Deloitte Access Economics

The value of water to Namoi Catchment

Namoi Councils

31 May 2012

Deloitte.

Contents

Charts

Tables

Glossary

Business as usual (BAU) – a scenario of 'normal' development, where the variable of interest (in this case water) does not change from some pre-determined concept of normal (such as no deviation from the present, or from long term averages). It is against this scenario that other modelled scenarios are compared, with the difference in outcomes referred to as an 'impact',

Computable General Equilibrium (CGE) – a modelling framework built on an established body of economic theory in which accounting identities used by statistical agencies (including the Australian Bureau of Statistics) are explicitly met, and where the actions of any agent in the economy (for example, changes to government taxation policy) has either direct or indirect flow on impacts to all other agents.

DAE-RGEM – Deloitte Access Economic regional CGE model.

Employment – The number of Full Time Equivalent (FTE) jobs in a region or sector.

GDP/GSP/GRP -– Gross Domestic Product, Gross State Product or Gross Regional Product respectively - a commonly used measure of economic activity. One method for constructing this measure is to take the sum of all value-add that occurs within the region of interest.

Government expenditure – in the same way that households consume goods and services, the government in each region also consumes goods and services for the purpose of supplying public goods through government expenditure. Within DAE-RGEM the government sector represents a combination of all the levels of government from local council to federal government.

Household/representative household – Most CGE models (including DAE-RGEM) use a single household agent/unit in the model to represent the total activity of all households in a region – a so-called representative household. In each year the representative household earns income which is allocated in part to consumption of goods and services (for example, accommodation services and food products), and in part to savings which are then used for investment in capital goods.

Investment – Investment in the model refers to the creation of new physical capital, either to replace old depreciated capital (for example, an old computer replaced by a new computer) or to increase the total capital stock (for example, to increase the number of computers in a business).

Labour supply – The count of the employed and the unemployed (but available for work) population.

Real Wages – the wages received by employees adjusted for inflation.

Terms of Trade – a commonly used ratio measuring the difference between the price of a region's exports and the price of a region's imports.

Value Added – the difference between the value of product sold in an industry and the value of the intermediate inputs (that is, goods and services used for production) in an industry. For example, if a factory purchases $10 of ingredients and produces $15 worth of bread, the value added in providing the product is $5. Value added is distributed across payments to the factors of production including labour, capital and land.

Executive Summary

This report presents the results of Deloitte Access Economics' modelling of the economic impacts of a drier future on the Namoi economy. The impacts of a drier future have been modelled using three integrated models: (1) a water and landuse model of the Namoi Catchment; (2) a Computable General Equilibrium (CGE) model with the Namoi Catchment as a discrete region in the global economy and 3) a community level disaggregation resilience model.

The water and landuse model determines the agricultural landuse and eventual agricultural output of the Namoi Catchment under different water availability scenarios. Taking this agricultural production data as an input, the CGE model estimates the effects of each water availability scenario on the whole economy of the catchment, including the main economic indicators of gross regional product (GRP), employment and wages. The community model then disaggregates the catchment level results to the individual communities based on their land and water use and industry profiles.

The following discussion presents the high level modelling results from several drier future scenarios for the Namoi Catchment.

The value of water assessment reflects the combined outputs of the three models, when used to model the effects of declining water availability in the Namoi Catchment. Key results of this process are as follows:

- The best estimate water availability scenario is based on the proposed Murray Darling Basin Plan, where rainfall is 0.4% lower by 2030 and there is 13.1% less water available for irrigated agriculture (based on changes in allocations and entitlements). This scenario leads to an average annual decline in agricultural production of $23.6 million (in 2010 prices) by 2030, or 2% of the total value of agricultural production in the Namoi Catchment.
- The losses are primarily experienced in irrigated agriculture (especially cotton) rather than dryland agriculture. In the scenario, irrigated agriculture is affected by both climate change (and its resulting effects on reduced allocations) and reduced entitlements whereas dryland agriculture only experiences the impacts of reduced rainfall from climate change.
- Overall, gross regional product in the catchment falls by $38 million, representing a fall of 0.4%, and the economy supports almost 70 less jobs on a full time equivalent (FTE) basis.
- For every additional dollar of agricultural production– of which approximately 60 cents is value-added – Namoi's GRP overall grows by $1.36. This is a value-added multiplier of approximately 2.3. This means that, of the total value added to the economy of water use in agriculture, 40% of it is realised in agriculture. The flow on effects of reduced water availability is experienced across the wider economy, most notably in food processing and construction.
- Of the two likely causes of reduced water in the future – climate change and the Basin Plan – Namoi's economy is more vulnerable to those relating to the Basin Plan, at least out until 2030. Of course, any climate change is likely to continue to develop beyond

2030, in a way that is not modelled here. Similarly, the values associated with environmental improvements from the Basin Plan are not modelled here.

- A scenario where climate change acts alone, without a policy based reduction in entitlements, the losses are more modest. In this scenario, (with a 0.4% reduction in rainfall and a 5% reduction in water allocations by 2030) agricultural production falls by $5.2 million or 0.7%, while GRP falls by $12 million, or 0.1%. These losses are experienced in both dryland and irrigated agriculture.
- A scenario where the only change is a reduction in irrigation entitlements of 8.5%, as a consequence of the Basin Plan, leads to an $8.2 million or 1.1% loss in the value of agricultural production and a loss in GRP of 22.1 million (0.2%). In this scenario, all losses are experienced in irrigated agriculture. In fact, there is a slight gain to dryland agricultural values, as more land is converted from irrigation to dryland.
- Far more economically destructive to the catchment than forecast climate change or the Basin Plan would be a longer term continuation of the climatic conditions experienced during the recent drought.
- The value of water – be it a millimetre of rainfall or a ML of irrigation water – varies depending on how much water is already being used. At the margin (defined by long term average conditions of 350 GL of water used and average catchment wide rainfall of 578 mm), the following marginal values of water are observed:
    - For each mm of rainfall lost to dryland agriculture, the size of the regional economy declines by $519,000. (This is the value of rainfall to dryland agriculture.) The link between rainfall and runoff, and hence allocations and irrigated water use, ensures rainfall is even more valuable than this.
    - For each ML of irrigation water lost the size of Namoi's economy declines by approximately $750.
- The value of water, and hence the impacts of less water, are not experienced uniformly throughout the catchment. At a community level, the towns expected to be proportionally hardest hit are either those that are most heavily dependent upon irrigated agriculture (Wee Waa and Walgett), and/or lack the characteristics that allow a community to be resilient to negative external change (Wee Waa, Walgett, Baradine and Quirindi).
- Scenarios to adapt to this drier future have not been modelled here. Rather, the modelling capacity to explore a wide range of adaptation responses has been provided to the Namoi Catchment Management Authority to assist in planning responses.

