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**2023**

Industry & Community Project

# **GUAC TO GOLD.**

**Revolutionising Avocado Waste  
Reduction and Reuse Strategies**

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# EXECUTIVE SUMMARY

This report addresses the pressing issue of avocado waste in Australia, contributing to the larger challenge of food waste in the horticulture sector. Our approach combines cultural inspiration from avocados with a design thinking approach to develop sustainable solutions. Aligned with waste hierarchy principles, our objectives focus on prevention and re-use. By implementing smart packaging with nanosensors, we enable real-time monitoring of avocado freshness, reducing spoilage and providing accurate ripeness indications to consumers. We consider the potential consequences of this approach, as it may result in an excess supply of avocados that do not meet the criteria for perfect ripeness.

To address this issue, we have an additional recommendation, an in-store education campaign, utilising pop-up events, to raise awareness and promote the repurposing of overripe avocados and effectively reducing potential household waste. Implementation of these innovative and sustainable solutions will mitigate avocado waste, yielding economic and environmental benefits. Collaboration across the avocado supply chain is vital in addressing food waste and fostering a more sustainable food system.

By taking urgent action and embracing these solutions, we can minimise avocado waste, preserve resources, and contribute to responsible consumption and production, paving the way for a sustainable future.



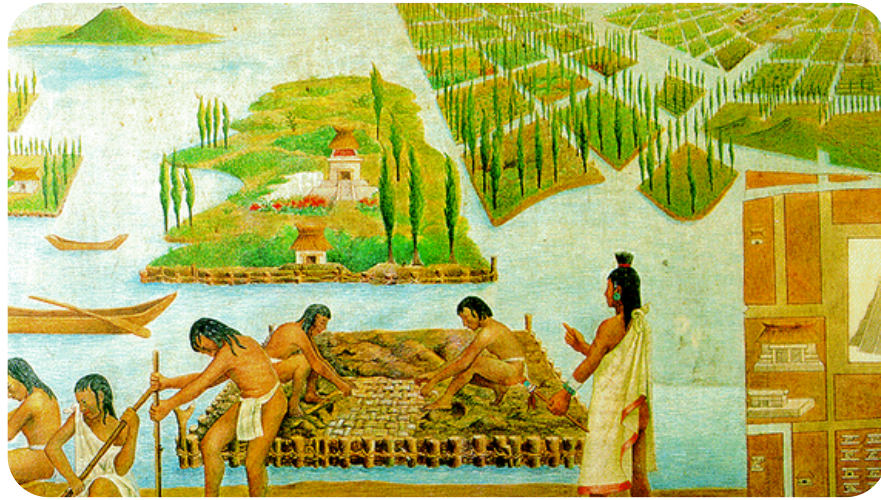
# INTRODUCTION

## CONTEXT

Food waste has expansive consequences for both our economy and the environment, posing significant risks to precious resources and accelerating environmental degradation (Richards et al., 2021). This demands our attention, innovation, and collaboration. Waste reduction is a crucial component of sustainable food systems, impacting all points across a food supply chain. Australia alone discards over 5 million tonnes of food annually, amounting to a staggering cost of over \$20 billion per year (Commonwealth of Australia, 2017). This wastage is primarily driven by households, accounting for 71% of the total, followed closely by manufacturing and processing companies, at 29% (Pickin et al., 2020). Horticulture produce of fruits and vegetables, also bears a significant burden in terms of food waste. Throughout the supply chain, an alarming 18-22% of fruit and vegetable biomass is lost nationally (Juliano et al., 2019). This loss represents a missed opportunity for nourishing our communities and maximising the resources invested in cultivation. In light of these alarming statistics, it is evident that urgent action is needed to address food waste throughout the supply chain, particularly in the horticulture sector. Our collective responsibility extends beyond statistics but to implementing innovative solutions that can effectively minimise waste, preserve resources, and foster a sustainable food system.



## OUR FOOD SYSTEM



Throughout history, civilizations have grappled with food preservation and waste management (Mansfield & Mendes, 2013). In this context, ancient cultures like the Mayans, Aztecs, and Ancient Mexican groups emerge as examples, demonstrating their deep respect for nature and their ability to repurpose and preserve every part of a fruit (Medina, 2014). With this finding, we focus on a fruit that has stood the test of time, Avocados. Symbolising prosperity and fertility, avocados have captivated hearts across centuries and managed to find its way to Australia in 1852. Our report will confront the pressing global issue of food waste as we draw inspiration from the cultural and historical significance of avocados that spans millennia. We aim to incorporate the indigenous roots and wisdom passed down through generations when innovating solutions that not only address the challenges of the present but also lay a sustainable foundation for the future.



# PROBLEM STATEMENT

The avocado industry is a big part of the Australian alimentary sector which continues to grow every year. Increasing volumes of avocado production have a high potential to lead to greater waste of valuable resources which could bring profit both economically and environmentally if they are properly managed.

