



Otto Berckmueller



Alexander Rubin



Is Lab-Grown Meat Ethical? If  
So, Should Arizona invest in the future  
of Lab-Grown Meat?



# Who We Are

## Burlington Bio

**Co-Founders of Burlington Bio**  
**Researchers at the University of Vermont**



**What We Do: Create sustainable and humane methods to produce cultivated meat directly from animal cells**

**Our Philosophy: The future of food is not about choosing between tradition and technology, but harmonizing the two to nourish humanity**



# Why Are We Here

## Transform Arizona's Meat Industry

### Reasons

Existing Relationship with University of Arizona President Suresh Garimella

Renewable Energy Surplus

Regulatory Support Potential

### Goals

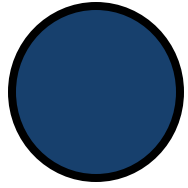
Create Cultivated Meat Hub

Provide Mutually Beneficial Solutions for All Meat Producers

Leverage Renewable Resources to Improve Environmental Issues

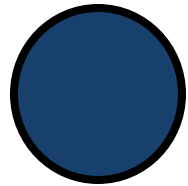


# Today's Agenda



Ethics Framework  
&  
Stakeholders

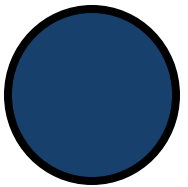
Understanding the current state of Arizona as a result of the impacts of the meat industry.



Recommendations

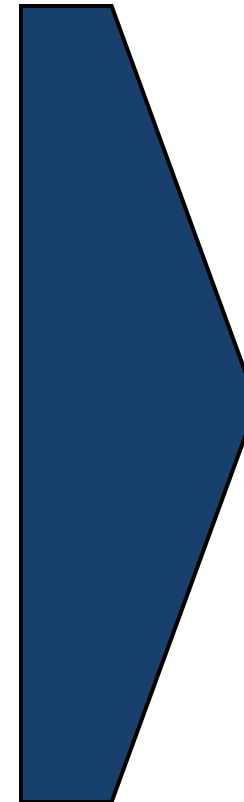
Outline key stakeholders and how we approach their financial, legal, and ethical concerns.

Should Arizona Invest in the Future of Lab Grown Meat?



Analysis and  
Impacts

- Ethics Matrix – Stakeholders
- Pillars of Common Good
  - 4 E's: Environment, Economics, Equity, Ethics



**Final Decision:**  
The state of Arizona promotes Lab-Grown meat to be grown within the state, aiming to become major hub.

# How It's Made

Cell Collection



Cell Cultivation



Harvesting and Structuring





# Why We Care

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# Planet

**35%** increase in world population by 2050

**2x** the resources will be required to feed the 2050 population

**14.5%** of GHG emissions come from livestock farming

**77%** of agricultural land is for livestock farming

Yet provides only **18%** of the world's calories



# Arizona Agriculture Concerns

## REDUCED WATER AVAILABILITY

Drought has led to more

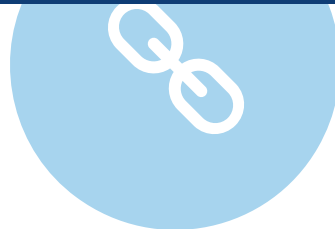


## SOIL DEGRADATION

Caused by rising temperatures, water

# Climate Change

Current regulatory framework can make new incentives difficult to enact



Few young people view agriculture as a viable career path – high impact on Native Nations



# Key Arizona Agriculture Statistics

## 2017 Census of Agriculture

915,647 Acres of Harvested  
Cropland

19,000 Farms  
33,847 Farmers

Average Farmer Age: 59.4 years



## 2022 Census of Agriculture

871,863 Acres of Harvested  
Cropland

16,400 Farms  
29,100 Farmers

Average Farmer Age: 60.1 years

Supports findings of 2023 U of A report that sole reliance on traditional practices make agriculture an unsustainable industry in  
Arizona



# Ethics Decision Matrix

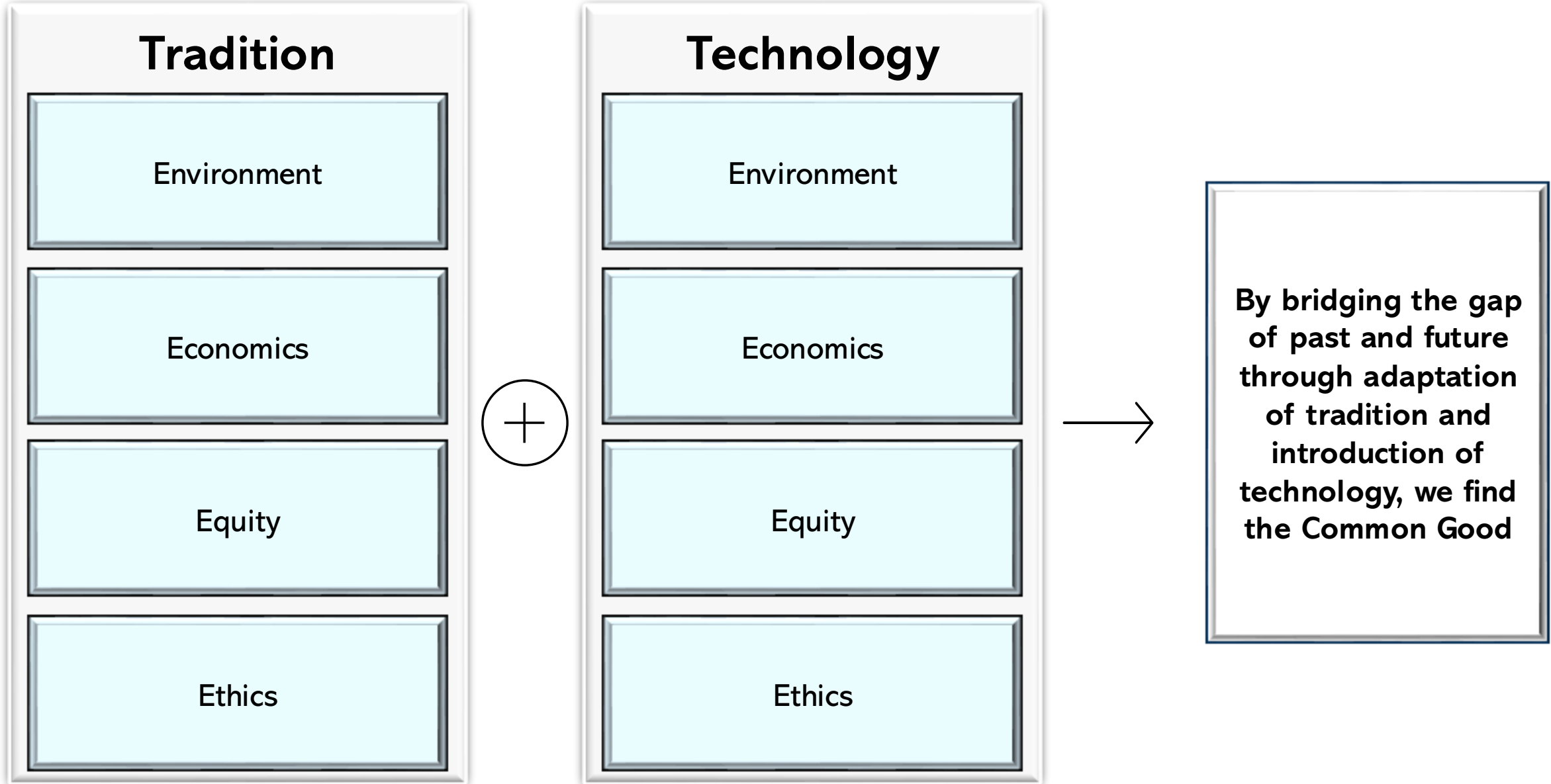
	Common Good Framework	Utilitarianism	Virtue Ethics
Stakeholder Consideration	✓	—	—
Contributes to Harmonization	✓	✗	✓
Long-Term Viability	✓	✗	✓
Applicability to Arizona	✓	✓	—

