Technology activities – Levels 4 and 5

A technological approach to support and create the animal welfare, biosecurity and food systems

CORE EDUCATION Tātai Aho Rau

Ministry for Primary Industries
Manatū Ahu Matua

Animal Welfare – improving practices

Public perception of the welfare of farm animals can affect the economic performance of the primary industries. The perception that inhumane practices are responsible for producing some of the food that we eat can be influenced by the media and welfare organisations. Consumers and trading partners may perceive that the way people manage animals on farm, during transportation or in slaughterhouses may pose a risk to animal welfare. Students could investigate the ways in which technological developments have impacted on animal welfare practices and standards and how this may influence consumer perception both positively and negatively.

Students can begin by designing a community survey that asks respondents about the general issues that they feel most affect animal welfare on farm, during transportation and in slaughterhouses. They can then use the responses to help shape their thinking about how technologies in the past, currently in use, or future developments might have caused or alleviated concerns people have.

Change over time

Investigate how facilities on farm for animals have changed over time. Refer to photographs of farms over the last 50 years (These are available from the Alexander Turnbull Library and collections of local council archives), to compare changes in technology and identify the thinking behind the changes made. Consider these changes in terms of their impact on animal welfare. Have the students identify the knowledge that was used to develop the welfare codes and why it was important to codify this knowledge. Can they see the impact of changes to the codes in the changing of technological solutions?

Transportation

There is a specific code of welfare in New Zealand for the **transportation of live animals within New Zealand** and regulations around the **exportation** of live animals from New Zealand. Ask students to examine the code of welfare for the transportation of animals. Have the students focus on the animals' needs during transportation and how the code is used to ensure these could best be met. Encourage students to refer to the five freedoms and positive emotion in animals.

Prompt them to think about the role of technology in both causing and resolving issues associated with animal systems transportation.

Related resources:

- **Code of Welfare for transport within New Zealand**
- **Report on the transport within New Zealand code**
- **Fitness for transport guidance poster**
- **Fitness for transport guidance brochure**
- **Guide to the welfare of calves during transport.**

Slaugherhouses

Students are unlikely to have experience of slaughterhouses or abattoirs. If there is one in your area, it may be possible to interview the manager or an employees of one. Be aware that discussions on this topic may bring up issues that distress students.

Temple Grandin is an American scientist and technologist who specialises in Animal Welfare, particularly that of stock as they go to slaughter.

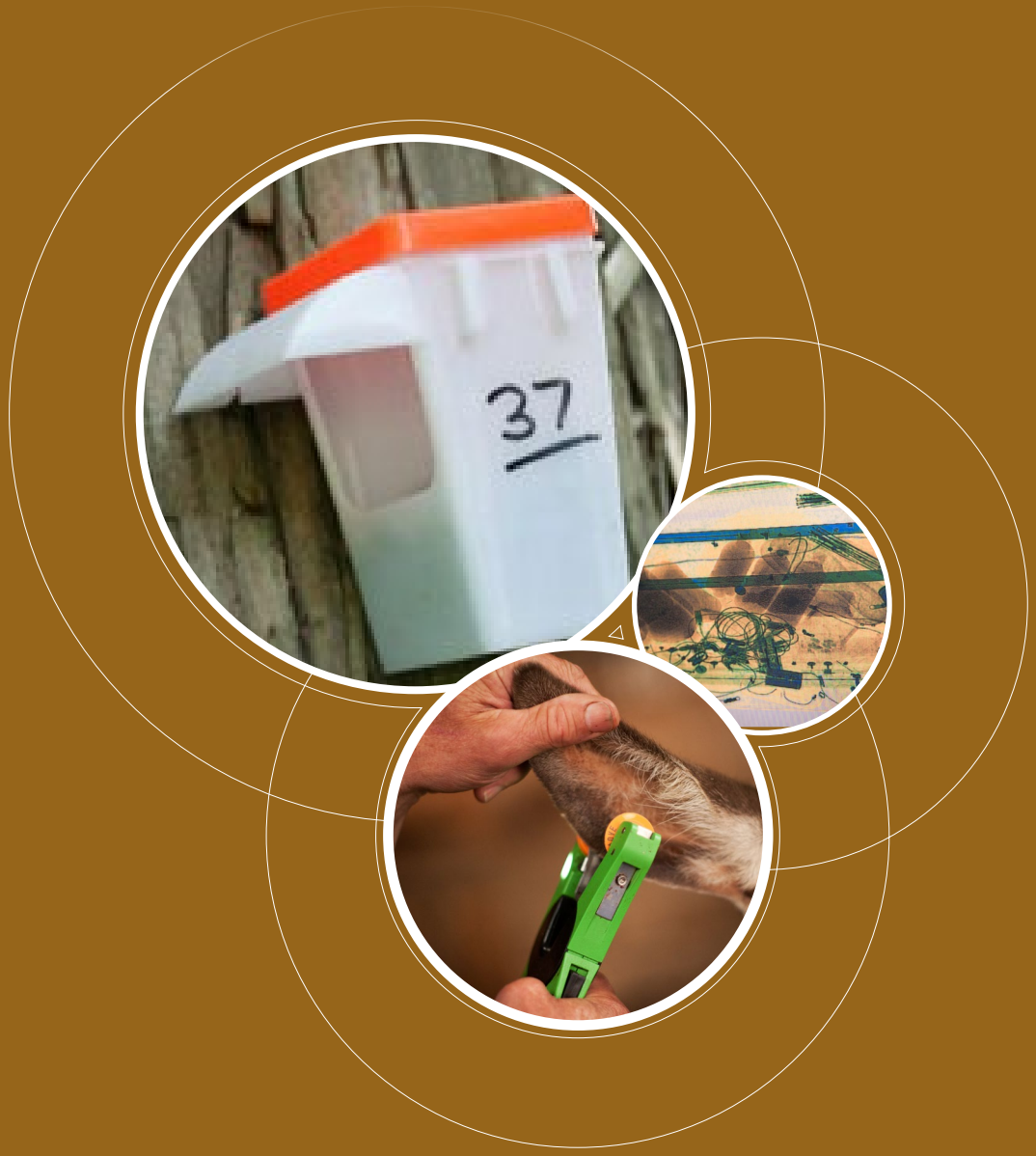
In **2016**, Grandin identified five basic causes of animal welfare problems in slaughter plants:

1. Poorly designed or improper stunning and handling equipment.
2. Distractions that impede animal movement, such as sparkling reflections on a wet floor, air hissing, high-pitched noise or air drafts blowing down the race towards approaching animals. These distractions can ruin the performance of a well designed system and cause animals to become excited. When this happens, prodding will be required to make them move.
3. Lack of employee training and poor supervision of employees by management.
4. Poor maintenance of equipment and facilities, such as malfunctioning stunners or worn, slick, floors that cause animals to slip and fall.
5. The poor condition of animals arriving at the plant (crippled and sick animals).

Ask students to choose one of these five problems and prepare a technological brief to help solve the identified problem. Once the brief is completed, students will need to carry out research to develop a conceptual design that could improve animal welfare at a particular slaughterhouse. Use the technological practice indicators for Brief Development and Outcome Development and Evaluation to allow students to self-assess their work. The manager of a local meatworks could be asked to visit and provide feedback as the students develop their design.

Resource:

- **Dr. Temple Grandin's Web Page**
- See the codes of welfare on the **MPI website**, particularly the **code of welfare for commercial slaughter**. There is also a **code report** which would be of use here.
- There is also a **code of welfare for transport within New Zealand**, and you can find guidelines about **exporting live animals** outside of New Zealand on the MPI website.



Biosecurity – tools and taonga species

The success of biosecurity management in New Zealand is dependent on both people and technology. From mobile x-ray machines that check cruise ship passengers' luggage, to DNA barcoding methods for the identification of exotic and high-risk quarantine insect species, technology is used extensively throughout the biosecurity management system.

Creating and maintaining a technologically sound biosecurity toolkit is one of the seven main drivers for **Biosecurity 2025**

Biosecurity tools

Students research existing biosecurity tools, find out what they measure, and assess their shortfalls and strengths.

These resources explain a few of the biosecurity tools available.

- NIWA **weed risk assessment** and **Fish risk assessment model**
- **How humane are our pest control tools?** Paper by MAF New Zealand, 2011
- **Biosecurity tools for plant virus detection**
- **Self resetting traps – Goodnature**
- **Remote Monitoring of Traps and Vertebrate Pests**
- **CatchIT software – developed to manage and analyse data for community pest control projects.**

Biosecurity and taonga species

Taonga species are native birds, plants, and animals of special cultural significance to hapū and iwi.

Māori have a vested interest in ensuring taonga species are protected from pests, weeds and pathogens. Human habitation in New Zealand has had a huge impact on native species and the introduction of exotic animals and pest species has exacerbated the environmental risks to the country's biodiversity.