## **This leads to our aim...**

To analyse the current situation and to recommend possible solutions to mitigate and manage avocado waste.

## KEY OBJECTIVES

Our objectives are based on the principles of waste hierarchy which is a powerful and well-organised tool. We are aiming to create solutions which would fit into the highest positions: prevention, re-use and recycling, as they are considered to be the most effective ones (European Commission Waste Framework Directive, 2008). Moreover, our expected outcomes align with the sustainable development agenda since we're working towards responsible consumption and production (UN Sustainable Development Goal 12).

**1**



Report the magnitude of resources wasted during avocado production and assess existing waste management practices and markets.

**2**



Evaluate the existing methods employed for recovering avocado waste and research potential opportunities for improvement.

**3**



Create an actionable campaign or service to incentivize and drive continuous improvement in avocado waste management practices

**4**

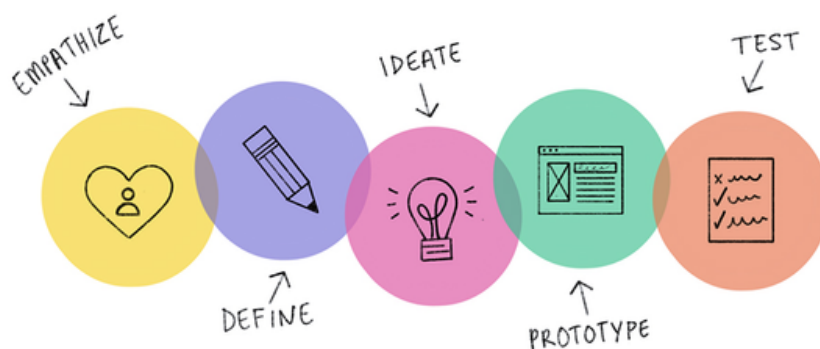


Develop a strategy to extract value from avocado waste, considering various factors which would also aim to mitigate greenhouse gas emissions.

# APPROACH & METHODOLOGY

## DESIGN THINKING APPROACH

Our approach to research methodology was guided by the principles of design thinking, a dynamic and iterative process that lends itself well to addressing complex challenges with a human-centred focus. Design thinking allowed us to embark on an open-ended exploration, emphasising stakeholder needs and fostering a deep understanding of the problem at hand. By employing various research methods such as surveys, semi-structured interviews, and affinity diagrams (Tomistch et al., 2021), we delved into the intricacies of the avocado industry from producers to consumers to uncover insights that would shape our solutions. In the ideation phase, we adopt a two-fold approach. Firstly, in the divergent thinking phase, we generate numerous ideas and test their validity against our literature findings, surveys and interviews from the inspiration and empathy phases. Secondly, in the convergent thinking phase, we narrow down the ideas to select the ones that align closely with user needs and show potential for success. Moving into the implementation and prototyping phase, we focus on developing the most promising ideas identified. These ideas are then tested against peer and mentor feedback, allowing us to iterate on the prototypes. It is important to note that user needs are dynamic and continuously evolving. Therefore, our solutions must embrace a continuous cycle of divergent and convergent ideation, as well as implementation. By following this systematic process, rooted in design thinking, we aim to develop innovative and sustainable solutions for our problem statement.



## RESEARCH METHODS

To ensure the robustness and alignment of our research and problem-solving approach with our aim(s) and objectives, we have carefully chosen specific methods and sources of evidence. Firstly, we will conduct a comprehensive literature review that draws from diverse external sources, including industry reports from esteemed organisations like Hort Innovation and Avocado Australia, as well as peer-reviewed journal articles. By utilising these reputable sources, we aim to gain a holistic understanding of the avocado industry landscape and identify existing food waste diversion options (objective 1 & 2). In addition, we will employ brainstorming exercises for ideation, allowing our team to generate innovative ideas. To gain valuable insights into the industry, we will conduct stakeholder and supply chain analyses, as well as employ the business model canvas (objective 2). While these methods and sources of evidence are well-aligned with our aim and objectives, it is important to acknowledge their limitations. The literature review may have inherent biases or gaps, and the selected sources might not capture the entirety of the avocado waste landscape. Despite this limitation, we believe that by synthesising the insights obtained from these methods and sources, we will be able to develop evidence-based strategies that address our objectives.

