

MORE SUSTAINABLE FOOD PACKAGING INNOVATIONS



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Innovations for more Sustainable Food Packaging

SUMMARY OF CONCEPTS

- The entire value chain has an impact on sustainability
- **Comprehensive LCAs need to be employed** so food waste-decreasing packaging can be properly assessed
- **Collection and sorting finesse is needed** to reduce environmental impact of packaging
- Design Innovation results in more sustainable food packaging
 - **Design for separation** by consumers or recyclers
 - **Design for circular economy** with single structure polymers bioderived recyclable materials
 - **Design for reuse** of pre-consumer packaging
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 - **Employ active packaging** to extend shelf life and reduce food waste
 - **Employ intelligent packaging** to assess food quality/safety and reduce food waste

More Sustainable Food Packaging

WE CAN DO BETTER



Packaging can be **sustainable**, **affordable** and **convenient**
Packaging can **enable** affordable healthy and sustainable food choices
Packaging needs to **pole vault** technically and in the value chain

More Sustainable Food Packaging WE ARE GETTING UNSTUCK

*Meaningful increases in sustainable packaging and decreases in food waste are **attainable by reconsidering the value chain processes** that define how food goes from farm to fork*



More Sustainable Food Packaging

THERE IS ALIGNMENT

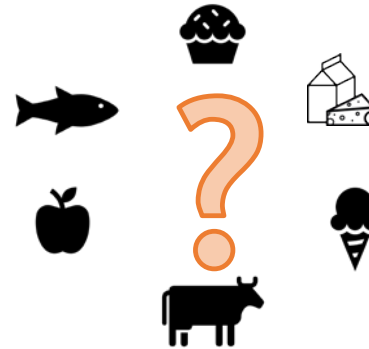
While not viable in the past, more **sustainable packaging** that **reduces food waste** is in **harmony** with:



Urbanization



Retail environment
shifts



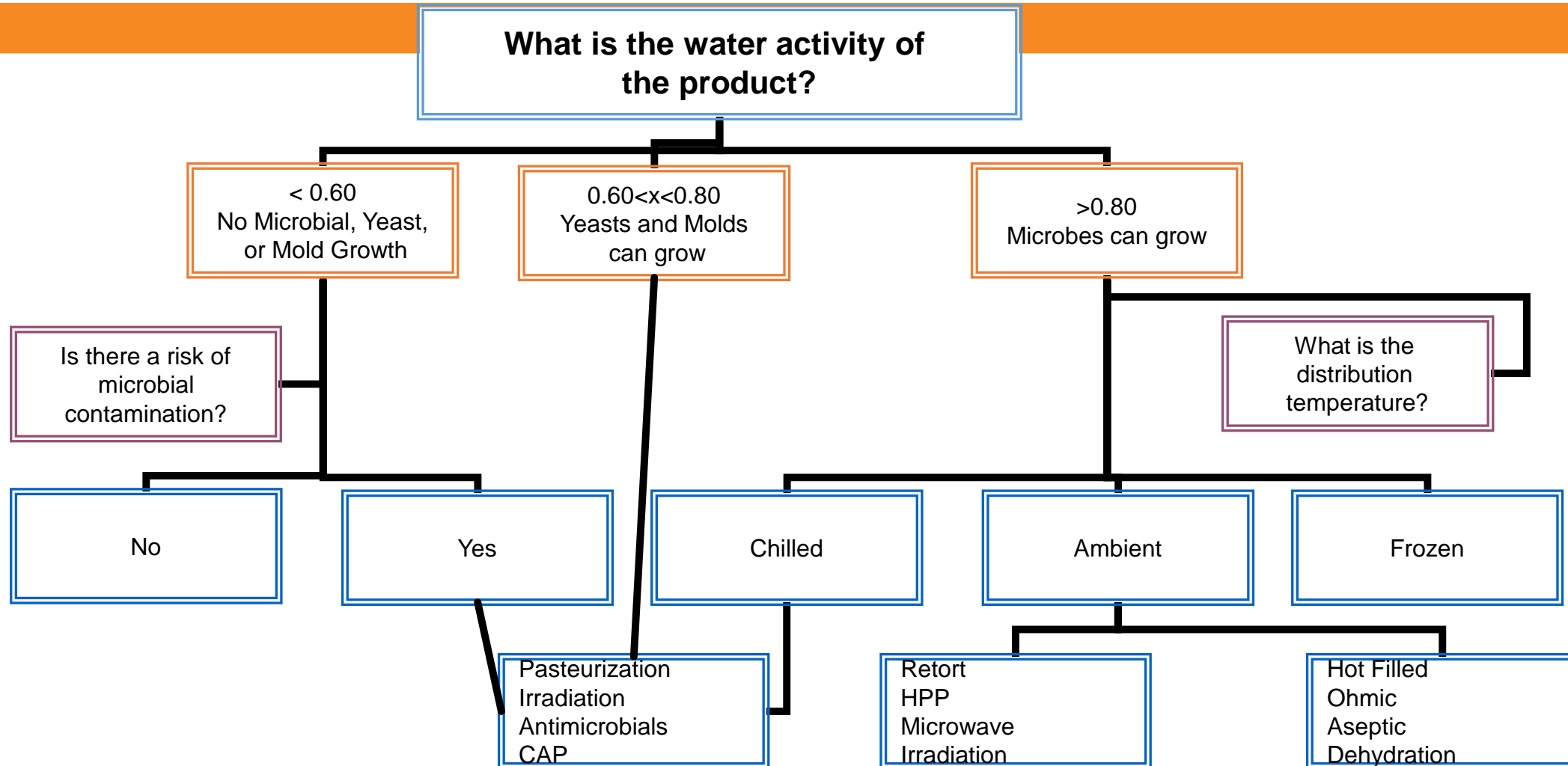
Understanding of **food**
insecurity impact



