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RIPPLES ON THE POND: *BEYOND THE MERE ROBOTICISATION OF AG AND MINING*

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The metaphor of ripples:

Comparative static change or dynamic shower of changes

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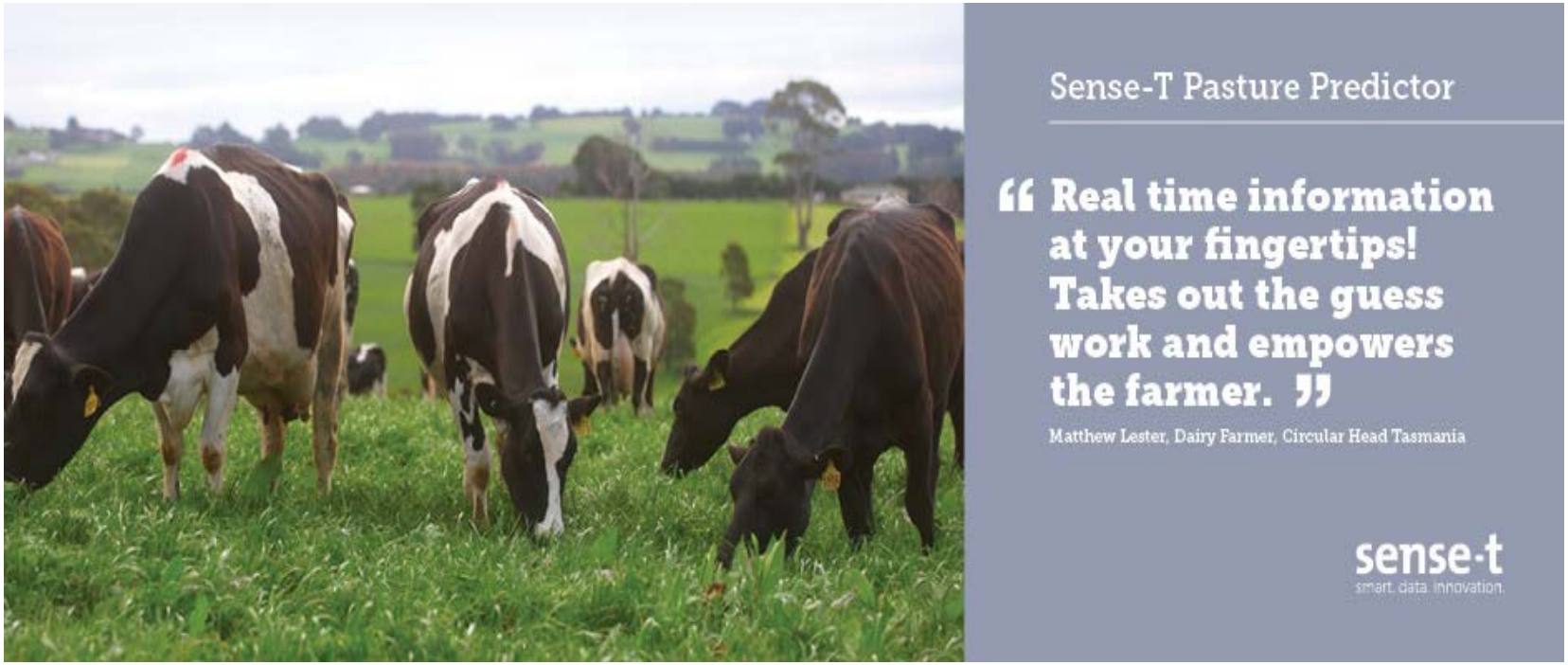
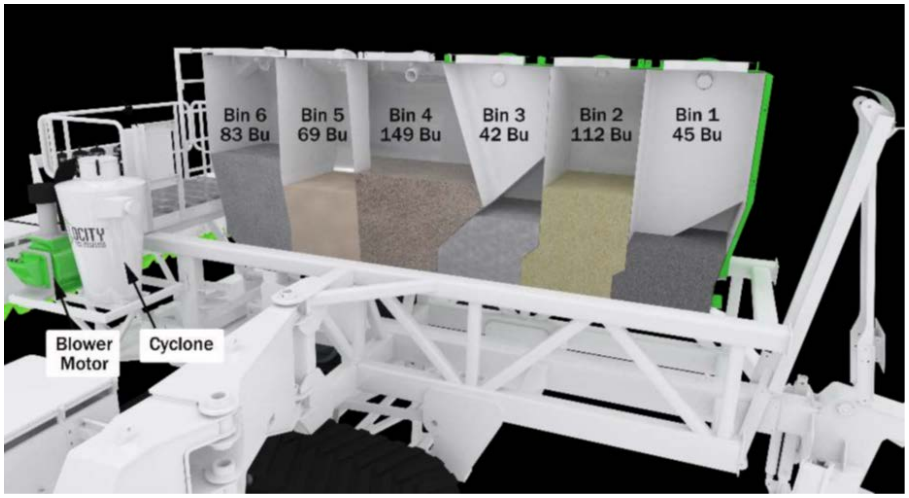
AGRICULTURE