## INTERDISCIPLINARY PROFILES

In our project, we leveraged the diverse expertise and skills within our group to design and execute our approach. Shavil's background in economics, marketing, and design provided a strong foundation for communicating business strategy and visualising our findings. Ekaterina's knowledge in archaeology and history brought valuable research and analytical skills to the team, facilitating data-driven decision-making and effective communication. Loretta's expertise in neuroscience and psychology brought an evidence-based approach, ensuring objectivity and critical analysis of outcomes. Her proficiency in scientific writing and contextual understanding added depth to our literature reviews and project scope. Nguyen Nhat Anh's specialisation in global studies infused our project with a socio-political perspective, enriching our understanding of cultural norms and market behaviour. With her research skills and multicultural exposure, she contributed significantly to gathering and organising data. By combining our disciplinary knowledge and skills, we created a well-rounded approach that allowed us to tackle the project from multiple angles, ensuring a comprehensive and informed execution.

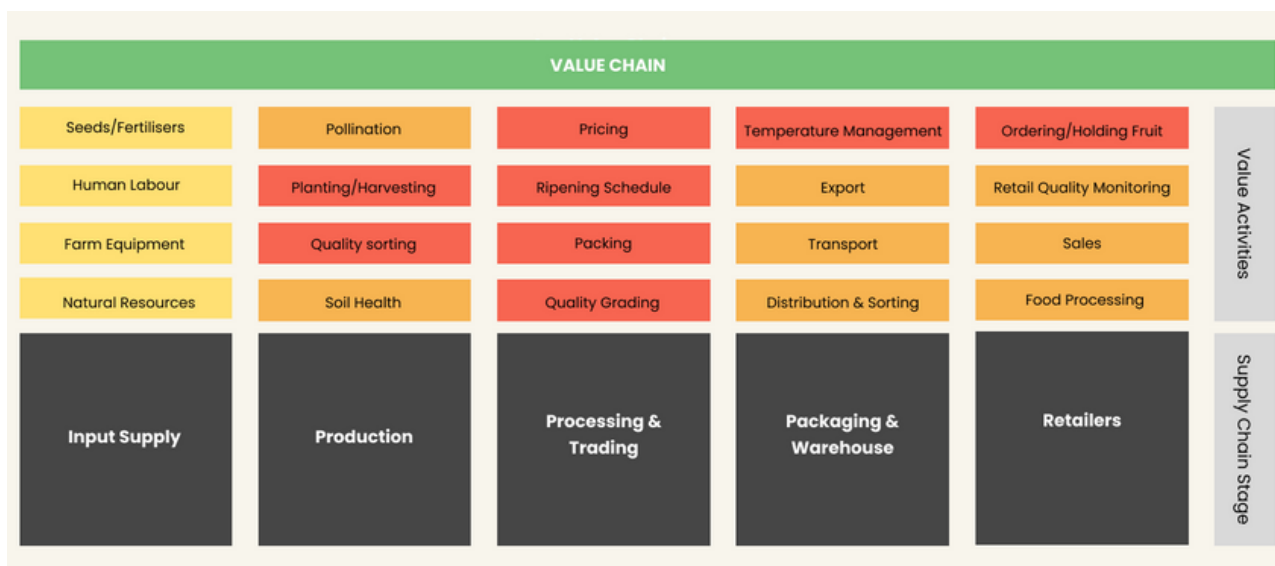


# FINDINGS & RESEARCH

## Industry Research

The Australian avocado industry has projected growth in North Queensland, Central Queensland and Western Australia in alignment with Avocados Australia Strategic Plan 2023-2027 (Petrou, 2022). This plan aims to boost domestic avocado consumption, increase production quantity and quality, as well as refine supply chain operations for improved sustainability and profitability (Petrou, 2022). Moreover, avocado consumption has tripled in the last decade (Webb and Aedy, 2017), with 4.76kg consumed per capita during 2021/22. During this year, Australia produced over 122,197 tonnes of avocados, which was 56% more than the 2020/21 period. These production volumes are predicted to reach 170,000 tonnes by 2026 (Petrou, 2022). With the expectation of industry growth, it is crucial to revise waste management practices to avoid greater economic and environmental impacts that would otherwise follow.

In our research of the Avocado Industry, we leveraged the business model canvas to gain insights into the value creation processes. This analysis enables us to identify the key stakeholders and possible stages of the supply chain in which we could design potential recommendations to set off a ripple effect of positive change. By mapping out the interconnections and dependencies within the industry, we unveiled opportunities to collaborate and foster synergistic relationships among stakeholders. Subsequently, intending to justify where along the supply chain needs intervention. Following the insight into the avocado industry using the BMC, a supply chain was mapped out (figure x). This enabled us to conduct an analysis concerning the influence and interest in a potential avocado waste solution.



