Australian Sugar Milling Council submission to the Parliamentary Inquiry into Agricultural Innovation.

The Australian Sugar Milling Council (ASMC) is the peak industry organisation for raw sugar milling in Australia. The ASMC represents some 95 per cent of Australian raw sugar production. There are 24 sugar mills in Australia, owned by eight companies. These mills produce raw sugar, which is either directly exported or refined in four Australian refineries. With around 80 per cent of raw sugar being exported, Australian sugar is priced on the global market.

Innovation and technology are critical to maximising efficiency and productivity across the sugar industry supply chain and ensuring global competitiveness for raw sugar. Milling companies support and encourage the adoption of technology along the supply chain to enhance productivity. This submission outlines examples across many activities in agricultural production that are supported by milling companies, and where there are opportunities for improvements and barriers to adoption.

The information is set out in a table to cover the three components of the terms of reference. GPS and the rollout of the NBN underpin a range of technology improvements, including controlled traffic, auto steer, harvester tracking, haul-out tracking, and compliance monitoring and record keeping. Some barriers to adoption that are common across many themes include cost of new technology being beyond many growers to pay and the relatively small market in Australia for sugar cane farming equipment results in not being able to purchase configurations that best suit Australian conditions. This also applies to chemicals, where chemical companies are not willing to develop new products suited to Australia or pay for the registration of some existing chemicals used in other countries. Another significant barrier to adoption of new technologies in sugar cane production systems is the reluctance to adopt changes. There is a large gap between research and extension for adoption.

Technology is important in monitoring and supporting best management practices, which improves productivity and environmental outcomes. However, most mills find that they still need to focus on getting the basics right first, before moving onto new technology. CANEGROWERS have produced a series of short YouTube videos outlining how many of these new technology developments are being used on farm to improve efficiency and environmental performance. The latest can be found here:
https://www.youtube.com/watch?v=zPn-OGUYxTc

Improvements in efficiency of agricultural practices due to technology	Emerging technologies relevant to the agricultural sector	Barriers to adoption of emerging technology
GPS guided controlled traffic, (including the use of auto steer), fertiliser rate controllers, GPS guided planting and GPS operated and controlled spray systems have several benefits which improve agricultural productivity. These include reduced soil compaction, lower fuel use, more targeted application of fertiliser and sprays and improved planting. The use of auto steer at harvest also reduces damage and improves ratooning of sugarcane following harvest (improving the yield the following year)	Electric vehicles may be used for farming operations, including tractor work. The advantages and disadvantages would need to be assessed.	Cost of components (including screens and base stations for auto-steer) is a barrier, particularly for smaller growers. Options provided by milling companies to improve access to the latest GPS technology include providing networks of RTK base stations and loaning equipment to growers. The Australian Government Reef Program funds has also encouraged some farmers to adopt the changes. Perceived cost of change can also be a barrier, which may be overcome through extension services demonstrating the benefits and savings in the longer term.
Recent work has indicated that significant losses of sugarcane are occurring in the harvesting process (harvesters moving too quickly through the cane). Some mills have fitted their harvesting fleets with GPS trackers that can record ground speed.	Harvester trackers can be further enhanced to record basecutter RPM, extractor fan speed, fuel usage and other information which would provide improvements to harvesting efficiency and enhance acceptance of the changes. Separating trash/extraneous matter in the field will also improve critical quality issues that affect income (for both growers and millers). Initial assessments by one of the milling companies demonstrated gains along the supply chain by improving harvesting equipment design to separate trash.	A current barrier to adoption is the poor networks and data connections. Harvesters are built overseas and changes requested for the Australian market are not met due to the relatively small size of the Australian sugar industry.

	Driverless technology for farming and harvesting would reduce the time pressure on harvesters.	
GPS is used to enhance the efficiency of cane transport systems, by enabling better coordination of cane trains and road transport systems.	Extending the GPS tracking system to cane haulout operations would improve the efficiency at the harvesting end. It would allow the harvester operator to see live the location and expected arrival of the next haulout, allowing the operator to schedule the harvesting to meet haulout availability, improving harvesting efficiency and minimising losses and damage (including reducing compaction.) As the technology is developed, it will enable better coordination with cane trains and road transport systems, further enhancing harvesting efficiency. Crop yield monitoring also has the potential to enhance transport and haul out operations.	The cost of implementing are currently too high for haulout operators, but some mills have established tracking of haulout systems so harvesters can test the benefits. Currently harvesting crop yield are too inaccurate to be of assistance.
GPS tracking of trucks that return mill mud to sugarcane paddocks are now monitored in some regions, improving the efficiency of record keeping and compliance requirements. It is also being used to capture information on a range of farm management activities, including mill mud and fertiliser applications, spraying and cane planting.	Further enhancement of farm management tracking and recording will improve the efficiency of cane farm BMP, particularly as suitable data transfer technology is developed to support and streamline the process.	Cost of installing the equipment continues to be a barrier for some operators.
Electronic consignment is establishing near to live information about harvesting	The electronic consignment format can be applied across GPS tracking systems and be	