Deloitte Access Economics

1 Forecast drier future

Over the coming decades the Namoi Catchment's economy is expected to be impacted by both the effects of climate change and a reduction in irrigation entitlements held in the region as a result of the Murray Darling Basin Plan. This section outlines the findings of modelling on the economic impact on the region of the proposed Murray Darling Basin Plan water buyback scenario.

Base case, or business as usual (BAU)

To model the impacts of a drier future, it is first necessary to develop a comparison 'no change' world, against which the drier future scenario can be compared. This so called 'Base Case' scenario, models the future of the region without any changes to water availability. In effect, this is a 'business as usual' water availability future for the Namoi Catchment, where the climate does not change from long term averages and where there is no reduction in entitlements out of the region. In other words, the volume of irrigated water use does not decline. The economic outcomes of the water availability scenario are then compared to the Base Case, with the differences called the 'impact' of less water.

Key assumptions of the historical baseline climate scenario for the Namoi Catchment are summarised below:

- Average annual historical rainfall for the Namoi Catchment is 578 mm.
- The average variability in rainfall between years (coefficient of variation) is 27%.
- Average annual general security water allocations of 69% of total volume entitlement.

Forecast drier future scenario assumptions

The following assumptions were made in estimating the key water availability parameters for the scenario:

Table 1.1: Forecast drier future water assumptions

		Projections	
	Long term average	2019	2030
Average annual rainfall mm	578	-0.2%	-0.4%
Average water extraction allocation volume	69%	-2.5%	-5.0%
Total water extraction entitlements ML	497,000	-8.5%	-8.5%
Overall impacts on extractive water availability		***-10.8%***	***-13.1%***

Results

The impacts of reduced water from climate change and the purchase of an additional 2,750 GL/year for the environment on the key variables of the Namoi Catchment economy are provided in Table 1.2.

By 2030, the value of agricultural production is modelled to decline by 2%, representing lost agricultural production value of $23.6 million.

After including the flow-on effects to the rest of Namoi's economy, the reduction in water availability resulting from the proposed Murray Darling Basin Plan causes a 0.4% decline in real GRP, or a loss of $38.0 million from the regional economy. This reduction in production corresponds to a decline in employment of approximately 60 full time employees in the region, under normal labour market conditions.

The overall economic impacts of a drier future, especially the employment impacts, are highly sensitive to assumptions around key labour market assumptions, particularly the ability and willingness of workers of the Namoi Catchment to exit the labour force when opportunities decline relative to elsewhere. The results identified above reflect a Namoi labour market responding in a manner that has been calibrated on trends observed during the recent drought. Impacts reported here will be magnified should the population become more mobile than it was during the drought, and more people leave the region in pursuit of relatively better economic opportunities elsewhere.

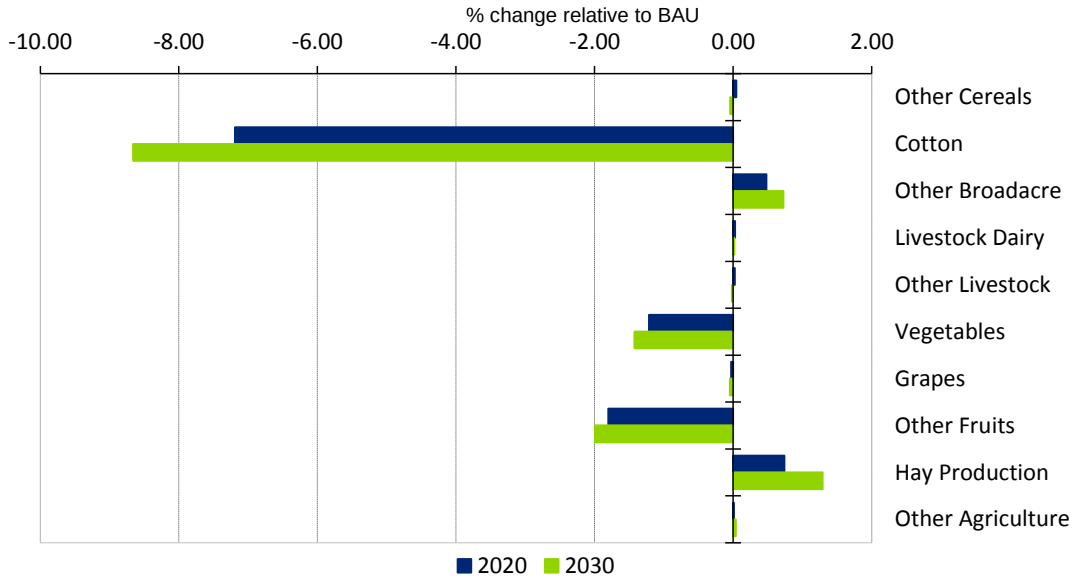
Table 1.2: Scenario results

Impact – compared to BAU	2020	2030
Value of agricultural production ($A,2010 prices)	-$19.5 million	-$23.6 million
Real GRP - % Change	-0.4	-0.4
Employment - % Change	-0.1	-0.1
Household cons - % Change	-0.3	-0.3
Investment - % Change	-0.4	-0.2
Govt. Exp - % Change	-0.3	-0.3
Exports - % Change	-1.0	-1.2
Imports - % Change	-0.3	-0.3
Terms of Trade - % Change	0.2	0.3
Real wages - % Change	-0.1	-0.1
Real GRP ($A, 2010 prices)	-$26.0 million	-$38.0 million
Real HH cons ($A, 2010 prices)	-$12.1 million	-$19.0 million
Employment (FTE)	-49	-59

The higher relative fall in water allocation and entitlement volumes (than rainfall) sees irrigated agriculture experiencing proportionately more of the impacts than dryland agriculture. This is because, in the scenario, irrigated agriculture experiences the effects of climate change (and its resulting effects on reduced allocations) *and* from reduced entitlements, whereas dryland agriculture only experiences the impacts of reduced rainfall from climate change. The relative effect of rainfall, climate change and policy on dryland and irrigated agriculture is explored more in the next section.