## STAKEHOLDERS

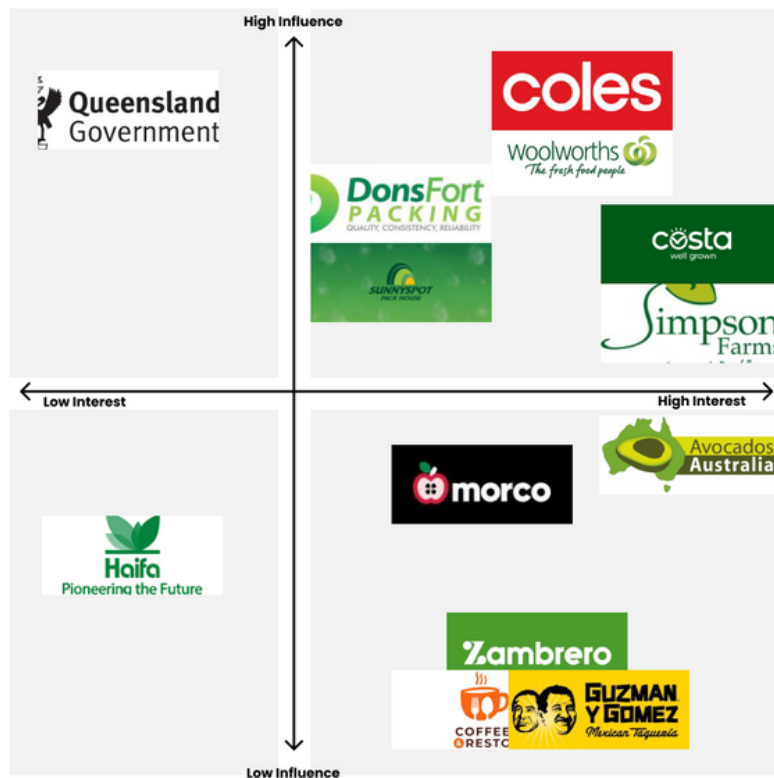
- seed fertilisation companies
- agricultural service providers

- Costa group
- Simpsons Farm
- Public Sector Pension Investment Canada

- Morco Fresh (produce supplier)
- Sunnyspot Packhouse
- Dons Fort Packing
- Avorama
- SuperPak

- Retailers
- Woolworths, Coles, HFM
- Guzman, restaurants, cafes

- Consumers



## Industry Analysis

Through our analysis above, we believe that packaging companies' strategic position allows them to have a direct influence on waste reduction throughout stages of the supply chain. As they contribute to sorting, product quality and preparing for presentation of the final product of avocados, this makes them a pivotal point for implementing a waste management measure. Secondly, their position in between farmers and the wholesalers allows for collaboration opportunities. And lastly, packaging companies have the potential to drive industry-wide change by setting new standards for sustainable packaging practices that affect retailers and thus consumers.

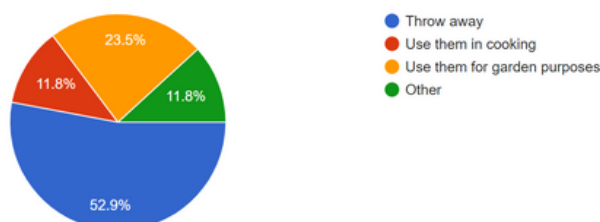
Focusing on the farmers' side may not yield significant results, due to the existing sorting infrastructure for avocados being already well-established and functioning optimally. Furthermore, enhancing this technology would require a substantial global overhaul, making it less feasible for waste minimization. Instead, we are directing our attention to the packaging companies. When avocados are packaged, the likelihood of singular avocados going missing decreases significantly, providing a controlled variable. The key uncontrolled variables lie in the spoilage and mishandling of avocados during storage, distribution, and at the retail level. By targeting waste minimization in the area of spoiled avocados, we can implement feasible and cost-effective measures that still have a substantial impact.

## Consumer Research: Survey Results

Insights about avocado waste from a consumer perspective were gained through our own independent primary research. We sourced both quantitative and qualitative data through a survey, enabling the assessment of existing household waste management practices (objective 1) and the identification of opportunities for improvement (objective 2). Our results (n = 34) show 52.9% of participants report buying 1-2 avocados per week, and a majority purchase more than one avocado at a time. 50% of participants said they purchase avocados for immediate consumption, and the other 50% purchase for later consumption. We also found that firmness was the most commonly used indicator of ripeness at 85.3%, and most people reported purchasing avocados when they are almost ripe. To determine the main causes of household avocado waste, we surveyed participants about their disposal habits. 23.5% reported never throwing away avocados, 64.8% said occasionally or sometimes, and 11.8% said they dispose of avocados often. Also, 52.9% throw away overripe avocados in the garbage instead of repurposing. These findings provide evidence that overripeness is a major factor for avocado waste, since many people purchase avocados and let them ripen at home. Unpredictable ripening time and inaccurate planning may lead to spoilage before consumption, thus is a focus for our solution.