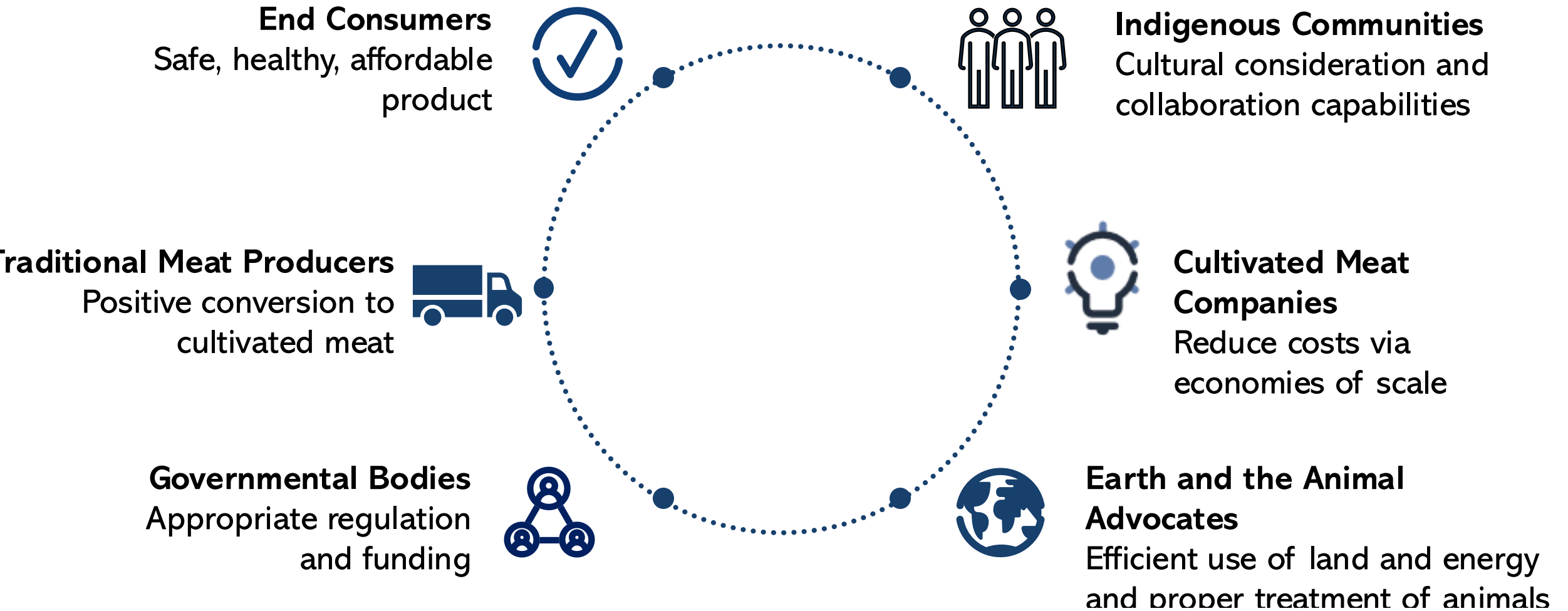


***“The future of food is not about choosing between tradition and technology, but harmonizing the two to nourish humanity.”***



# Pillars of Common Good







# Our Recommendations

**Create Inclusive  
Regulatory Environment  
Encompassing Cultivated  
Meat**

**Utilize Renewable Energy  
to Support New Industry**

**Provide Research Grants  
and Tax Breaks**

**Leverage Expertise of the  
President of U of A,  
Suresh Garimella**

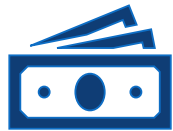


# Financial Considerations

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# Cultivated Meat Market Analysis

## Current Industry Milestones



All time investments reach **\$3.1 Billion** in 2023



In the summer of 2023, the USDA granted final approval, including label approval and a grant of inspection, to both UPSIDE Foods' and GOOD Meat's cultivated chicken products.



