td>300</td>
<td>8.0</td>
</tr>
<tr>
<td>Beef</td>
<td>80</td>
<td>2.1</td>
<td>157</td>
<td>4.2</td>
</tr>
<tr>
<td>Mining</td>
<td>358</td>
<td>9.6</td>
<td>99</td>
<td>2.6</td>
</tr>
<tr>
<td>Food Processing</td>
<td>39</td>
<td>1.0</td>
<td>212</td>
<td>5.7</td>
</tr>
<tr>
<td>Mineral processing</td>
<td>27</td>
<td>0.7</td>
<td>357</td>
<td>9.5</td>
</tr>
<tr>
<td>Other Manufactures</td>
<td>56</td>
<td>1.5</td>
<td>271</td>
<td>7.2</td>
</tr>
<tr>
<td>Utilities</td>
<td>49</td>
<td>1.3</td>
<td>141</td>
<td>3.8</td>
</tr>
<tr>
<td>Construction</td>
<td>369</td>
<td>9.9</td>
<td>1049</td>
<td>28.0</td>
</tr>
<tr>
<td>Total</td>
<td>3743</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: ABS 2011 census data.

The present

Times have changed. Perhaps fears of invasion still persist, given Australia’s treatment of refugees who come by boat. But instead of regarding the populations of east and south Asia and the Indonesian archipelago as a defence matter, with their growing national incomes, they are now regarded as providing an opportunity for accelerated food exports. We examine this in our second scenario.

Senator Heffernan argued in 2006 that farmers should move north to where the water is. This was in response to recurrent droughts in south-eastern Australia, which continued for two more years after Heffernan was quoted. A third scenario examines the Flinders-Gilbert scheme against a background of deteriorating farm productivity growth in southern Australia.

The CGE scenarios

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1 Indeed, the western tip of Java, the most heavily populated island of Indonesia, remains undeveloped. Krakatoa wiped out settlements in the region in 1883.
2 http://www.abc.net.au/water/stories/s1766574.htm
We use a dynamic version of TERM, a multi-regional CGE model of Australia. In the present application, the model represents the regions of North West Queensland, the rest of Queensland and rest of Australia separately. Wittwer and Banerjee (forthcoming) provides further details on the model. The model is based on the theory of Dixon and Rimmer (2002) and Horridge et al. (2005).

In our dynamic applications, we compare a policy scenario with a baseline. In this study, we have a single policy scenario which is compared with three different baselines:

1. a business-as-usual baseline with ongoing farm productivity growth and ongoing export demand growth;
2. a baseline in which export demand growth is accelerated due to rising incomes in Asia and elsewhere; and
3. a baseline in which farm productivity in the south (i.e., rest of Australia) is slower than in (1) due to the negative impact of climate change.

The total investment imposed on the model in agricultural and downstream industries including road transport is close to $3 billion over all years of the investment phases, with peaks of around $700 million from 2015 to 2017. While the investment phase raises employment and regional macro variables relative to forecast, the main interest of this study is on whether the irrigation schemes can pay for themselves in the longer term.

First, we convert CSIRO estimates of direct impacts into modelled shocks.

**Table 2 Estimated farm outputs, hypothetical case studies, mature phase**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Hectares</th>
<th>Output (tonnes)</th>
<th>Price ($/t)</th>
<th>Value $m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton</td>
<td>24,000</td>
<td>50,000</td>
<td>2,400</td>
<td>120</td>
</tr>
<tr>
<td>Rice</td>
<td>7,000</td>
<td>67,200</td>
<td>400</td>
<td>27</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>25,000</td>
<td>320,000</td>
<td>530</td>
<td>170</td>
</tr>
<tr>
<td>Peanuts</td>
<td>10,000</td>
<td>48,000</td>
<td>300</td>
<td>14</td>
</tr>
<tr>
<td>Rhodes Grass fodder</td>
<td>1,000</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Sorghum fodder</td>
<td>10,000</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
</tbody>
</table>


**Table 3 Endowments and technological change in North West Queensland**

($m 2011 prices, mature phase)

<table>
<thead>
<tr>
<th></th>
<th>Capital</th>
<th>Land</th>
<th>Tech</th>
<th>Row total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile factors</td>
<td>206</td>
<td>59</td>
<td>88</td>
<td>353</td>
</tr>
<tr>
<td>BeefCattle</td>
<td>4</td>
<td>49</td>
<td>11.5</td>
<td>64.5</td>
</tr>
<tr>
<td>GinCotAgSrv</td>
<td>23</td>
<td>-</td>
<td>7</td>
<td>30</td>
</tr>
<tr>
<td>MeatProds</td>
<td>4</td>
<td>-</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>OtherFood</td>
<td>19</td>
<td>-</td>
<td>34.7</td>
<td>53.7</td>
</tr>
<tr>
<td>RoadTrans</td>
<td>16</td>
<td>-</td>
<td>23.7</td>
<td>39.7</td>
</tr>
</tbody>
</table>

The endowment and technological gains shown in Table 3 that directly relate to Table 2 are those for mobile factors and beef cattle. Given that Table 2 shows values of output (which includes intermediate costs plus value-added) and Table 3 shows value-added numbers, this
conversion appears to err on the side of optimism. Possibly, in the first two rows of Table 3 at least, half the gains may be more appropriate.