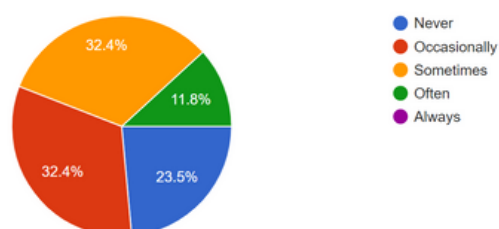
What do you do with avocados that are overripe?

34 responses



How often do you throw away avocados that were purchased?

34 responses



# Ideation

The primary driver of household avocado disposal is their spoiling before consumption. Avocados are climacteric fruits, so will continue to ripen after they are harvested, usually triggered by exogenous ethylene gas (Garcia-Salinas, 2016). Since the ripening process continues after reaching supermarkets, avocados that are under ripe when purchased can quickly spoil.

Following our survey and industry research and analysis, our team used the Crazy 8s exercise for ideation and generated 32 potential solutions (FIGURE X for ideas). After some deliberation with each other, we unanimously agreed to pursue smart sensor labels for avocados to detect ripeness, directly addressing our supply chain improvement objective. Additionally, we decided to launch an engaging in-store campaign to foster appreciation for overripe avocados, as this second recommendation perfectly embodied our commitment to community engagement.



## Research into Ripening sensor labels

Smart packaging of perishable goods is a recent technology that allows real-time monitoring of freshness through the detection of volatile organic compounds, ethanol, hydrogen sulphide, pH or CO<sub>2</sub> which are released as the fruit ages (Alam et al., 2021). Avocados release a specific combination of volatile compounds, including ethylene, as they ripen. Carbon nanotube-based technology has been developed to detect ripening of fruit through the emission of ethylene gas. Esser et al., (2012) designed a copper complex that recognises sub-ppm concentrations of ethylene. Their research showed that avocados had the second highest response to this sensor out of the fruit tested, and had an increase in ethylene emission within the first week (Esser et al., 2012). Researchers from [Embrapa Instrumentation](#) have employed this technology in their colour metric sensor, Yva. It uses this nanoparticles to detect ripeness, and has been tested on mangoes, papayas and bananas. The sensor has a QR code that consumers can scan to provide information about the fruit (Silva, 2020). Freshtag is another application of this nanotechnology, however it uses time and temperature detection to monitor the freshness of perishable products (Result, 2021) . Since the technology for ripeness indicators have already been designed and tested, the next step forward is applying these labels within the Australian Avocado Industry.

## Research into Supermarket Campaigns

Our research also revealed that a majority of avocados are thrown away instead of repurposing. Supermarket waste reduction initiatives focus on decreasing food waste within the store, by donating stock (ColesGroup, 2023), and promoting the purchasing of fruit and vegetables that are imperfect (ColesGroup, 2023; Woolworths, 2023). Currently, there are no supermarket initiatives that focus on the role of the consumer, and how food waste can be reduced at home. In-store pop-ups facilitate enjoyable experiences of sensory and social interaction. This deeper engagement plays a crucial role in education and creating personal connections between consumers and products (Rosenbaum et al., 2021). Educating consumers about avocado waste through campaigns also benefits supermarkets by strengthening their reputation in relation to sustainable practices.

# DISCUSSION

## Recommendation #1: Nano-technology smart label: Avoripe

The nanosensors in smart labels contain a copper complex that detects and responds to ethylene (Esser et al., 2012). As the avocado ages and the concentration of volatile compounds increases, the label will change colour. They can be attached directly to the skin of the avocados to accurately indicate ripeness, and therefore allow consumers to purchase avocados of the desired ripeness. These labels are made from polyethylene terephthalate, which is recyclable and environmentally conscious (Alam et al., 2021). This labelling system would be implemented at the packhouse facility right after harvesting, allowing ripeness indication to inform handling and sorting of avocados throughout the rest of the supply chain. Ripeness sensor labels also will reduce supermarket waste, as a visual cue will incite urgency to managing the produce. Damage to fruit from handling and inspection by customers would be minimised, since a visual colour cue makes squeezing fruit for firmness unnecessary. Ready-to-eat avocados are also more likely to be purchased if there is a clear indication that they are ripe, and therefore will not be left to spoil in supermarkets.



## Feasibility and Viability

The feasibility of implementing nano-sensor technology in the avocado supply chain depends on various factors, including technological readiness, cost-effectiveness, scalability, and regulatory considerations. While the concept of nanosensor-based freshness monitoring is promising, there are several aspects to consider regarding its implementation. Firstly, to design and engineer the smart label, there's a need to engage in a collaborative partnership with a renowned nano-technology research firm. Our research has identified Insignia Technologies as experts in the field of fruit and vegetable science and sensor nanotechnology. This collaboration will ensure that we leverage the latest advancements in the industry. Implementing the smart labels will require coordination with both on-site and off-site packing facilities. Specifically, we will work closely with Sunny Spot packhouse, a leading packaging facility for avocados, to seamlessly integrate the smart labels during the grading and packing stage of the avocado's journey from farmers to retailers. Their expertise and infrastructure make them an ideal partner for this strategy.