Sensors linking upstream research and genetics to the dinner table …

COW HERDING ROBOT



CUSTOM ROBOTS, ALONE OR IN SWARMS

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AUTOTOMIZED DRONES: CURRENT SCALE

AUTONOMOUS MACHINERY: RIGHT SCALED & SWARMS

Traditional distribution of value

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Economic impact of PIC activity by category, period and location Source: SJ Research Services, Special Tabulations, 2017.				
	GDP ($M)	Employment (PY)	Labour Income ($M)	Government revenue ($M)
Direct Impacts	$5,828	72,305	$1,494	-
Indirect Impacts	$5,498	57,955	$2,706	-
Induced Impacts	$4,435	46,294	$2,018	-
Total Impacts	$15,762	176,561	$6,218	$4,355
	By location			
% in Prairies	65%	37%	29%	53%
% in ROC	35%	63%	71%	47%

Economics of Roboticization

- All the evidence suggest adoption of robotics will be fast and disappear within the existing economic structure of the ag industry.
- The average age of farmers has been rising and average size of farms increasing—robots address the labour shortage.
- It looks like robotics will just help the existing industrial system stay viable.
- We have no evidence that robotics will be fundamentally disruptive to agriculture itself.

	Social	Environment	Economy
+	• Enables families to stay on farms • Improves farmer lifestyle	• Machinery can have lighter load on the ground improving soil compaction problems. • Technology appropriate solutions. • Data for a traditionally data poor environment • Drone and autonomous small tracks for feed hunting could offer really major improvements to the environment.	• Data will be a controversy. • The big ag machinery companies will eventually extract more than they put in so to speak. • The machines will be autonomous and the farmers will access their data but the machinery companies will gain from data accumulation – like we see with the 'app economy'.
-	• Hard to foresee any major impacts		
FNs	• No significant connection now; hot likely relevant		

Since 2014

- Initial reluctance replaced by very high rates of adoption of autonomous traditional farm machinery
- But explicit value proposition unclear—unlike social media, pricing is explicit and paid by producer rather than imputed and extracted from advertiser (encourage to attend Graeme Jobe's talk later this aft)
- And growing concerns over 'machinery' repair controls and lock-in—legislation popping up to deal with right to repair