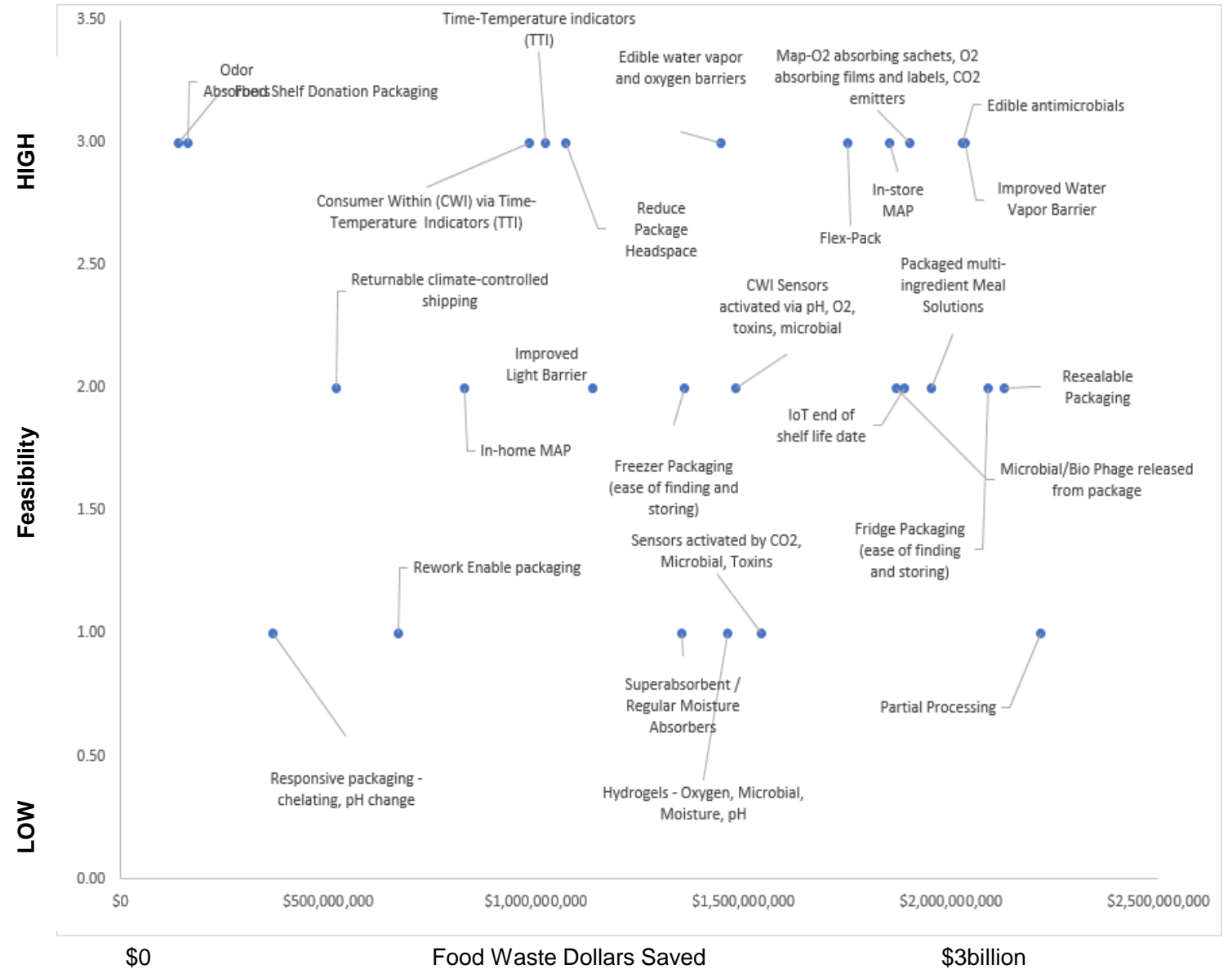
Circular economy
opportunities

More Sustainable Food Packaging

WE HAVE PACKAGING FOR MANY REASONS



RESULTS - SNAPSHOT OF TOTAL FOOD WASTE REDUCTION AS A FUNCTION OF FEASIBILITY



Design Innovation for More Sustainable Food Packaging

Design Innovation results in more sustainable food packaging

- Design for separation by consumers or recyclers
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Design Innovation for More Sustainable Food Packaging

OVERVIEW

RECYCLE READY PACKAGING



CHEMICALLY RECYCLABLE POLYMERS

CONSUMER SEPARABLE - DESIGN
FEATURES

REVERSIBLE ADHESIVE FOR INDUSTRIAL
SEPARATION

POLYMER COMPATIBILIZER

SINGLE COMPONENT MATERIALS



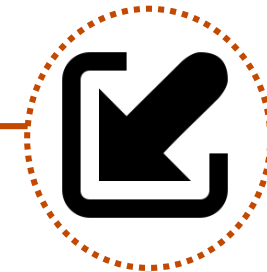
INCORPORATION OF NANO PARTICLES

SINGLE POLYMER COMPOSITE STRUCTURE -
NANO FIBERS

SINGLE POLYMER COMPOSITE STRUCTURE -
SELF REINFORCED COMPOSITES

SHDPE = BI-MODAL HDPE