Food Safety News

USDA's regulatory approvals are in for two lab-grown chicken operations

**FSN**



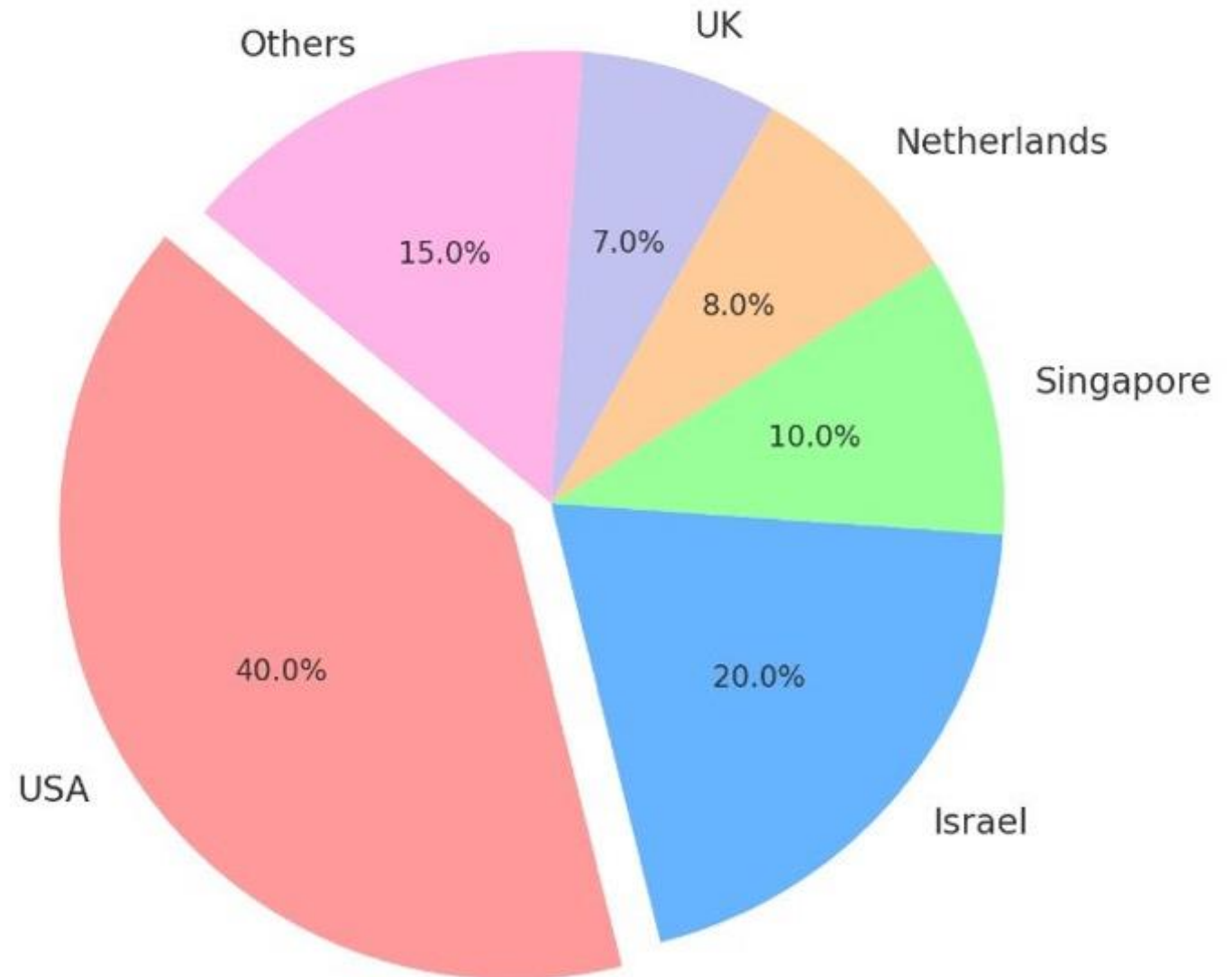
# Cultivated Meat Market Analysis

## Industry Outlook

Global Growth Rate at **45.5% CAGR** from 2024-2032

2032 market value of **\$81.66 Billion USD**

There are currently **174** cultivated meat companies globally



# Cultivated Meat Market Analysis

## Market Capture

Estimated **10%** market capture of current meat market by **2040**

Good Food Institute reports **45%** of Americans would try cultivated meat

### Trial Appeals

Curiosity/Novelty **65%**

Environmental Reasons **51%**

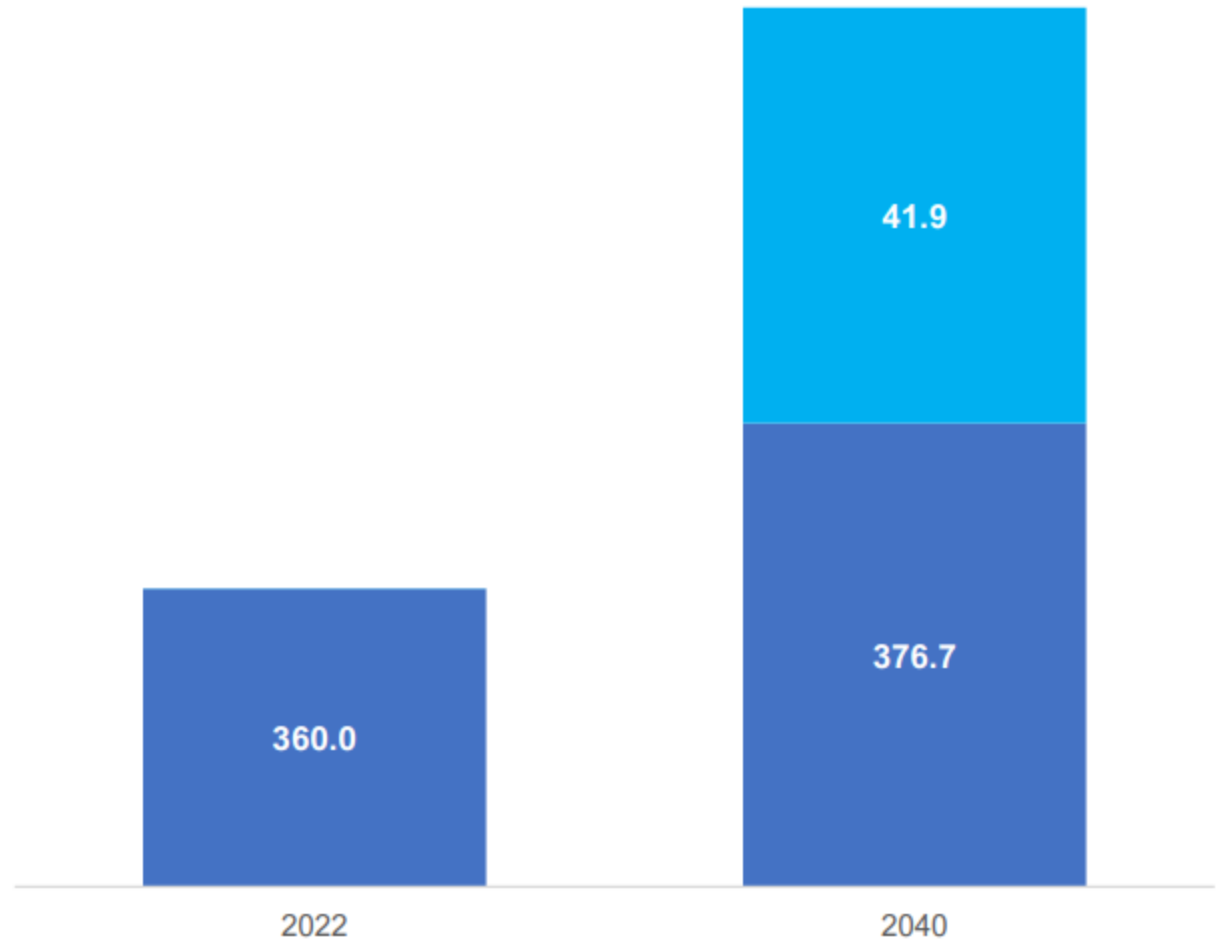
Animal Welfare **51%**

Global Food Security **44%**

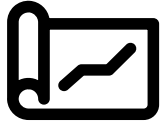
Health Reasons **23%**

Projected Rise of Cultivated Meat Market | Million Metric Tons

■ Conventional Meat ■ Cultivated Meat

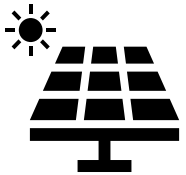


## Key Impacts



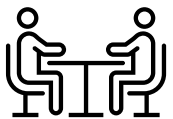
### Job Conversion

For every 500,000 metric tons of cultivated protein, over 5,000 factory jobs are likely needed. This is equivalent to the traditional farming method.



### Investment and Utilization of Renewables

\$11.81 B invested and 18,130 new jobs in Arizona since Inflation Reduction Act (2022)



### Positive Feedback Loop

As environmental conditions improve, traditional agriculture becomes a more viable career path in Arizona

**The State of Arizona  
Expects 150,000 Clean  
Energy Jobs by 2030**

**Supporting Renewable  
Energy and Cultivated  
Meat Sectors**



# Public Perception

Factors  
Impacting  
Perception

**Curiosity**

**Environmental Concern**

**Ethical Stance**

**Taste/Texture**

**Health Concerns**

**Affordability**





# Public Perception

## Methods of Improving Perception



Improving taste and texture to match traditional meat



Utilizing behavioral science to approach consumers on moral and ethical basis



Driving down costs via economies of scale



Properly educating consumers on the science



## José Andrés

Appeals to vegetarians and religious/cultural groups looking for slaughter-free protein

Celebrity status offers consumers a chance to learn from a trusted figure

