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- (i) Research is needed when developing agricultural technologies as it enables Australian agricultural industries to maintain their competitive edge. The research that goes into new technologies, such as robotic milking parlors, ensure that industries have a competitive advantage over other countries. Competitive advantage opens up markets to industries, increasing demand for a product and therefore ~~is maintain~~ increasing profit.

Research is needed in agricultural systems, such as plant production, as it ensures that technologies are developed that will help maintain the industry. Technological developments in relation to plant production ensure that production is maintained and is able to compete with other countries. Technologies such as genetic engineering help to improve the quality and quantity of plants as it provides desirable traits/characteristics that suit the plant to its environment. For example, gene technologies have helped to create Bt Cotton, which has the ability to produce a naturally occurring toxins, taken from bt bacteria, that kills the heliothis caterpillar that has detrimental

effects on cotton crops. ~~Technology~~ Research ensures that the technology being developed ~~will~~ will assist with the maintenance of plant production.

(ii) Newly adopted technologies, such as genetic modification, is a development that is not widely adopted. Genetic modification involves removing, adding or altering the genome of a plant or animal, for example Bt Cotton is a genetically modified organism ^(GMOs) ~~the~~ the gene from bt bacteria which codes for a toxin has been inserted into the DNA of cotton plants to provide it with the ability to naturally produce the toxin which kills the heliothis caterpillar.

Gene technology is not widely accepted because of the perceived risks associated with genetic modification. ^{Environmental} Activist groups oppose genetically modified organisms because they believe that GMO species will cross-breed with non-genetically modified organisms ^{having} causing detrimental effects to the environment. Activist groups also believe that there are potential health risks to both humans and animals, connected with genetic modification.

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New technologies may also ~~be~~ not be widely adopted due to the cost of the new technology. The high costs that go into research and development to produce new technologies may be passed onto the consumer. Many consumers/producers will not have the money to afford the new technology, and therefore, only those who can afford it will **adopt** it.

~~Due to the patenting of new technology~~

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Computer related technologies are highly beneficial to agricultural production. The National Livestock Identification System (NLIS) is a technology that was developed to meet the requirements of the European Union. NLIS provides lifetime traceability of ^{individual} animals from birth to death and all geographical locations between. The eartag or rumenbolus ~~is~~ is ~~a~~ significantly beneficial to Australian agriculture as it provides the industries ~~to~~ with the ability to control, prevent and manage disease outbreaks. ~~The~~ ability to do so ensures that if ~~a~~ the beef, goat or sheep industry were to ~~be~~ experience a disease outbreak, e.g foot and mouth disease, the issue would be able to be contained within an area, due to the history of the animal recorded on the NLIS database.

NLIS not only provides meat safety, biosecurity and disease free industries, but it also benefits the individual farmer. When an animal is sent to the abattoir, the information on carcase - carcase feedback - is scanned onto the NLIS database, where the farmer can access information on his heard - enabling him to alter any stages in production that will result in a higher yield/profit

Global Positioning Systems (GPS) is a recently developed computer-related technology that has the ability to revolutionise plant production. GPS devices send and receive information from the orbiting satellites. They use this information to help guide/steer producers/tractors through crops to optimise planting^{efficiency} and to minimise chemical usage. GPS are used to monitor the sowing of seeds to ensure that seed drop is even and compaction zones are decreased. The advantage of reducing compaction zones when using GPS is that the ~~area over~~ soil is impacted at a minimum level, therefore soil structure is maintained and erosion does not occur. This, therefore results in a higher yield, as a larger ~~of~~ area of land has been utilised for sowing.

Robotic milking is a computer related technology that is used to manage agricultural production in the dairy industry. Automatic-milking systems (AMS) are comprised of a robotic arm, ~~with~~ ~~sens~~ that controls the sensor used for teat cup application; and attaches + removes + cleans teat cups. AMS benefits production as it reduces the labour required in milking. Compared to conventional milking, where every process is

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done manually, there is no ~~manpower~~ manual labour required to operate the computer run system. AMS is a highly efficient system that is able maintain the health of the herd through teat & teat cup cleaning. This prevents any diseases such as mastitis from infecting the heard.

Not only does AMS reduce manual labour, and maintain herd health, AMS reduces the milking time of each cow. Thus yield is increased as more cows can be milked more often. A study in the Netherlands showed that automatic milking systems increase the milking yield of individuals cows by an average of 11%, due to its ability to stimulate bimodal milk let down.

Computer technologies significantly benefits agricultural production in several industries. However implementing ^{new} technology into a farming system is an expensive procedure. ~~AMS~~ Automatic milking parlours can cost up to and above \$100,000. GPS systems also have significant costs 'up to and above \$20,000, depending on which system is adopted. Although the cost of a product may deter a producer from implementing it, he should consider the previously mentioned benefits of new technology

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