*Potential Template for Cost Analysis*

<b>Cost Analysis</b>	Cost per sticker	Year 1	Year 2	Year 3	Year 4
<b>Quantity of Sticker</b>	X,XXX,XXX	50,000	75,000	100,000	200,000
Material	\$0.20	\$100,000.00	\$15,000.00	\$20,000.00	\$40,000.00
Manufacturing Process	\$0.15	\$7,500.00	\$11,250.00	\$15,000.00	\$30,000.00
Quality Control	\$0.03	\$1,500.00	\$2,250.00	\$3,000.00	\$6,000.00
Packaging	\$0.05	\$2,500.00	\$3,750.00	\$5,000.00	\$10,000.00
<b>Production Cost Total</b>	<b>\$0.43</b>	<b>\$111,500.00</b>	<b>\$32,250.00</b>	<b>\$43,000.00</b>	<b>\$86,000.00</b>
Distribution	\$0.08	\$8,000.00	\$1,200.00	\$1,600.00	\$3,200.00
R&D Investment		\$200,000			
Maintenance Costs	\$0.10	\$5,000.00	\$7,500.00	\$10,000.00	\$20,000.00
Customer Support	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000
<b>Total Estimated Cost</b>		<b>\$466,000.00</b>	<b>\$103,200.00</b>	<b>\$127,600.00</b>	<b>\$225,200.00</b>

*Figures are estimated using data from (Trafton, 2012)*

## Consumer Desirability

Avocados have been cherished for their ability to nourish and sustain communities throughout history. Our Nano-Sensor Smart Labelling technology aligns with the time-honoured tradition of minimising waste and embracing sustainability. It also serves as a powerful tool to boost profitability for businesses in the retail sector. By ensuring avocados are delivered to consumers at their peak ripeness, retailers, including restaurants and supermarkets, can enhance the overall quality and taste of their avocados which leads to increased customer satisfaction and contributes to positive word-of-mouth recommendations. Additionally, the precise ripeness monitoring provided by the smart labelling helps retailers optimise their inventory management, reducing the risk of overstocking or understocking avocados. This enables businesses to minimise waste, lower operational costs, and improve profit margins. The ability to consistently deliver superior quality avocados can also differentiate retailers from their competitors, attracting more customers and establishing a reputation for excellence. Ultimately, our Nano-Sensor Smart Labelling empowers businesses to leverage the cultural significance of avocados to drive profitability, customer loyalty, and success in the competitive marketplace

## Limitations

While ripe sensor labels for avocados offer numerous benefits, they also face certain limitations and constraints. One limitation is the accuracy and reliability of the sensor technology. Achieving precise calibration and consistent detection of avocado-related volatile compounds can be challenging, leading to potential false positives or negatives. Ensuring the accuracy and reliability of the nanosensors is essential. Calibration of the sensors to detect and respond specifically to avocado-related volatile compounds, while minimising false positives or negatives, is a key challenge.

Another constraint is the cost of implementing and maintaining the ripe sensor labels. The use of nanotechnology and specialised materials adds to the production and operational expenses, which may affect the overall cost-effectiveness and feasibility of widespread adoption. Consideration must be given to ensure that the benefits of reducing waste and improving customer satisfaction outweigh the associated costs. Any technology introduced into the food supply chain must meet regulatory standards for food safety and consumer protection. The implementation of nanosensor-based technology would need to address any regulatory considerations associated with the use of nanomaterials in food packaging