The combination of reduced yields and land use substitutions sees the value of production from cotton decline at an average annual rate of 8.7% by 2030 (compared to business as usual). Falls in the value of production are also seen in other irrigation dependent commodities such as vegetables (down 1.4%) and other fruits (down 2.0%).

Chart 1.1: Impacts on agricultural output



The land that otherwise would have been used for irrigated agriculture – primarily cotton – is transitioned into dryland crops such as other broadacre and other cereals.[1] Even though there is more land being used for dryland agriculture, there are small falls in the overall value of dryland agriculture, because of the effect of lower yields from reduced rainfall. In other words, even though the area of dryland agriculture goes up, the yield from that larger area is lower.

Nevertheless, the higher relative fall in water allocation and entitlement volumes sees irrigated agriculture experiencing proportionately far more of the impacts than dry land agriculture. This is particularly true in the first five years, as irrigated agriculture suffers most initially from the fall in water entitlements form the Basin Plan.

Flowing on from the direct shock to agriculture will be a decline in the value of output from selected industries that source inputs directly from the local agricultural industry (dairy products down 0.1% and processed food down 0.2%).

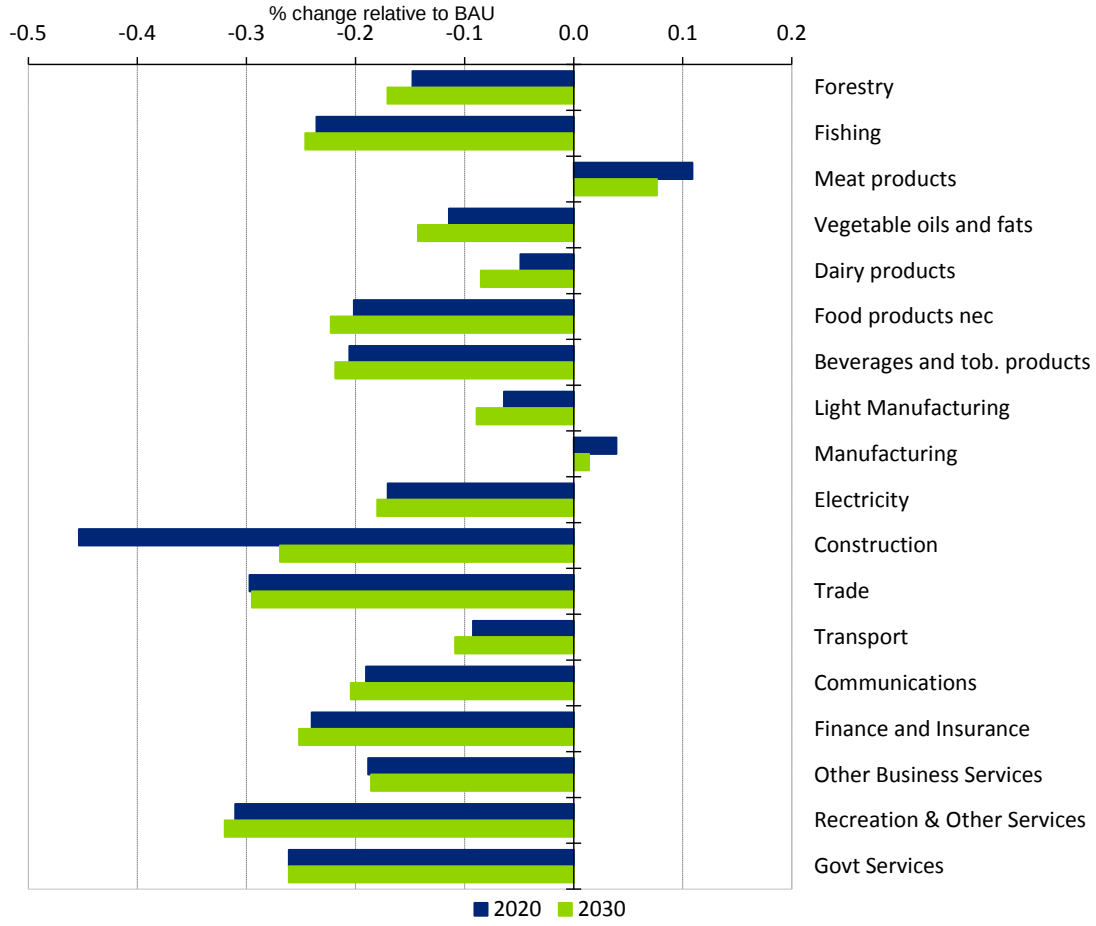
Construction provides a good representation of the general health of the region's economy as an increase in investment in physical assets reflects confidence in the local economy. By 2020, construction in the Namoi Catchment is expected to decline by 0.5%; however, as the economy adjusts to the shock, and excess capital and labour are redeployed, the decline in the value of construction output is expected to moderate to 0.3%.

Declines in other industries are primarily due to reduced expenditure in the region (from lower employment and reduced farm incomes). This will be most important to service-based industries such as finance and insurance, retail trade, recreation and government services.

[1] Refer to previous milestone reports for descriptions of each agricultural sector.

The rise in manufacturing is likely due to the sector benefitting from the small fall in wages in the region, as remaining businesses have a labour price advantage over competitors that they otherwise do not have.

Chart 1.2: Flow on impacts to other industries



Community level impacts

Table 1.3 provides a summary of the community level impacts of the forecast drier future scenario. These include:

- the absolute $ impact to agriculture and the rest of the economy;
- the impact to agriculture (rest of economy) in terms of the size of each town's agriculture industry (economy);
- the impact to agriculture (rest of economy) in terms of the size of each town's agriculture industry (economy) adjusted for the relative vulnerability of each town; and
- the size of the agriculture industry in comparison to the rest of the economy.

Impacts on agriculture

Across the catchment, Wee Waa, Walgett and Boggabri are expected to experience the largest impacts to agriculture from the drier future scenario. This is because of two main reasons:

- the agriculture industry dominates the local economy of these communities; plus
- they are expected to experience the largest decline in the value of agricultural production (in terms of the size of their agriculture industry), because of the nature of the irrigated production that occurs there.

For example, under this scenario the value of agricultural production in Wee Waa is expected to decline by 5.8% (which is the strongest impact on any community in the Namoi Catchment). This is particularly important given Wee Waa's agricultural industry comprises 90% of the town's economy.