Early Adopters begin to create buzz and curiosity due to China Chilcano's exclusivity



# Legal Considerations

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# Regulatory Landscape & Grants

## FDA/USDA

- 2019 formal agreement between the USDA and FDA defined each entity's role in the regulation of cell cultivated meat
- In the summer of 2023 USDA/FDA approved the sale of Cultivated Meat in the US



## Regulatory Threats

- H.R 4368 Bill – Would prohibit research funding

## Grants

- \$19 Million in federal grants
- USDA invested \$146 Million in sustainable agriculture including cultivated meat research



Collaborate with Suresh Garimella to drive research and funding

State and federal grants are provided to support R&D efforts

Stimulates growth and attracts established companies

Establish definition and labeling requirements

Work with USDA/FDA to create state-level department to oversee compliance

Provides structure to the process

Provide incentives for traditional farmers and food producers who diversify strategy

Ensures harmony is achieved



# Environmental Standards &

## Targets for Arizona

**Achieve Clean Water and  
Air Act goals**

**Improving  
pollution problem**

**Net-zero emissions by  
2050**

**Building resilient food  
production systems**

## **How?**

**Cultivated Meat Uses:**

- Up to **99%** less land
- **82-96%** less water
- **7-45%** less energy
- **78-96%** fewer GHG Emissions
- Emits Fewer Pollutants

## Impacts

**Increases climate  
resilience**

**Improved public health**

**Environmental cost  
savings**

**Enhance environmental  
justice**

## **Patent Benefits in the Industry**

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**Provides competitive advantage and barrier to entry**

**Establish credibility and leadership**

**Facilitate collaboration and investments by clearly defining each company's intellectual property**

## **Potential Patent Types**

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**Product patents**

**Platform patents**

**Use patents**

**Analytical patents**

## **Patent Location**

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**North America, Europe, and East Asia are popular application spots**