operations, improving the supply of cane bins for rail haulage, increasing harvesting efficiencies (better quality and less delays) and enabling better information flows between harvester and mills.	available to growers as near to live as possible. Currently these are recorded and reported days or weeks after harvesting. Have the information available in real time will allow farmers to make decisions that improve harvesting as it occurs. Similarly decisions about haulage and cane transport based on real time information will improve efficiency and deliver savings. Cost effective mobile data technology that enables increased remote monitoring and control of agricultural processes.	
NBN rollout is making it easier for cane farmers to access information from the mills, such as harvesting progress, analysis of harvester performance and records of nutrient and chemical application. The NBN is also making it affordable to monitor transport and safety activities via video recording or by capturing photographs. Activities such as cane bin supply, level crossing safety and employee safety all contribute efficient farming and transport system. Cane quality can be monitored visually as the cane bins arrive in the mill and growers and harvesters can see how their cane compares visually with others in the district, helping them to respond quickly to emerging issues.	NBN rollout will improve grower access to production information that is collected by mills and will enable access to the information live. (Currently in some areas, production information captured and stored by mills is printed out and provided to growers upon request. The information includes block details and productivity, fallow management, irrigation layouts, safety plans, fertiliser applications and irrigation applications.) Harvesting elevators can also be equipped with cameras so growers and millers can monitor the product and respond quickly to emerging issues and correct poor performance.	Full use of the NBN benefits requires information and tools on how to maximise its use and potential.

Satellite imagery is being used for harvest management in many areas and can be used for yield mapping. Cane grub activity and other pests are easily identified from aerial photography / remote sensing tools such as google earth. However, a good understanding of the damage requires frequent imagery (every 4 to 8 weeks throughout the year is ideal).	Improved access to remote sensing, infra-red satellite technology and google earth (updated more frequently and low or no cost) for the early detection of cane grub and other pests.	Cost and frequency are current barriers to adoption of this useful too. Currently the sugar industry can piggy back off other remote sensing projects, but this is by nature, ad hoc.
Local weather information is enabling improved irrigation, fertiliser and chemical application. Accurate, locally based weather information has become vital for an efficient farming business, and this is enabled by establishing local (automatic) weather stations.		Currently many farmers are relying on weather data from local airports, which can be quite different to the real conditions in their localities. Some mills are establishing a network of weather stations to track weather events, so each cane farmer is no further than 5km from a station. Application of fertilisers and chemicals can be better timed to ensure maximum benefit and minimum wastage. The weather stations also provide information about pan evaporation, wind and rainfall, improving the timing and allocation of irrigation, which saves water and reduces electricity costs associated with irrigation.
Low pressure centre pivot automated (computer controlled) irrigation system with soil moisture probes, scheduling (such as IrrigWeb) and automatic weather stations, has significantly increased the efficiency of irrigation (both water use efficiency and reduced work load). It also	Hand held leaf temperature and nitrogen sensing equipment to monitor plant growth and better match plant needs with irrigation and nitrogen fertiliser applications.	Capital cost of installing the centre pivot irrigation system is a barrier. Grower age and attitudes can be a barrier to adoption amongst older growers. Some mills are working with growers to do detailed assessments of irrigation needs and benefits for their location and support

ensures the water applied is meeting the needs of the crop, improving the productivity of the crop and soil health.		converting to more efficient systems. Currently the cost of electricity is resulting in farmers irrigating less, reducing productivity.
Subsurface drainage equipment is improving drainage in cane fields.		The up-front capital cost is a barrier to the adoption of subsurface drainage equipment.
Slow release and controlled release fertiliser (for example Entec) improve the efficiency of fertiliser use and minimise off site impacts (such as reef water quality)	Various types of slow release and controlled release fertilisers continue to be investigated (for example coatings, inhibitors).	The primary barrier is the cost of the products compared with consistency of results. There is a general lack of understanding and confidence in the technology.
Use of cane varieties that work best in local conditions improves productivity. This is based on local testing and development work. Development of new cane varieties is ongoing work that is important in maintaining productivity.	The use of aerial technology (drones) to monitor crops and varieties.	The basic knowledge of the use, backup and upfront costs of emerging technologies.
Agricultural software enables efficient data management, storage, analysis and reporting.	Big data is opening an infinite range of possibilities, but is crippled by an effective system to manage the data and then initiating actions based on the data analysis outcomes.	Cost effective access can be a barrier, but some mills are providing systems for managing data, recording farm activity and producing reports for productivity improvements and compliance. Productivity services groups have access to these data systems to carry out farm planning and assist with reporting. IT and data management systems are becoming more complex (and more overwhelming for users). As the roles of technology professionals becomes more specialised, it is becoming increasingly confusing for farmers and

		data managers and IT specialists to communicate, which can be a barrier to adoption.
Facial recognition technology is being adapted to identify plant parts, which is used in robotic technology.	Robotic weeding is being pursued by private companies in Australia. Government assistance would help develop the concept for agriculture at a commercial scale.	Cost of new technology.
	3D crop modelling could be used to determine the best row configuration, spacing and direction for new cane (and other crop) varieties.	Cost of new technology is a barrier to testing and adoption. New technology is very expensive when it is first developed but rapidly becomes cheaper as it is adopted or updated. Often when it is affordable, a newer, better and more expensive version is available.