Similarly, Boggabri's agriculture industry represents over 20% of the region's economy and the drier future scenario results in a 1% decline in the value of agricultural output in the community.

Walgett's agriculture industry accounts for 40% of the community's economy. Consequently, the 0.3% decline in the value of agriculture will still result in noticeable impact on the community's economy.

There are, however, two notable exceptions to this general trend – Narrabri and Curlewis. The impact of a 3.8% decline in the value of agriculture in Narrabri will be less significant than, for example Wee Waa, as agriculture only (directly) accounts for 5.4% of Narrabri's economy.

While the agriculture industry accounts for almost 40% of Curlewis' local economy, the dominance of dryland agriculture ensures this community's agriculture industry will fare relatively well in the forecast drier future scenario.

Impacts on the rest of the economy

The flow-on impacts to the wider economy of reduced water availability are determined by each town's industry structure. While a town in the region may not be heavily dependent on agriculture, it may be reliant on downstream agribusiness – such as food processing, dairy processing and vegetable oils and fats – or expenditure from farmers in the catchment more broadly.

Towns in close proximity to Tamworth (Nemingha, Kootingal, Kingswood, Moonbi, Attunga and Bendemeer) experience declining economic activity despite minimal overall impacts on their agricultural industries. This is primarily due to their dependence on service-based industries that rely on total expenditure in the region such as business, recreation and government services.

This is particularly evident for Tamworth itself. As the business and retail centre of the Namoi Catchment, Tamworth is expected to experience a relatively larger share of the decline in downstream industries – such as retail trade, recreation services and government services – despite the minimal direct impact on the community's agriculture industry.

While the size of Narrabri's agriculture industry is relatively small in comparison to some communities in the catchment, the local economy is heavily dependent on agribusinesses such as agriculture related R&D (private and government) enterprises and business services that directly support agriculture (agronomists, accountants, farm management, livestock officers, etc). This dependence on farm expenditure will exacerbate the 3.8% decline in the value of agriculture beyond this one industry.

Vulnerability adjusted impacts

Vulnerability adjusted impacts present the expected community level impacts accounting for each town's resilience characteristics such as level of education, mining prospects, general labour market opportunities, income levels, Indigenous status and distance to large urban centres (see Appendix A for more details).

Communities with relatively low levels of resilience are expected to experience a larger share of the impact than the mechanical disaggregation would suggest (as they are unable to adapt and respond to the shock from less water). Tamworth is the most resilient community in the catchment while Walgett and Barraba are the least resilient.

The resilient characteristics of Tamworth's population and economy ensure the community will experience a smaller impact than expected. In fact, after adjusting for the degree of vulnerability, Tamworth shifts from being one of the communities most affected by reduced water availability to a community that experiences a medium impact from reduced water availability. In contrast, Quirindi is expected to see local economic activity decline by more than what its industry profile would suggest.

Table 1.3: Impact on the value of output at the town level – forecast drier future

	Impact to ($,000):		Impact as a share of industry/ economy (%)		Impact as a share of industry/ economy, adjusted for relative vulnerability (%)		Agriculture's share of economy[(a)]
	Ag	*Economy*	*Ag*	*Economy*	*Ag*	*Economy*	
Attunga (L)	-1	-637	-0.01	-0.21	-0.01	-0.20	3.4%
Baradine (L)	22	-816	0.27	**-0.27**	0.27	**-0.32**	2.8%
Barraba	267	-379	0.59	-0.19	0.61	-0.24	**22.6%**
Bendemeer (L)	-4	-398	-0.06	-0.19	-0.10	-0.20	3.6%
Boggabri (L)	-330	-201	**-1.06**	-0.13	**-1.18**	-0.17	**20.8%**
Curlewis (L)	-14	-356	-0.02	-0.18	-0.02	-0.20	**37.5%**
Gunnedah	-600	-3,163	**-1.07**	-0.20	**-0.98**	-0.21	3.6%
Kingswood (L)	7	-1,542	0.05	-0.22	-0.01	-0.21	2.0%
Kootingal	1	-1,204	0.02	-0.22	0.01	-0.21	0.7%
Manilla	-1	-762	0.00	-0.21	0.00	-0.24	10.8%
Moonbi (L)	-3	-849	-0.04	-0.23	-0.05	-0.21	2.1%
Narrabri	-2,379	-2,671	**-3.83**	**-0.23**	**-3.52**	**-0.24**	5.4%
Nemingha (L)	0	-859	2.13	-0.22	2.24	-0.21	0.0%
Nundle (L)	-1	-331	0.00	-0.22	0.00	-0.24	14.3%
Quirindi	8	-1,220	0.01	-0.21	0.01	**-0.25**	14.3%
Tamworth	-4	-15,807	-0.03	**-0.23**	-0.03	-0.22	0.2%
Walgett	-232	-511	**-0.32**	**-0.28**	**-0.36**	**-0.35**	**39.6%**
Wee Waa	-12,099	-587	**-5.83**	**-0.25**	**-5.92**	**-0.30**	**90.0%**
Werris Creek	2	-552	0.01	-0.19	0.01	-0.18	5.3%

Note: Ag: agriculture; (a) Agriculture industry's share of total economic output in each community (based on mechanical disaggregation); coloured cells represent 5 largest impacts in each column.

2 Scenarios

This section decomposes the forecast drier future scenario into its components, namely:

- rainfall;
- climate change; and
- government policy (proposed Murray Darling Basin Plan).

A comparison of the scenarios is then provided to highlight the relative effect of each scenario on the Namoi Catchment's economy. The impact of the proposed Murray Darling Basin Plan is larger than the other scenarios modelled because it is this scenario that, by far, represents the biggest cut in water availability to the catchment (8.5% cut in water available for irrigation). This is despite an increase in production of dryland agriculture.

The next most costly scenario is the water available to the Namoi Catchment under climate change conditions. This consists of both a reduction in rainfall and a reduction in allocation rates (with an overall reduction in water available for irrigation of 2.5% by 2019 and 5.0% by 2030).

Finally, the rainfall only scenario is used to illustrate the decline in the value of agriculture expected in the region following a 0.2% reduction in average rainfall. This scenario will predominantly impact dryland agricultural production.

2.1 Rainfall only

The following assumptions were made in estimating the key water availability parameters for the rainfall only scenario:

Table 2.1: Water assumptions of rainfall only scenario

		Projections	
	Long term average	2019	2030
Average annual rainfall mm	578	-0.2%	-0.4%
Average water extraction allocation volume	69%	0.0%	0.0%
Total water extraction entitlements ML	497,000	0.0%	0.0%
Overall impacts on extractive water availability		***0.0%***	***0.0%***

The impacts of reduced water from rainfall are provided in Table 2.2.