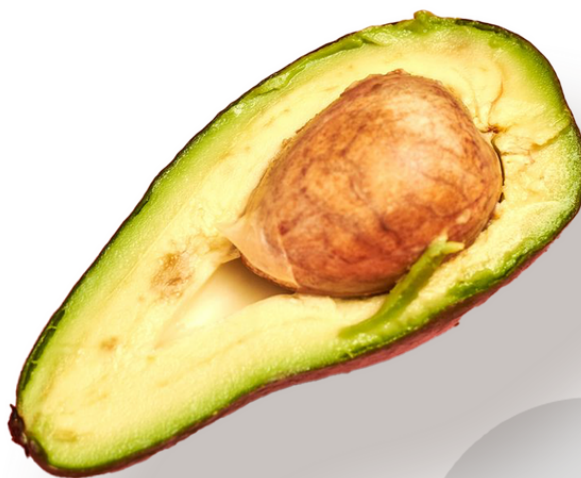


## Recommendation #2: Waste Reduction Campaign: Rescue and Relish

Although the implementation of ripeness indicators will minimise avocado waste, some waste will remain as a consequence of neglecting ripening fruit as per our survey findings. To combat this problem, we suggest a recommendation to educate consumers on the use of these “undesirable” avocados. Our waste reduction campaign aims to spread awareness about how household avocado waste can be reduced by repurposing overripe avocados. This will be achieved through in-store pop-up stalls that provide taste-testing samples of victuals that incorporate overripe avocados that may otherwise be disposed of. This includes a variety of simple products such as brownies, muffins and smoothies, catering for different food preferences. The recipes for these food products will also be provided in a free brochure, encouraging consumers to make use of overripe avocados at home. These pop-ups will be implemented in major supermarkets, such as Woolworths and Coles. Woolworths has been involved in various sustainability initiatives, with a commitment to reducing waste and emissions (Woolworths, 2023). Similarly, Coles partners with organisations to reduce food waste, with the aim of diverting 85% of solid waste from landfill by 2025 (ColesGroup, 2023). Our avocado waste reduction campaign facilitates these goals by increasing consumer awareness about avocado usage and waste, and how overripe fruit holds value through repurposing.

### THE OVERRIPE AVO

MASHED  
IN A  
SANDWICH  
WHO CARES?



**GRAB THE RECIPE**

**RESCUE  
& RELISH**



## Feasibility and Viability

Keeping in mind the goal of increasing public appreciation of the value of avocado waste, we will engage consumers using the retailer segment. We plan to use the channel of grocery shops to promote the use of spoiled avocado in homage to the community traditions of transferring knowledge during the Aztec and Mayan periods years ago. Our version of this traditional collaboration will be a pop up stall at local supermarkets.

We examine market demand, prices, and logistical issues while determining the viability of a pop-up event that provides dishes cooked from overripe avocado within a supermarket. Avocado is presently one of the trending foods in terms of health and diet, so products and cuisines with avocado as the major ingredient will be in great demand. Consider the Coles supermarket. We expected a large number of people to attend the pop-up event due to the high number of walk-in customers and an estimated 20 million customer transactions each week (About Us | Coles Group, n.d.). Given the rise in avocado consumption (triple in the last decade, as mentioned above), we can be confident that public interest in such an event will be high.

In terms of financial viability, the price of avocados, the major ingredient, will be determined by seasonality, supplier relationships, and the amount needed for the event. However, because the major source of stock for this event is spoiled avocado, which consumers typically leave behind and do not purchase, it could be simply gathered from the supermarket's already existing stock. Expenses for additional ingredients for the dishes will be considered because a wide variety of foods will be prepared for the event. An effort to publish pocket-sized cookbooks is in the works. This brochure will be made available at no cost and placed in a prominent location next to the avocado aisle and the popup setup. For reference, Bellprint charges approximately \$249 aud for 10,000 DL flyers (Cheap DL Flyer Printing, n.d.). Popertee, a retail analytics specialist, has reported that the overall cost of a 30-day pop-up is around 36,000 AUD (Voidonicolas, 2022). Below is an estimated cost analysis for the supermarket pop up stall using data from Shopify, Popertee and Bellprint.

### Potential Template for Cost Analysis

<b>Cost Analysis</b>	<b>1-Day</b>	<b>7-Day</b>	<b>30-Day</b>
Labour	\$500.00	\$3,500.00	\$15,000.00
Pop-up Stall Equipment (tables, chairs)	\$300.00		
Serving Supplies	\$100.00	\$700.00	\$3,000.00
Marketing & Promotion Material	\$449.00		
Additional Ingredients	\$400.00	\$2,800.00	\$12,000.00
<b>Total Estimated Cost</b>	<b>1,749</b>	<b>\$7,000.00</b>	<b>\$30,000.00</b>

*Estimated cost using data from Shopify, Belprint & Popertee*

## Desirability

Large grocery stores like Coles and Woolworths are good examples of where these regulations could be implemented efficiently. The problem and recommended solution will be communicated to the Sustainability Strategy manager at Woolworths, Coles, or any other large supermarket, given that this type of event is more profitable and suitable for large merchants because resources can be reallocated and financial input in certain areas (such as human resources and the main ingredient) will be reduced. KPMG may use it as a model for a potential service they give to other merchants interested in adopting the Avocado Sustainable Framework into their operations.

## Limitations

Although this solution is quite useful for large merchants, it is evident that its limitations are determined by the size of the merchants who use it. Small merchants will have significant logistical challenges because most resources will not be made available, adding to the budget and resulting in less effective results than large merchants, not to mention the possibility of losses. Furthermore, there is less foot traffic at smaller establishments, which is the event's major promotional force, making the event less efficient and heightening the need to consider marketing expenses. While we expect the solution to have a significant educational impact, it is ultimately up to the consumer to make the necessary behavioural shift with the aid of our community education awareness.