**Many countries invest outside of their native countries**

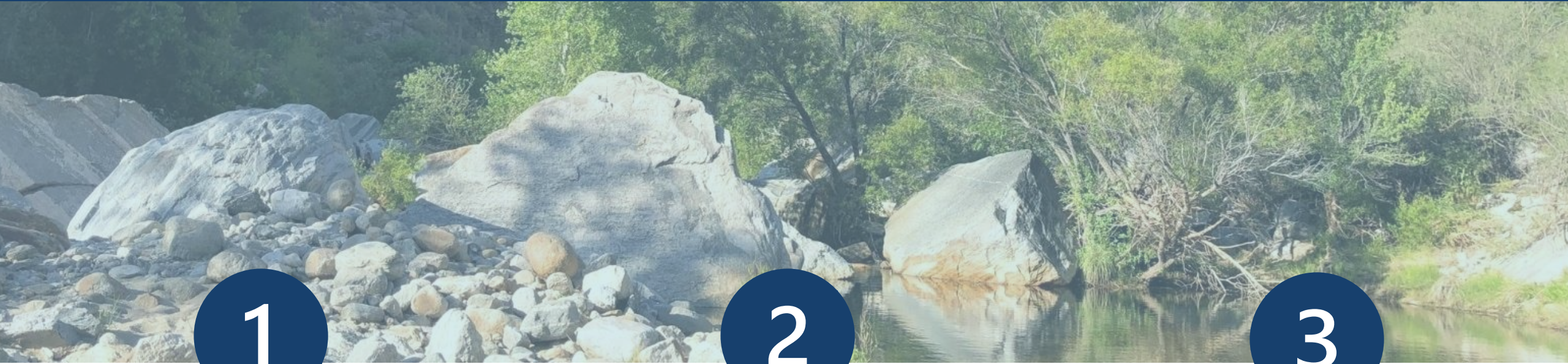


# Ethical Considerations

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# Environmental Benefits



1

**Natural Resource and  
Habitat Restoration**

2

**Increased Investment  
and Reliance on  
Renewable Energy**

3

**Improved Future  
Conditions for  
Agriculture**

# Equity and Tradition

## Fast Facts



50% of Native Nations have unresolved water rights issues



30% of the Navajo Reservation lacks running water

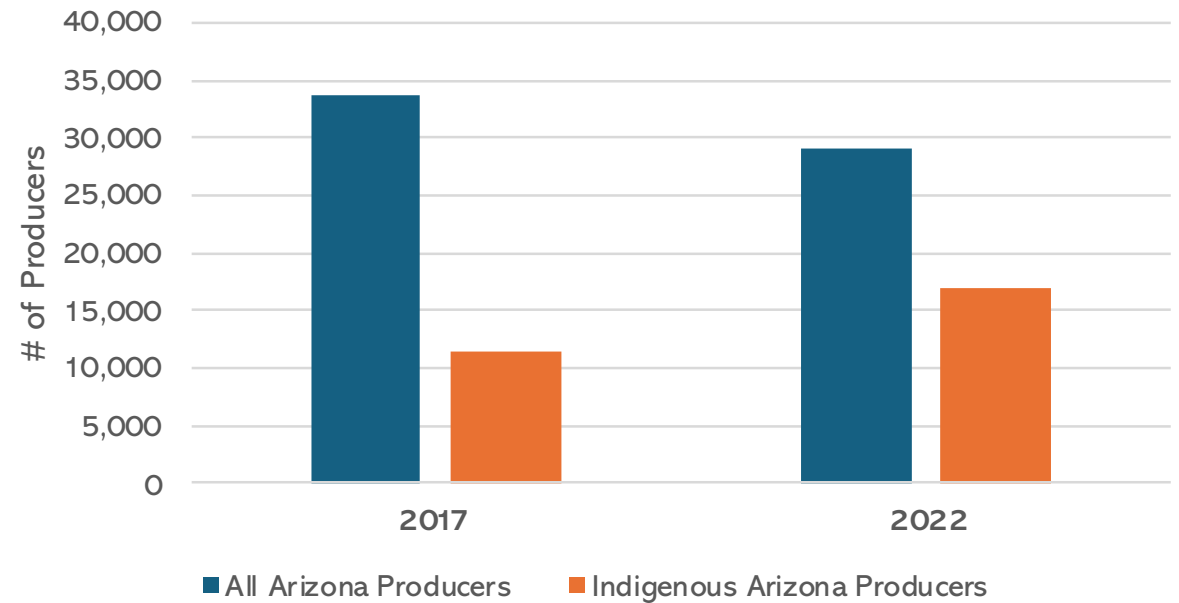


Indigenous farmers have generations of drought-resistant farming experience



58% of Arizona farmers are of Indigenous descent

### Arizona Census of Agriculture Demographics





# Equity – Native Nations

## Preservation of Arizona's Cultural Traditions in Meat and Agriculture Through Support of Native Nations



**Emphasize traditional indigenous growing practices by incentivizing regenerative agriculture and reduced water usage**



**Continue gubernatorial initiatives to support Native communities through Tribal-State partnerships and addressing water rights issues**



**Utilize U of A Native Nations Institute to create agricultural education programs to continue job growth of Native producers**



# Equity – Traditional Farmers

## Fast Facts



**3600 Farms** were lost between 2017-2022



**20 years** of megadrought has greatly impact water availability

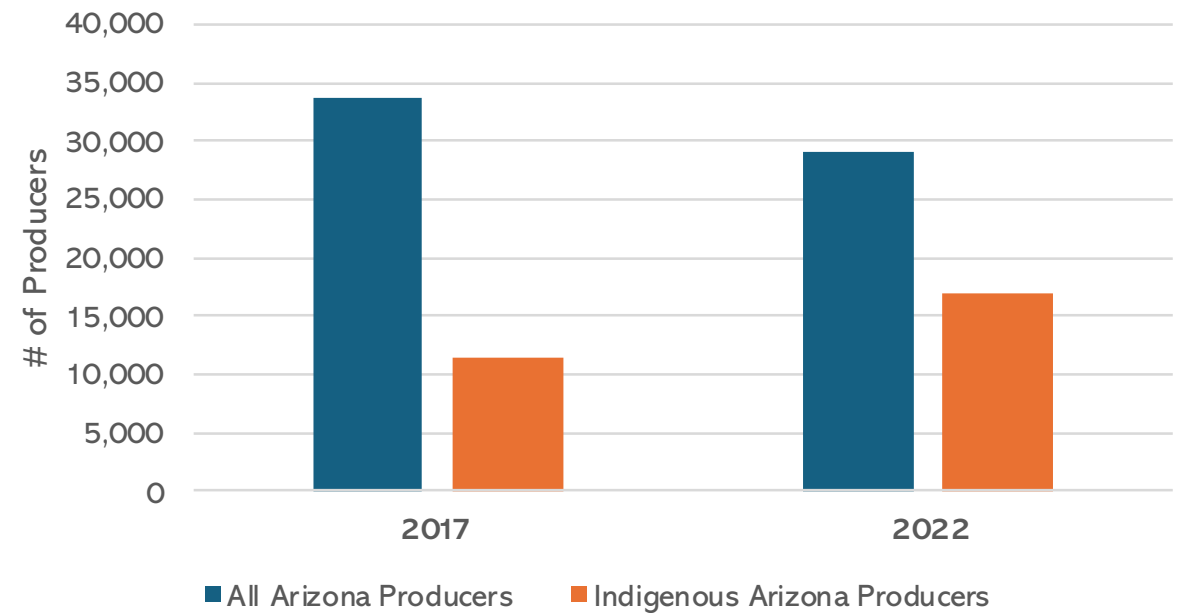


**72%** of the states water is utilized by farmers

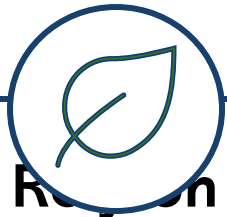


**60 years** is the average age of farmers in Arizona

Arizona Census of Agriculture Demographics



## Preservation of Arizona's Traditional Farmers through Strategy Diversification and Partnership



**Reimburse  
government  
incentives and  
partnerships to  
ensure farmers  
move to  
regenerative  
farming practices**