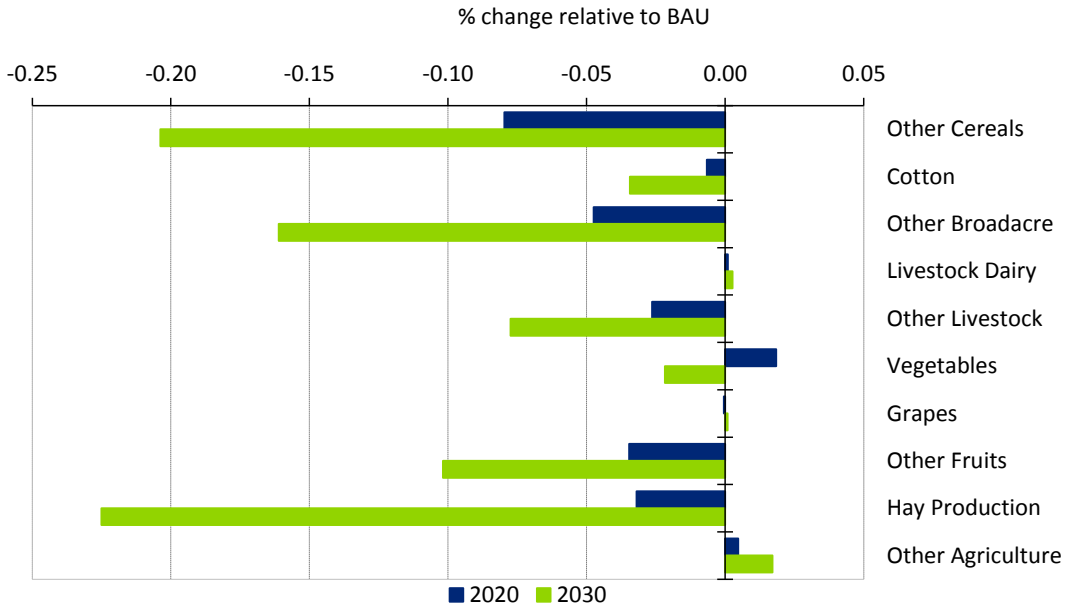
By 2030 the value of agricultural production is modelled to decline by less than 0.03% which represents a loss in value of $0.9 million.

Table 2.2: Results from rainfall only scenario

Impact – compared to BAU	2020	2030
Value of irrigated agricultural production ($A, 2010 prices)	-$37,000	-$68,000
Value of dryland agricultural production ($A, 2010 prices)	-$341,000	-$812,000
Value of total agricultural production ($A, 2010 prices)	-$378,000	-$880,000
Real GRP ($A, 2010 prices)	-$0.4 million	-$1.2 million

The reduction in rainfall will have the greatest impact on dryland agricultural production – particularly hay, other cereals, other broadacre and other livestock (see Chart 2.1). However water intensive agricultural industries such as cotton and other fruits will also experience a decline in the value of production as a result of less water.

Chart 2.1: Impact on agricultural production – rainfall only scenario



At the community level the communities most affected by reduced rainfall are those with sizeable dryland agricultural production: Walgett, Curlewis, Barraba, Werris Creek and Quirindi.

Wee Waa is expected to experience the largest absolute share of the impact at the catchment level (approximately $125,000), but this represents less than 0.06% of the value of agriculture in the community. This decline is primarily driven by Wee Waa's other cereals, other livestock and other broadacre sectors. However, the reduced rainfall will also reduce the value of the region's cotton production.

Accounting for almost 30% of the catchment's decline in the value of broadacre production and 20% of the decline in the value of production in other cereals it is unsurprising that Walgett is expected to experience the largest impact in terms of the share of total value of agriculture.

The $100,000 decline in agricultural production in Quirindi and $110,000 decline in Curlewis are due to the communities' other cereals and other livestock sectors. While this is a small decline, the impact is felt relatively harder in these two communities due to the relatively small size of their agriculture industry (than, for example, Wee Waa or Boggabri).

The declining value of Werris Creek's other cereals production accounts for the relatively stronger impact of reduced rainfall on this town (0.14% decline in the value of agricultural production).

Table 2.3: Impact on agricultural production at the town level – rainfall only scenario

Impacts	Total ($,000) *Agriculture*	Share of Total (%)
Attunga (L)	-10	-0.10
Baradine (L)	-7	-0.08
Barraba	-64	**-0.14**
Bendemeer (L)	-4	-0.05
Boggabri (L)	-35	-0.11
Curlewis (L)	-112	**-0.15**
Gunnedah	-65	-0.12
Kingswood (L)	-15	-0.11
Kootingal	-1	-0.03
Manilla	-29	-0.07
Moonbi (L)	-5	-0.06
Narrabri	-37	-0.06
Nemingha (L)	1	6.39
Nundle (L)	-15	-0.07
Quirindi	-102	**-0.12**
Tamworth	-1	-0.01
Walgett	-106	**-0.15**
Wee Waa	-126	-0.06
Werris Creek	-22	**-0.14**

2.2 Climate change

The following assumptions were made in estimating the key water availability parameters for the climate change scenario:

Table 2.4: Water assumptions of climate change scenario

		Projections	
	Long term average	2019	2030
Average annual rainfall mm	578	-0.2%	-0.4%
Average water extraction allocation volume	69%	-2.5%	-5.0%
Total water extraction entitlements ML	497,000		
Overall impacts on extractive water availability		***-2.5%***	***-5.0%***

The impacts of reduced water from climate change are provided in Table 2.5.

By 2030 the value of agricultural production is modelled to decline by approximately 0.7% which represents a loss in value of $5.2 million.