MINING

MINING BY TECHNOLOGY

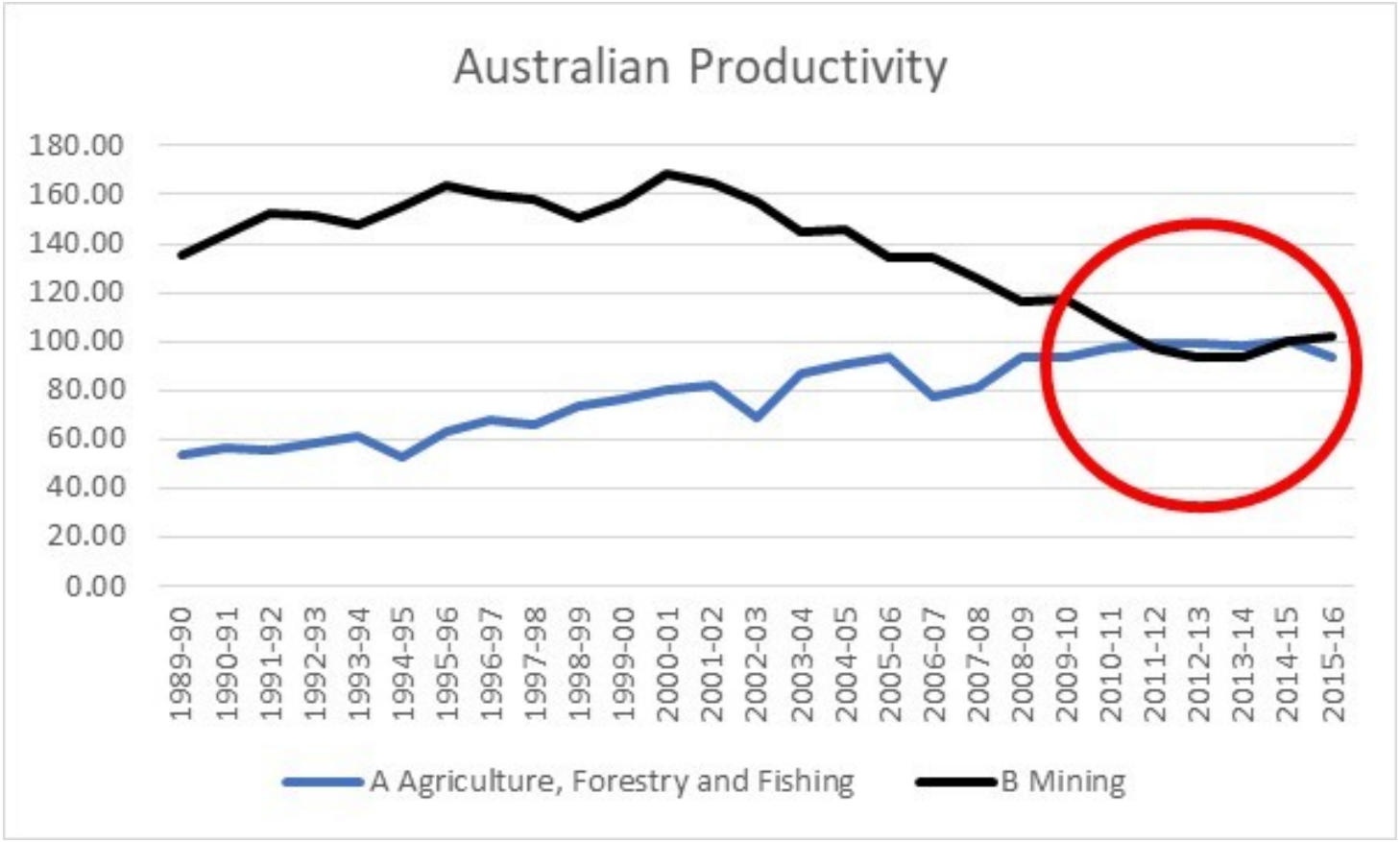
1. HAULAGE (400 TONNE) / Aust 200+ Operating