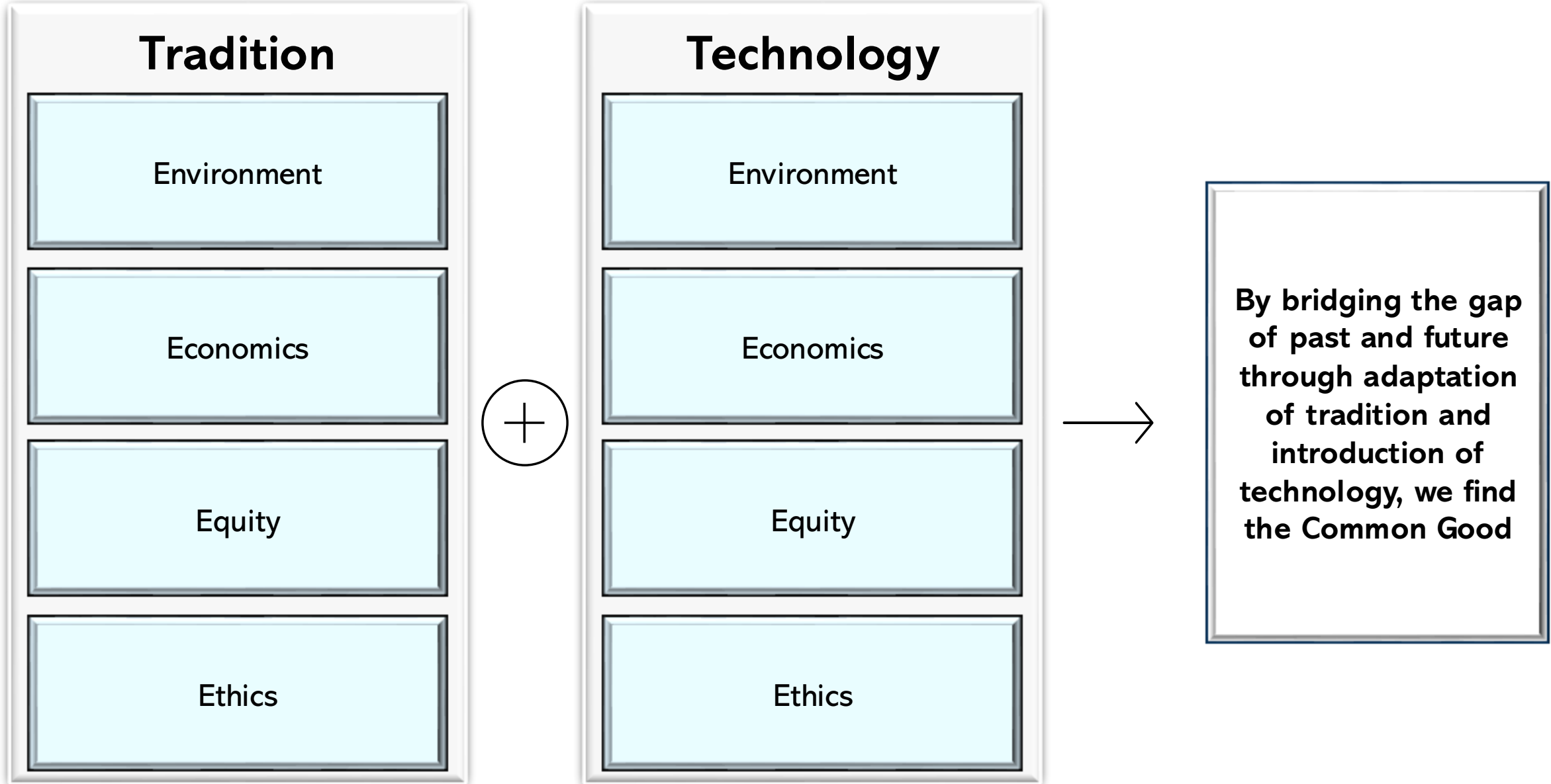
**Encourage  
investment into  
cultivated meat  
industry**



**Involve traditional  
farmers in  
cultivated meat  
research to find  
mutually beneficial  
solutions**



# Pillars of Common Good





# Pillars of Common Good

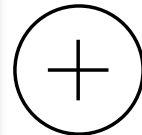
## Tradition

Transition to Regenerative Farming Practices

Sustainable Efforts in Traditional Agriculture Increase Long Term Viability

Proper Integration of Native Nations and Traditional Farmers

Improved Practices and Environmental Considerations



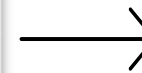
## Technology

Reduced Environmental Impacts with Economies of Scale

Research Grants and Introduction to Markets Create Profit

Regulation of Labeling and University Research Programs

Responsible Innovation and Focus on Stakeholder Needs



## Common Good

Combatted Effects of Climate Change and Resource Depletion

Future Food Systems Are Secured for a Growing Population

Fair and Just Representation of All Stakeholder Concerns

Successful Integration of Cultural Values and Humane Food Production



Alexander Rubin



Otto Berckmueller

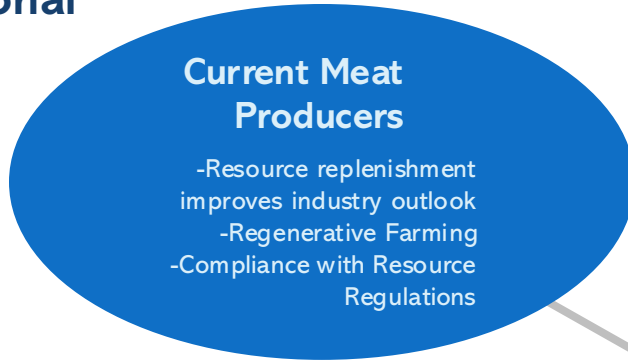
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# Sources