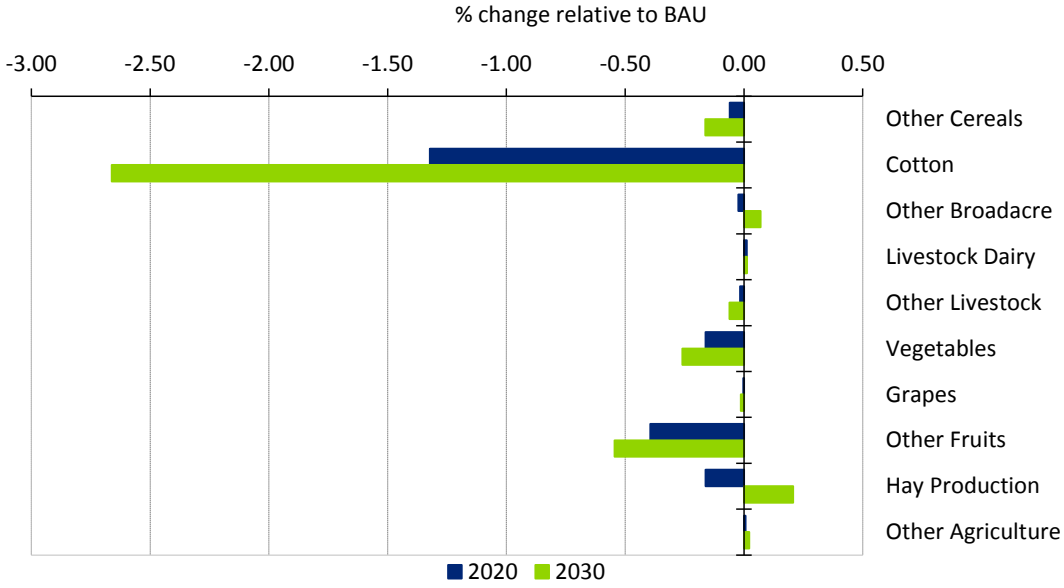
After including the flow-on effects to the rest of the Namoi Catchment's economy, the reduction in water from climate change (rainfall and allocation volumes) results in a 0.1% decline in real GRP, or a loss of $12.0 million from the regional economy.

Table 2.5: Results from climate change scenario

Impact – compared to BAU	2020	2030
Value of irrigated agricultural production ($A, 2010 prices)	-$2.4 million	-$4.4 million
Value of dryland agricultural production ($A, 2010 prices)	-$0.3 million	-$0.7 million
Value of total agricultural production ($A, 2010 prices)	-$2.6 million	-$5.2 million
Real GRP ($A, 2010 prices)	-$5.0 million	-$12.0 million

While the rainfall scenario primarily affected dryland cropping and grazing, the climate change scenario also affects the amount of water available for irrigation through the reduction in allocation volume. This can be seen in Chart 2.2. Cotton, as the region's biggest water user, experiences the largest decline in the value of production but there is also a decline in production values across some dryland sectors such as other cereals and other livestock.

Chart 2.2: Impact on agricultural production – climate change scenario



At the community level, communities with a large proportion of cotton production are the hardest hit – particularly Wee Waa, Narrabri, Walgett, Gunnedah and Boggabri. Wee Waa alone accounts for almost 80% of the catchment's decline in the value of cotton production under the climate change scenario.

Walgett, Gunnedah and Boggabri also experience declines in the value of production from other cereals – these three communities represent over one third of the catchment-wide decline in other cereals.

Table 2.6: Impact on agricultural production at the town level – climate change scenario

Impacts	Total ($,000) *Agriculture*	Share of Total (%)
Attunga (L)	-9	-0.09
Baradine (L)	-1	-0.01
Barraba	30	0.07
Bendemeer (L)	-3	-0.03
Boggabri (L)	-98	**-0.31**
Curlewis (L)	-77	-0.10
Gunnedah	-208	**-0.37**
Kingswood (L)	-7	-0.05
Kootingal	-1	-0.03
Manilla	-23	-0.06
Moonbi (L)	-4	-0.05
Narrabri	-644	**-1.04**
Nemingha (L)	0	1.64
Nundle (L)	-12	-0.05
Quirindi	-73	-0.09
Tamworth	-4	-0.04
Walgett	-140	**-0.19**
Wee Waa	-3,699	**-1.78**
Werris Creek	-14	-0.09

2.3 Policy only

The following assumptions were made in estimating the key water availability parameters for the policy only scenario:

Table 2.7: Water assumptions of policy only scenario

		Projections	
	Long term average	2019	2030
Average annual rainfall mm	578	0.0%	0.0%
Average water extraction allocation volume	69%	0.0%	0.0%
Total water extraction entitlements ML	497,000	-8.5%	-8.5%
Overall impacts on extractive water availability		***-8.5%***	***-8.5%***

The policy only scenario represents an 8.5% cut in entitlements in the Namoi Catchment as a result of the proposed Murray Darling Basin Plan. This scenario shifts production out of irrigated agriculture and into dryland production as the cost of water increases. However, the increase in the value of dryland production is insufficient to cover the loss from irrigated agriculture. As Table 2.8 summarises, the value of agricultural production in the catchment is expected to decline by $8.2 million by 2030 under this scenario.

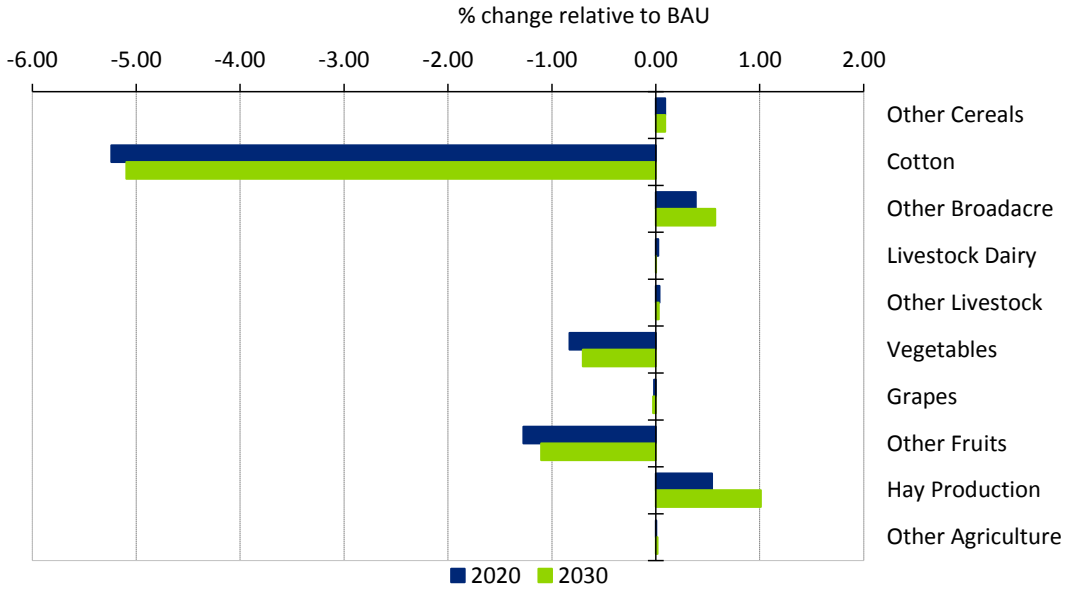
The results also illustrate the responsiveness of the agricultural industry versus the wider economy to a shock. The largest impact to the agricultural sector is felt soon after the policy comes into effect (2020), but by 2030 the sector has begun to adjust and the size of the impact moderates. On the other hand, the wider economy takes time to adjust – particularly the capital stock – and this is reflected in the larger impact on real GRP in 2030 than 2020.