2. DRILLS

3. TRAINS (REMOTE CONTROLLED FROM PERTH)

4. THE ‘NORADS’ (NOW NUMEROUS CENTRES)

AUSTRALIAN MINING PRODUCTIVITY HAS PIVOTED



SUNCOR HAS ORDERED 150 TRUCKS

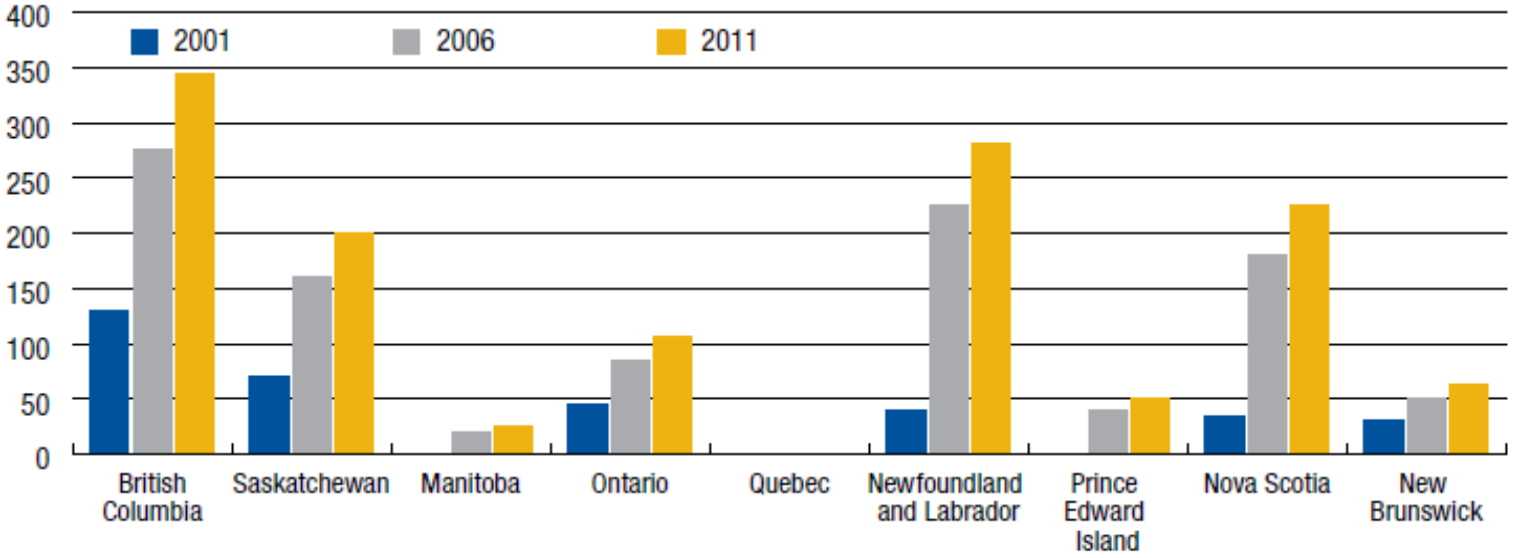
Suncor is building a fleet of 150 driverless trucks that will cut 400 jobs over the next six years

The energy company is already preparing for the switch by hiring its truck drivers on a temporary basis

HUNDREDS OF FLY IN FLY OUT WORKERS

Figure 14

Out-of-Province Canadian Commuter-Workforce in Wood Buffalo-Cold Lake — Oil and Gas Extraction and Support Activities in Mining



Source: Mining Industry Human Resources Council, 2013; Statistics Canada, 2006–2012; Conference Board of Canada, 2012

* This data is reported from the Census for 2001 and 2006; note that there were no commuters from Quebec — this may be due to data suppression and a few individuals from this province may indeed work in the oil sands region.

	Social	Environment	Economy
+	• Those getting new jobs in data centres (likely Calgary) will have a greatly improved lifestyle; FIFO lifestyle is psychologically hard on the workforce.	• Autonomous equipment more fuel efficient • Fewer workers on site lowers environmental impact • Few workers travelling by air lowers GHG • Greater % of workforce in cities 'good thing'	• Greater productivity will allow production at lower costs. • Calgary likely to become Canada's data centre (technological / cluster reinforcement patterns seen in Australia).

-	• Social impact of income loss will be in communities distant from mines due to FIFO workforce	• Greater productivity will allow production at lower costs. • It will open up new locations where not enough humans want to live to make mines viable.	• Traditional way places benefit from natural resource extraction is job creation – particularly for those that may otherwise not have good paying jobs. • Governments have not generally imposed optimal resource rent taxes. • Now, with job losses governments will need to do some very hard number crunching as to the extend modern mining provides net benefits.

First Nations	• First nations will be significant losers in economic change without significant policy work. • Reduction in the economy will really severely impact the social structure of remote First nations communities	• The trade-off (social licence) is that First nations get jobs for disruption to the environment – remote controlled mining if anything will increase the profitability of remote mines.	• Reduction of jobs will disrupt the remote First Nations that rely on the income.

Mining Ripples

- Ripples from the roboticization of mining will spread in almost imperceptible ways across the country.
- It will touch unlikely communities
  - NL and places like Kelowna BC
- First Nations will be on receiving end of change.

Conclusion

- Digital value added (dVA) will have different effects in different sectors
- Some changes will reinforce and sustain sectoral structure and design (e.g. ag)
- Some changes will relocate dVA and lead to changes in sectoral structure and design (e.g. mining) and destabilise social license
- Clear value propositions core to adoption
- Lumpy investments
- Lock in common issue, but on a different scale