Our task is to examine whether the Flinders-Gilbert is justifiable from the national perspective, so in this version of the study, we will for the most part consider only national results.

**Figure 1 National real consumption and real investment**
 (% deviation from forecast)

Figure 1 shows the deviation in real investment (the direct shocks) and real consumption from forecast at the national level. Higher than forecast investment results in a temporary increase in national employment relative to forecast, based on the assumption of sticky wages in the labour market (Figure 2). But as the investment phase winds down, national employment falls temporarily below forecast (in 2018) as this time, sticky wages mean that higher real wages persist even though the labour market has weakened. In the long run,
income gains from the Flinders-Gilbert scheme are transmitted through to higher real wages rather than higher national employment.

We might wonder why we not done better on aggregate consumption, which barely seems to rise above forecast at the national level. Figure 3 helps us to understand why. During the investment phase from 2015 to 2017, there is a real appreciation to accommodate the investment, which reduces exports and increases imports. This provides a temporary terms-of-trade gain which ends with the investment phase. Once the operational phase commences, export volumes increase relative to forecast. Since export demand curves are down-sloping, export prices fall, which impacts negatively on the terms-of-trade. This implies that the real consumption to real GDP ratio falls, with the consequence that real consumption does not rise above forecast in the operational phase. In addition, net foreign liabilities build up during the investment phase, so that additional debt servicing is required in the long run. This needs to be considered when we do a welfare calculation. The annualised welfare loss, which takes account of both aggregate consumption and, in the final year, the change in net foreign liabilities, is \textit{minus} $69$ million. A less optimistic interpretation of output gains from the scheme would result in a larger annualised loss.

**Figure 3 Trade volumes and the terms of trade**

(\% deviation from forecast)

Though we have been perhaps overly optimistic on the supply side of the Flinders-Gilbert scheme, what about the demand side? Supposing we alter the baseline so that export demand growth for agricultural and food products is more rapid than in the main baseline? At the national level, the impact will be mainly on the output of agricultural and food products in the long run, as supplies over a longer period of time tend to be relatively elastic. But in North West Queensland in which the Flinders-Gilbert is located, supplies are relatively fixed due to the fixed nature of the irrigation scheme. The main impact of more rapid export demand growth will be on returns earned by the scheme. Figure 4 shows the national output of scenario 2/baseline 2 and scenario 3/baseline 3 (to be discussed) relative to the main baseline.
Figure 4 National agricultural and food processing output
(% change relative to baseline 1/scenario 1)

![Graph showing national agricultural and food processing output](image)

Figure 5 National real consumption and real investment (scenario 2/baseline 2)
(% deviation from forecast)

![Graph showing national real consumption and real investment](image)

Figure 5 shows us that the outcome for real consumption is better in the second scenario than in the first. When we calculate welfare, we end up with an annualised figure of plus $115 million. This is encouraging, but bear in mind the excessively optimistic supply shift on which the modelling is based. Still, there may be conditions under which the Flinders-Gilbert irrigation scheme is justified, but these are beyond the control of policy makers within Australia.

Finally, let us consider the third baseline, in which productivity growth in the main farming regions of Australia is slower than in the first baseline due to climate change.
Figure 6 National real consumption and real investment (scenario 3/baseline 3) (% deviation from forecast)

The outcome is better than in the first scenario, with the annualised welfare figure being plus $48 million.

**Policy implications**

What is the policy objective of the possible Flinders-Gilbert scheme? Is it to create new farmland so as to move farming away from the south in the wake of climate change? If so, there is a missing ingredient in the analysis. It is the adaptability of farmers and farmland in the south. Agricultural R&D appears to have become unfashionable over the past decade or so, despite the benefits it may provide to regional communities in the wake of changing global market circumstances and in enhancing adaptations to climate change. To his credit, Campbell (1962) was on top of this theme more than half a century ago. Some lessons seem to have been forgotten.

Regional communities face a divide from cities in the provision of essential services. Engineering schemes in regions may appeal to the nation-building spirit, but they are not a guarantor of enhanced regional development. Every time a regional community has government funding cut, be it through reduced health care services, reduced aged care services, reduced school funding or reduced TAFE funding, material harm is being done to employment prospects in these communities. No engineering scheme can camouflage the ripples of such decisions.

To some good news: the Flinders-Gilbert region has become a recent beneficiary of a move by the Royal Flying Doctor Service into dentistry (ABC 2013). That might matter more to people in the region than an irrigation scheme. The Flinders-Gilbert scheme, if it were to go ahead, would be in danger of following the same tortured path at the Ord River scheme.

**References**


Flinders and Gilbert Agricultural Resource Assessment, part of the North Queensland Irrigated Agriculture Strategy. CSIRO Water for a Healthy Country and Sustainable Agriculture flagships, Australia.