Table 2.8: Results from policy only scenario

Impact – compared to BAU	2020	2030
Value of irrigated agricultural production ($A, 2010 prices)	-$9.0 million	-$8.4 million
Value of dryland agricultural production ($A, 2010 prices)	$0.2 million	$0.2 million
Value of total agricultural production ($A, 2010 prices)	-$8.7 million	-$8.2 million
Real GRP ($A, 2010 prices)	-$18.6 million	-$22.1 million

The cut to entitlements affects irrigation-intensive industries such as cotton, vegetables and fruits. The shift towards dryland cropping is reflected in the increase in other broadacre, other cereals and hay production.

Chart 2.3: Impact on agricultural production – policy scenario



At the community level, irrigation dependent communities such as Wee Waa, Narrabri, Gunnedah and Boggabri will experience the largest declines in the value of agricultural production. Within the agricultural industry in these communities, dryland crops and grazing will increase in production value but not enough to mitigate the decline in irrigated agriculture.

The policy scenario is expected to result in a 3.5% decline in agricultural production in Werris Creek and a 2.5% decline in Narrabri.

Taking advantage of increases in available land and water, dryland dominant communities such as Barraba, Quirindi and Curlewis will see the value of production improve under the policy scenario.

While the value of agricultural production in Walgett is expected to decline by 0.1% this masks the change in landuses within the community – the value of cotton production will decline by $180,000 but $100,000 of this is offset by increases in the value of other cereals, other broadacre, hay and other livestock.

Table 2.9: Impact on agricultural production at the town level – policy scenario

Impacts	Total ($,000) *Agriculture*	Share of Total (%)
Attunga (L)	5	0.0
Baradine (L)	19	0.2
Barraba	218	0.5
Bendemeer (L)	2	0.0
Boggabri (L)	-218	**-0.7**
Curlewis (L)	38	0.1
Gunnedah	-355	**-0.6**
Kingswood (L)	18	0.1
Kootingal	1	0.0
Manilla	14	0.0
Moonbi (L)	2	0.0
Narrabri	-1,541	**-2.5**
Nemingha (L)	0	**-0.7**
Nundle (L)	7	0.0
Quirindi	57	0.1
Tamworth	-2	0.0
Walgett	-89	-0.1
Wee Waa	-7,189	**-3.5**
Werris Creek	10	0.1

To illustrate the diversity of the effect of the policy scenario across communities in the Namoi Catchment Chart 2.4 and Chart 2.5 provide the impact on the value of agriculture in Wee Waa and Moonbi. As the table above shows, Wee Waa will experience a decline in the value of agriculture while Moonbi will experience a slight increase in the value of agriculture.

Wee Waa's decline of over $7 million (or 3.5% of the total value of agricultural production) is almost entirely driven by a shock to the irrigation intensive cotton sector. This decline represents almost three-quarters of the decline in cotton at the whole of catchment level.

While Moonbi's vegetable sector will decline under the policy scenario, this will be more than offset by rising production values in other livestock, other broadacre and hay.

Chart 2.4: Impact on value of agriculture from policy scenario – Wee Waa

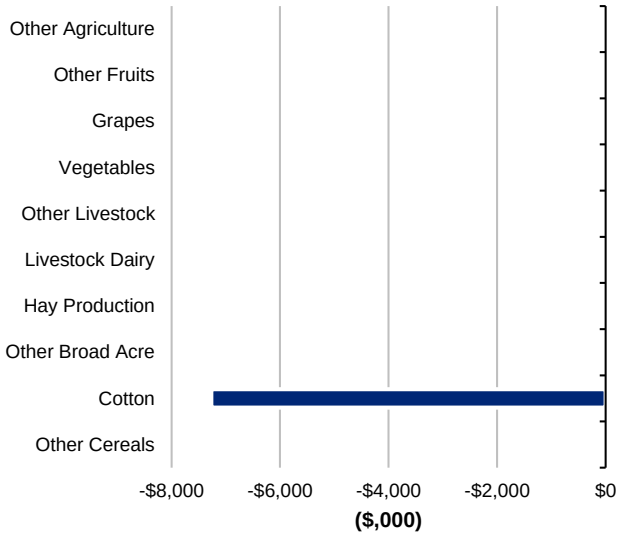
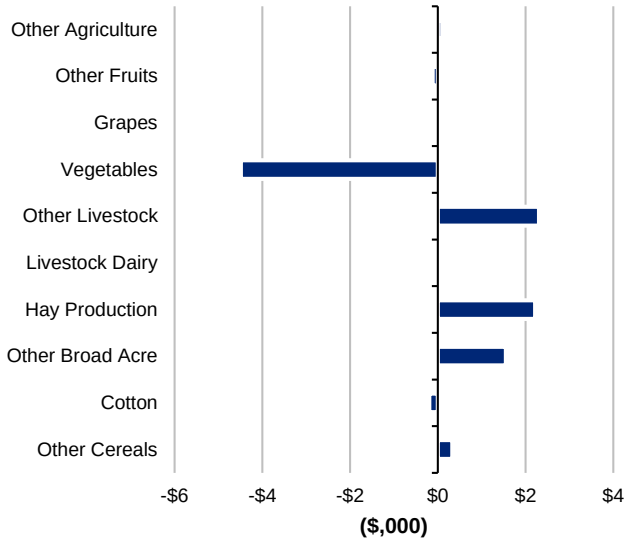