# CONCLUSION

Avocados have been with us for a very long period of time and their production is still thriving. But as we can see, the waste isn't managed properly which results in unsustainable practice and profit loss for businesses. As we've stated, our research and objectives are aimed to increase the awareness of the importance of sustainable practices in the avocado industry and their implementation, keeping in mind the benefits for business and convenience for customers. We've used various methods and approaches in order to examine the issues from different perspectives and which are suitable for different parts of the research.

Through the integration of Nano-Sensor Smart Labelling, we aim to inspire a new avocado legacy, a legacy that reveres the cultural and historical value of avocados while embracing cutting-edge technology. By championing the preservation of avocados' heritage, we ensure that this iconic fruit continues to captivate hearts and minds for generations to come. The better and greener future of the whole planet can start with a small avocado saved from going to waste - so it's time for all of us to take action and our project can be a perfect step towards it.



# APPENDIX

## Survey Questions used in independent research

What is your age?

\_\_\_\_\_

What is your gender?

- Male
- Female
- Other

How many avocados do you purchase per week on average?

\_\_\_\_\_

How many avocados do you purchase at one time?

\_\_\_\_\_

Do you purchase avocados for immediate consumption, or for later consumption?

- Immediate consumption (1-2 days)
- Later consumption (3+)

How do you check the ripeness of an avocado?

- Colour of the skin
- Firmness
- Stem
- I don't check

At which ripeness stage do you typically purchase avocados?

- Not yet ripe
- Almost Ripe
- Ripe

How often do you throw away avocados that were purchased?

- Never
- Occasionally
- Sometimes
- Often
- Always

What do you do with avocados that are overripe?

- Throw away
- Use in cooking
- Use them for garden purposes
- Other

Would you be interested in purchasing avocados with a label that indicated ripeness based on colour?

- Yes
- No
- Maybe

Would you be interested in recipes that incorporate avocados, such as brownies and muffins?

- Yes
- No
- Maybe

# APPENDIX

## Waste hierarchy

(European Commission Waste Framework Directive, 2008)



# Brochure used in the Rescue and Relish Campaign

## Muffins

**Ingredients:**

- 2 eggs
- 1 cup sugar
- 1/2 cup oil
- 1 1/2 cups avocado (peeled and mashed)
- 1 tsp vanilla
- 2 cups flour
- 1 tsp baking powder
- 1 tsp baking soda
- 1/2 tsp salt
- 3/4 cup miniature chocolate chips

**Preparation:**

- In a medium bowl, beat eggs, sugar, oil, avocado, and vanilla until smooth.
- In a smaller bowl, stir together flour, baking powder, baking soda, and salt.
- Gradually add flour mixture to avocado mixture, beating well until all ingredients are well combined.
- Gently stir in 1/2 cup miniature chocolate chips.
- Divide batter evenly amount 12 lined muffin cups.
- Sprinkle remaining 1/4 cup chocolate chips over top of each muffin.
- Bake at 350 degrees for 20 - 23 minutes or until a cake tester comes out clean. Allow to cool before serving.

## Enjoy the taste of a better future

by reducing avocado waste



For more recipes, scan the QR code below:



**AvoRipe**



**RESCUE & RELISH**

**Recipe Guide**

**Group 4**

## Smoothies



**Ingredients:**

- 1 cup milk
- 1 avocado, halved and pitted
- 1/2 cup vanilla yogurt
- 3 tablespoons honey
- 8 ice cubes

**Preparation:**

Place milk, avocado, yogurt, and honey into a blender; add ice cubes and blend until smooth.

## Guacamole

**Ingredients:**

- 2 avocados, halved, stones removed, peeled
- 60ml (1/4 cup) fresh lime juice, plus extra to serve
- 1 small red onion, finely chopped
- 1 ripe tomato, finely chopped
- 2 garlic cloves, crushed
- 1 small fresh red chilli, deseeded, finely chopped
- Salt & ground black pepper



**Preparation:**

- Place the avocado flesh and lime juice in a medium bowl and use a fork to mash until almost smooth.
- Add the onion, tomato, garlic, chilli and lime juice and season with salt and pepper. Use a spoon to mix well.
- Serve with a squeeze of extra lime juice.

## Brownies

**Ingredients:**

- 1 avocado, cubed
- 2 eggs
- 1/2 cup honey(170 g)
- 1 teaspoon vanilla extract
- 3/4 cup whole wheat flour(75 g)
- 1/4 cup cocoa powder(30 g)
- 1 teaspoon baking powder



**Preparation:**

- Preheat oven to 350°F (175°C).
- In a blender or food processor, combine avocado, eggs, honey and vanilla extract. Blend until smooth, scraping down sides as necessary.
- In a large bowl, whisk the flour, cocoa powder and baking powder.
- Combine the wet and dry mixtures and fold until a batter forms. Pour batter into a greased 8x8 inch baking pan.
- Bake for 20-30 minutes. Allow to cool.

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