Examples of introduced species and pathogens include:

- Introduced fish (for example, trout and catfish) that have threatened local food sources, such as freshwater crayfish, dwarf inanga, giant kokopou, brown mudfish and eels.
- Introduced plant species (for example, marram grass and lupin) that threaten the coastal plant, pingao, which is used by Māori to create decorative work in wharenui.
- Myrtle rust, which presents a threat to the indigenous Myrtaceae species, such as pōhutukawa, manuka and rata, which hold considerable cultural value and were used extensively by Māori for medicine, construction and food.

Students can connect with local hapū or iwi to find out about the taonga species in their local areas and how they may have been or are threatened by introduced pests, plants or pathogens. They can examine Māori technologies that have been used to combat biosecurity threats and analyse how they are fit for purpose.

As a class, students can work with local iwi representatives to develop a database of local species, possibly as an app. **Nature Watch NZ** and the **Global Invasive Species Database** are examples they could use as models. Their databases should include:

- The names of taonga
- How the taonga can be protected through biosecurity
- Effective biosecurity practices
- Gaps in biosecurity practices
- Suggestions for community action.

Resource:

Māori values and wetland enhancement

Assessing whether culturally significant taonga species are present or absent.

Where to next

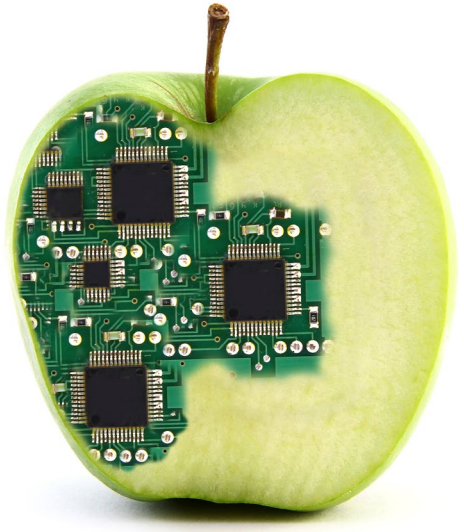
A number of recent scientific initiatives have an emphasis on reducing risks and threats (see **Biological Heritage Challenge** and **Better Border Biosecurity)** through the use of technology. Have students investigate one of the research examples through a "characteristics of technology" lens, examining where researchers have used knowledge, skills, and thinking in technology to trial new methods of pest and disease management.

Food – foods of the future

Students discuss and investigate developments and ideas for foods of the future. What will eating and food shopping be like in fifty years time?

Predictions are that climate change, population growth and excessive monocultural production will mean that new foods will need to be developed to keep up with customer demand. This could be in the form of repurposing known ingredients, developing entirely new foods, or eating foods that have high nutritional value, such as insects, that aren't necessarily produced globally on a commercial scale. Consumer perception is important in this development, as any future food will have to be perceived to be an improvement on what we already have – and in the case of insects for example, will need to be perceived by some people as food at all.

Make students aware of legislation that governs animal welfare, food safety and biosecurity. Can legislation be future proofed? Discuss how our current legislation will need to change to incorporate future foods. For example, the current animal welfare act does not cover the welfare of insects. The biosecurity act may not cover the risks to new crops, and the food safety act will have to cover safety around new kinds of protein. Have students research the rules and regulations that govern food technology and in particular the development of future foods. Explore why we need rules, who makes the rules, and how and why they protect producers and consumers.



Resources:

- **Review of nutritive substances and novel foods requirements**

  A summary of the review being undertaken by Food Standards Australia and New Zealand

- **Food Act 2014**

  The Food Act 2014 came into force on 1 March 2016. It takes a new approach to managing food safety.

- **Biosecurity in New Zealand – Policy, laws, and agreements**

  The Biosecurity Act 1993, administered by the Ministry for Primary Industries (MPI), is the primary legislation providing a range of powers, duties, and obligations.