Chart 2.5: Impact on value of agriculture from policy scenario – Moonbi

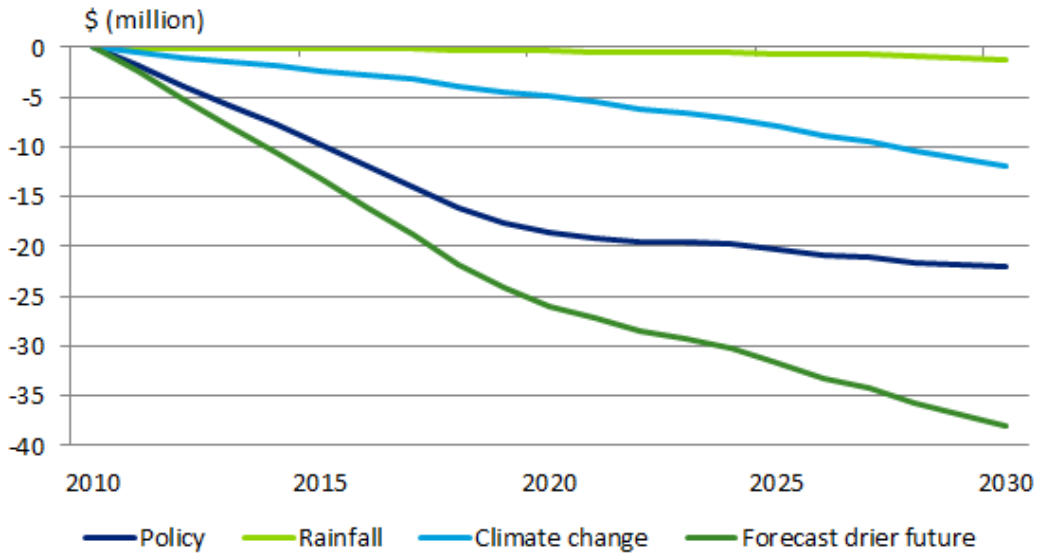


2.4 Comparison of scenarios

As illustrated in Chart 2.6, the timing of the impact of the policy scenario is non-linear while the rainfall and climate change scenarios have relatively linear impacts. As a consequence, the forecast drier future scenario (which combines the impacts of climate change with the proposed Murray Darling Basin plan impacts) is non-linear in its impacts.

Real GRP impacts are greatest under the policy scenario, although the impacts moderate beyond 2020 as landuse becomes more optimised to the drier conditions and the economy adjusts. Conversely, the rainfall and climate change impacts are more gradual; however, despite the linear loss in water over time in these scenarios, the impacts accelerate slightly reflecting the increased cost of each unit of water lost over time.

Chart 2.6: Real GRP impacts, compared to BAU



2.5 Sensitivity analysis

The impact of the water availability scenarios is expected to be non-linear, in terms of costs per unit of water lost. That is, the impacts of a 20% decline in water available for irrigation are more than double the impacts of a 10% decline. This occurs both in:

- agriculture, where the least efficient water uses are assumed to go first, meaning that the cost of each additional unit of water lost is greater as more water is lost; and
- the broader economy, where the flow-on impacts from a decline in agriculture become harder to adjust to as the decline increases in magnitude.

In other words, the multiplier effect on the rest of the economy from each dollar of production lost in agriculture becomes larger as the losses become larger.

The following assumptions were made in estimating the key water availability parameters for the two sensitivity analyses:

Table 2.10: Water assumptions of sensitivity one

		Projections	
	Long term average	2019	2030
Average annual rainfall mm	578	-0.7%	-1.6%
Average water extraction allocation volume	69%	-43.2%	-52.4%
Total water extraction entitlements ML	497,000		
Overall impacts on extractive water availability		***-43.2%***	***-52.4%***

Table 2.11: Water assumptions of sensitivity two

	Long term average	2019	2030
Average annual rainfall mm	578	-0.7%	-1.6%
Average water extraction allocation volume	69%	-21.6%	-26.2%
Total water extraction entitlements ML	497,000		
Overall impacts on extractive water availability		***-21.6%***	***-26.2%***

As shown in Table 2.12, doubling the cut to water available for irrigation – from a 26.2% cut to a 52.4% cut – by 2030 more than doubled the reduction in both the value of agricultural production and GRP.

Table 2.12: Sensitivity analysis

Impact – compared to BAU	2020	2030
Sensitivity One:		
Value of irrigated agricultural production ($A, 2010 prices)	-$64.4 million	-$80.7 million
Value of dryland agricultural production ($A, 2010 prices)	$0.1 million	-$0.1 million
Value of total agricultural production ($A, 2010 prices)	-$63.7 million	-$80.8 million
Real GRP ($A, 2010 prices)	-$131.8 million	-$195.4 million
Sensitivity Two:		
Value of irrigated agricultural production ($A, 2010 prices)	-$28.1 million	-$34.6 million
Value of dryland agricultural production ($A, 2010 prices)	-$0.4 million	-$1.4 million
Value of total agricultural production ($A, 2010 prices)	-$28.5 million	-$36.0 million
Real GRP ($A, 2010 prices)	-$60.0 million	-$87.6 million

Limitation of our work

General use disclaimer

This report has been prepared for the use of Namoi Councils. This report is not intended to and should not be used or relied upon by anyone else and we accept no duty of care to any other person or entity in respect of any reliance placed on the report.

Contact us

Deloitte Access Economics
ACN: 49 633 116

Level 1
9 Sydney Avenue
Barton ACT 2600
PO Box 6334
Kingston ACT 2604 Australia

Tel: +61 2 6175 2000
Fax: +61 2 6175 2001

www.deloitte.com/au/economics

Deloitte Access Economics is Australia's pre-eminent economics advisory practice and a member of Deloitte's global economics group. The Directors and staff of Access Economics joined Deloitte in early 2011.

About Deloitte

Deloitte provides audit, tax, consulting, and financial advisory services to public and private clients spanning multiple industries. With a globally connected network of member firms in more than 150 countries, Deloitte brings world-class capabilities and deep local expertise to help clients succeed wherever they operate. Deloitte's approximately 170,000 professionals are committed to becoming the standard of excellence.

About Deloitte Australia

In Australia, the member firm is the Australian partnership of Deloitte Touche Tohmatsu. As one of Australia's leading professional services firms. Deloitte Touche Tohmatsu and its affiliates provide audit, tax, consulting, and financial advisory services through approximately 5,400 people across the country. Focused on the creation of value and growth, and known as an employer of choice for innovative human resources programs, we are dedicated to helping our clients and our people excel. For more information, please visit our web site at www.deloitte.com.au.