- <https://aranca.com/assets/docs/Aranca-Special-Report-Cultivated-Meat-Industry-Current-Status-Way-Forward.pdf#:~: Fueled%20by%20growing%20demand%20for%20sustainable%20and%20ethical%20food%20choices>
- <https://centerforfoodsafety.org/blog/6458/is-lab-grown-meat-healthy-and-safe-to-consume>
- <https://climatepower.us/news/two-years-later-clean-energy-boom-brings-more-than-18000-jobs-and-almost-12-billion-in-investment-to-arizona/>
- <https://cmr.berkeley.edu/2023/07/disrupting-the-plate-cultured-meat-technology/>
- <https://crsreports.congress.gov/product/pdf/R/R47697>
- <https://dw.com/en/debunking-myths-about-lab-grown-meat/a-66963560>
- <https://dw.com/en/us-approves-lab-grown-meat-for-sale/a-65995610>
- <https://edition.cnn.com/2023/06/27/business/lab-grown-meat-kosher-halal/index.html>
- <https://ers.usda.gov/topics/natural-resources-environment/climate-change/>
- <https://foodsafetynews.com/2024/09/lab-meat-down-on-the-farm-its-going-to-happen-say-advocates/#:~: lts%20plug%2Dand%2Dply%20bioreactors,create%20more%20options%20for%20farmers>
- [https://gfi.org/initiatives/climate/environmental-benefits-of-alt-proteins/?\\_gl=116dazhs\\_upMQ..\\_gaMTQ5NzU3NTA1Mi4xNzI3MzAwMTMy\\_ga\\_TT1WCK8ETL\\*MTcyNzMwMDEyOS4xLjEuMTcyNzMwMDEyOS4wLjAuMA..](https://gfi.org/initiatives/climate/environmental-benefits-of-alt-proteins/?_gl=116dazhs_upMQ.._gaMTQ5NzU3NTA1Mi4xNzI3MzAwMTMy_ga_TT1WCK8ETL*MTcyNzMwMDEyOS4xLjEuMTcyNzMwMDEyOS4wLjAuMA..)
- <https://gfi.org/>
- <https://link.springer.com/article/10.1007/s11367-022-02128-8>
- <https://mckinsey.com/industries/agriculture/our-insights/cultivated-meat-out-of-the-lab-into-the-frying-pan>
- <https://nationalaglawcenter.org/cell-cultured-meat-updates-state-bans-labeling-requirements-and-regulatory-clarifications/>
- <https://nationalchurchillmuseum.org/fifty-years-hence.html>
- [https://nass.usda.gov/Statistics by State/Arizona/Publications/Annual Statistical Bulletin/2020/AZAnnualBulletin2020.pdf](https://nass.usda.gov/Statistics%20by%20State/Arizona/Publications/Annual%20Statistical%20Bulletin/2020/AZAnnualBulletin2020.pdf)
- [https://nass.usda.gov/Statistics by State/Arizona/Publications/Annual Statistical Bulletin/2023-2024/AZAnnualBulletin2023-2024.pdf](https://nass.usda.gov/Statistics%20by%20State/Arizona/Publications/Annual%20Statistical%20Bulletin/2023-2024/AZAnnualBulletin2023-2024.pdf)
- <https://npr.org/2023/05/18/1176657700/arizona-farms-running-out-water-farmers-climate-change-colorado-river>
- <https://scientificamerican.com/article/lab-grown-meat-approved-for-sale-what-you-need-to-know/>
- <https://sevendaysvt.com/food-drink/lab-grown-meat-could-help-feed-a-climate-changed-world-newly-launched-burlington-bio-hopes-to-take-a-bite-39326569>
- <https://ucdavis.edu/food/news/lab-grown-meat-carbon-footprint-worse-beef>
- <https://wsj.com/articles/inside-the-struggle-to-make-lab-grown-meat-12cf46ab>
- <https://www.forbes.com/sites/chloesorvino/2023/06/27/everything-you-need-to-know-about-lab-grown-meat-now-that-its-here/?sh=22b63d2cf8a5>
- <https://www.foodsafetynews.com/2024/09/lab-meat-down-on-the-farm-its-going-to-happen-say-advocates/#:~: lts%20plug%2Dand%2Dply%20bioreactors,create%20more%20options%20for%20farmers>

# Stakeholder Impacts

## Traditional



## Technological



## Earth and Animals

- Habitats restoration
  - More resources available for animals/habitats
- This node is a green oval containing the title 'Earth and Animals' and two bullet points: '-Habitats restoration' and '-More resources available for animals/habitats'. It is connected to the central 'Environmental Impacts' node by a grey line.

## Environmental Impacts

## End Consumer

- Gets to eat meat without hurting animals or the earth
  - Can support industry that aligns with public sustainability opinions
- This node is a blue oval containing the title 'End Consumer' and two bullet points: '-Gets to eat meat without hurting animals or the earth' and '-Can support industry that aligns with public sustainability opinions'. It is connected to the central 'Environmental Impacts' node by a grey line.

## Government

- Easier Compliance with Federal Regulations
  - Reduces clean-up costs from pollution and destruction of land.
- This node is a cyan oval containing the title 'Government' and two bullet points: '-Easier Compliance with Federal Regulations' and '-Reduces clean-up costs from pollution and destruction of land.'. It is connected to the central 'Environmental Impacts' node by a grey line.