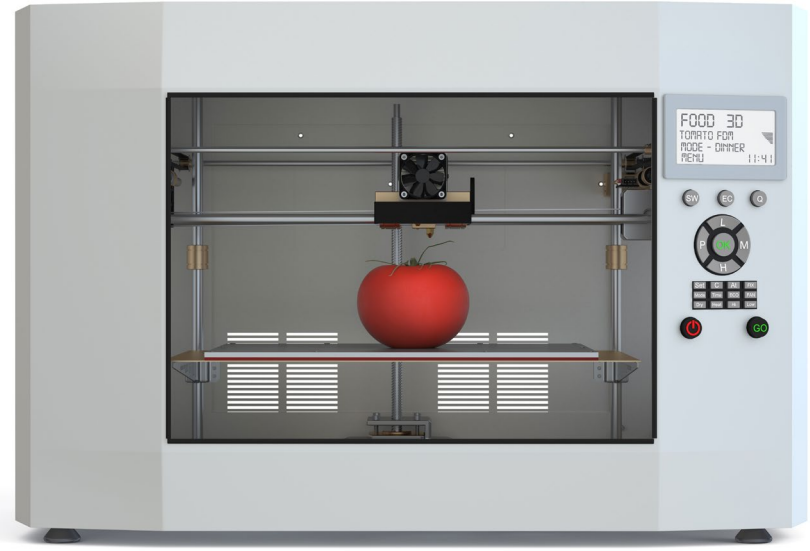
- **Animal Welfare Act**

  MPI leads and facilitates the management of animal welfare policy and practice in New Zealand. MPI promotes policies for the humane treatment of animals and is an important participant in the ongoing animal welfare debate.

What will we be eating in 2050?

Ask students to read and comment on the 11 opinion pieces in the article below.

What will we be eating in 2050? From 3D printed snacks and lab meat to insect protein



Students can choose to rank each idea according to one or more of these criteria:

- How viable they think the ideas would be in a New Zealand context
- How much legislative change would be required before the ideas are accepted in New Zealand?
- What perceptions and responses they think the general public would have to each idea. Are some ideas easier to accept than others? Would some ideas be more acceptable for different demographics? E.g. different cultures, ages, religious beliefs?
- The environmental costs of each of the ideas.

Using existing ingredients in a new way

View with students the foods produced by **The Future Market**. Using the knowledge students have of the environment and primary industries in New Zealand, ask them to come up with the conceptual design for a product that could be available here in 50 years. Ask students to start by designing a brief based on:

- the need for future foods;
- current gaps in the market or opportunities provided by changing consumer demands;
- the foods students would like to eat in the future.

Once they have completed the brief, ask them to design packaging to sell these new and inventive foods that are also nutritionally sound. Their packaging will need to take into account that the perceptions of customers in 2067 may need to be challenged.

Resources:

- **Future Foods 2050**

  Articles, opinions and video stories about feeding the globe with food technology and innovation.

- **The Food of the Future – a global point of view (teacher preview recommended)**

  As the population grows exponentially, the question is, and will continue to be, how do we feed this growing number of people in a way that does not diminish the quality of life through manufacturing side effects? The Food of the Future examines how we intend to do this.

- **Developing Novel Foods from Taewa**

  A description of the use of Māori potatoes to develop new future food products.

- **Future Food Systems**

  A summary of the research being undertaken in this area by Massey University.

The future of protein

Humans have long relied on meat as our main source of protein. This reliance may well become a thing of the past.

Divide the class into five groups. Each can take on one of the protein innovations described below:

- **Ethan Brown**: Founder of California-based Beyond Meat, which is processing plant proteins to chemically re-create the structure of meat
- **Daniel Imrie-Situnayake**: CEO of Tiny Farms, a start-up dedicated to developing technology for industrial-scale insect farming
- **Stephanie Mittermaier**: German food technology researcher who sees big potential for protein from sweet blue lupine seeds as an alternative to soy protein
- **Mark Post**: Dutch physiologist behind the world's first in vitro burger, made from meat grown in a lab, who wants to transform how meat is produced
- **Harman Singh Johar**: Entrepreneurial young entomologist who believes insect protein could become a near-perfect famine relief product.

Using these articles as an introduction each group can research a protein and develop a group presentation to sell the proposed innovation to the rest of the class. Presentation should include:

- the possibilities (or reality) of this innovation taking place in New Zealand;
- the benefits to the economy and environment;
- the local, national, and global impacts of the innovation;
- the innovation's potential effect on current primary industries;
- the nutritional benefits of the innovation;
- an explanation of how the food producer undertook technological development – how did they plan, organise, resource, and develop the food innovation? What knowledge did they use?

- information from a primary source, such as a company or individual undertaking this innovation, a food technologist, or an expert from MPI.

Set up the presentation as in a Dragon's Den scenario, with each group's ideas being voted for by the rest of the class to determine the most popular innovation.

Resources:

- **Chicken chunks made from peas bring in investors**

  An article about Sunfed meats, a New Zealand-based company that is turning yellow split peas into a substitute for chicken meat.

- **Meat without Livestock**

  Future Food – Meat without Livestock focuses on possibilities for replacing animal products with products that are not derived from animals.