# Key Stakeholders Impacted

## Government

- New Industry significantly boosts economy
- Investments turn Arizona into a cultivated meat tech hub

## Current Meat Producers

- Indigenous Producers
- Partnership and investments into new industry drives growth

## How?

- Research Institutions and industry leaders work together.
- UVM and U of A partner with help of Suresh Garimella
- State creates regulatory laws that encourage innovation.
- Grants are provided for funding
- Tax Incentives encourage partnerships between traditional farmers and labs

## Cultivated Meat Companies

- Rapid Industry development
- Improved Public Proception

## Local

No local ordinances regarding cell cultivated meat have been proposed or passed in Arizona

Local farmers can sell directly off their farms following federal and state regulations enforced by state and local bodies

County health departments in Arizona regulate retail and restaurant sale and processing of meat

## State

Florida (SB1084) and Alabama (SB23) full ban on manufacturing and sale of cultivated meat products

Iowa (SF2391) defined labeling requirements for manufactured-protein food products, including insect and plant-based proteins

One Arizona bill to ban all sale did not pass the Senate (HB2121) - one to prohibit labeling products as meat (HB2244) is in the Senate

## Federal

2019 formal agreement between the USDA and FDA defined each entity's role in the regulation of cell cultivated meat

FDA oversees cell collection and growth – the USDA's FSIS checks cell harvesting, processing, and proper labeling of products

REAL Meal Act of 2024 proposed in the House aims to prohibit federal research funding for cultivated meat

# Ethical Matrix

Planet	Issues	Solutions	Who/What loses out	Utilitarianism Why majority wins
Environment	<ul style="list-style-type: none"> <li>Resource Requirements</li> <li>Energy</li> <li>Feeding Growing Population</li> </ul>	<ul style="list-style-type: none"> <li>Efficiency of the meat decreases resource needed.</li> </ul>	Short-term: <ul style="list-style-type: none"> <li>Energy to scale up business will have negative effect on environment</li> </ul>	<ul style="list-style-type: none"> <li>More resources available per person</li> <li>Healthier Planet</li> </ul>
Producers	<ul style="list-style-type: none"> <li>Rising Input cost</li> <li>Labor Shortages</li> <li>Climate Change</li> <li>Feeding Growing Population</li> </ul>	<ul style="list-style-type: none"> <li>Efficiency cuts costs</li> <li>Lab autonomy</li> <li>Climate doesn't affect Labs</li> <li>Efficiency helps meet growing demand</li> </ul>	<ul style="list-style-type: none"> <li>Traditional Farmers</li> <li>Large Agricultural companies involved in livestock farming</li> </ul>	<ul style="list-style-type: none"> <li>Move from unsustainable to sustainable industry</li> <li>Preserves resources</li> <li>Creates new jobs and alters industry</li> <li>Feeds more people</li> </ul>
Consumers	<ul style="list-style-type: none"> <li>Environmental concerns</li> <li>Supply chain disruption</li> <li>Health concerns</li> </ul>	<ul style="list-style-type: none"> <li>Cuts down on GHG &amp; Resources</li> <li>Increased lab self-sufficiency = less disruptions</li> <li>Controlled Lab environments</li> </ul>	<ul style="list-style-type: none"> <li>Consumers reluctant to change preferences</li> <li>Short-term: prices will be high for consumers</li> </ul>	Long Term: <ul style="list-style-type: none"> <li>More nutrition for a cheaper price, using less resources, and for more people.</li> </ul>

# Ethical Matrix

Arizona	Issues	Solutions	Who/What loses out	Utilitarianism Why majority wins
Environment	<ul style="list-style-type: none"> <li>• Water Usage (Drought)</li> <li>• Soil Degradation</li> <li>• GHG Emissions</li> </ul>	<ul style="list-style-type: none"> <li>• Scales back resource use.</li> <li>• Restores soil conditions</li> <li>• Emits 78-96% less GHG</li> </ul>	Short-term: <ul style="list-style-type: none"> <li>• Energy to scale up production will have negative effect on environment</li> </ul>	<ul style="list-style-type: none"> <li>• Arizona restores natural resources</li> <li>• Reverses drought and other effects of climate change</li> </ul>
Producers	<ul style="list-style-type: none"> <li>• Water Shortage</li> <li>• Soil Degradation</li> <li>• Vulnerability to Climate Change</li> </ul>	<ul style="list-style-type: none"> <li>• 82-96% less water usage-reverses shortage</li> <li>• 99% less land usage-restores soil conditions</li> <li>• Climate doesn't affect Labs</li> </ul>	<ul style="list-style-type: none"> <li>• Traditional Farmers</li> <li>• Large Agricultural companies involved in livestock farming</li> </ul>	<ul style="list-style-type: none"> <li>• Move from unsustainable to sustainable industry</li> <li>• Preserves resources</li> <li>• Creates new jobs and alters industry</li> </ul>
Consumers	<ul style="list-style-type: none"> <li>• Impacts from Drought</li> <li>• Supply Chain Disruption</li> <li>• Health Concerns</li> </ul>	<ul style="list-style-type: none"> <li>• Less water usage</li> <li>• Increased lab self-sufficiency = less disruptions</li> <li>• Controlled Lab environments</li> </ul>	<ul style="list-style-type: none"> <li>• Consumers reluctant to change preferences</li> <li>• Short-term: prices will be high for consumers</li> </ul>	Long Term: <ul style="list-style-type: none"> <li>• More nutrition for a cheaper price, using less resources, and for more people.</li> <li>• Less farm impacts</li> </ul>

# Indigenous Alternatives Consideration

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- Indigenous perspectives have been notably absent from the mainstream conversation about lab-grown meat, also known as “cultured meat,” “clean meat” or “in vitro meat.” But the technology may have important implications for Indigenous cultures
- One of the appeals of meat made in a lab is that it’s possible to grow cell cultures from many types of animals, even those that would be cost-prohibitive or logistically impossible to cultivate by farming. This fact has led companies to experiment with a number of meats that have great cultural significance to Indigenous groups across North America, including [bison, elk](#) and [rabbit](#), as well as salmon.



## UC Davis Rebuttal

Experts in the cell-cultivated meat field have pushed back on the UC-Davis life-cycle analysis study because it assumes pharmaceutical-grade medium are being used in cultivated meat production. According to researchers, the cultivated meat industry is moving to food-grade medium, which requires less energy to produce compared with pharmaceutical-grade medium

# FINANCIAL

One possible solution is for startups to outsource cell manufacturing, leasing equipment and production rather than each of them spending \$100 million to \$200 million on their own facilities, Frederick says. Venture capitalists have liked this approach and infused some funding into companies doing this, like Ark Biotech

## Current Issues

Environmental Concerns



## Future Solutions

Cultivated meat will cut down on GHG, resource usage, and energy consumption. This will reverse many major concerns.

Supply Chain Disruptions



Labs limit disruptions due to less inputs, more autonomy, and heavily controlled environments.

Health Concerns



Cultivated meat is designed to be healthier than traditional meat. Feeding a growing population in a more efficient way.