REDEFINE PACKAGING



CONSUMER DEFINED PACKAGING
MINIMAL CONSUMER PACKAGING-
MASTERPACKS

Design Innovation for More Sustainable Food Packaging

CHEMICALLY RECYCLABLE POLYMERS

PET

- Alcoholysis
- Energy intensive hydrolysis
- Glycolysis
- Aminolysis

Polyethylenes

- Cross alkane metathesis
- Processing converts PE and other polyolefins into liquid fuels



Design Innovation for More Sustainable Food Packaging

BIOMASS DERIVED AND RECYCLABLE

BIO-PE

BIOMASS-DERIVED POLYETHYLENETEREPHTHALATE (PET)

POLYETHYLENE FURANOATE (PEF)

POLYTRIMETHYLENE FURANDICARBOXYLATE (PTF)

POLY(TRIMETHYLENE TEREPHTHALATE)
(PTT)

POLY(TRIMETHYLENE TEREPHTHALATE) (PTT)



Coke PlantBottle
CSD Drink/Water
Global
30%



Volvic
Bottled Water
UK, 6x50cl
20%



Sokenbicha
RTD Tea
USA, 15.2-fl oz
up to 30%



VitaminWater
Flavoured Water
USA, 20-fl oz
up to 30%

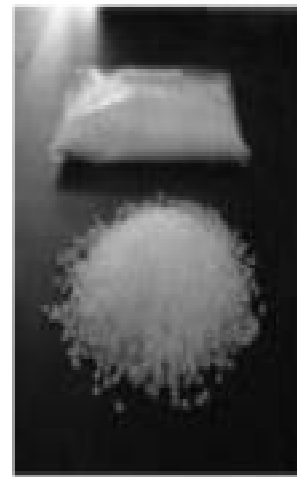


Heinz PlantBottle
Ketchup
30%

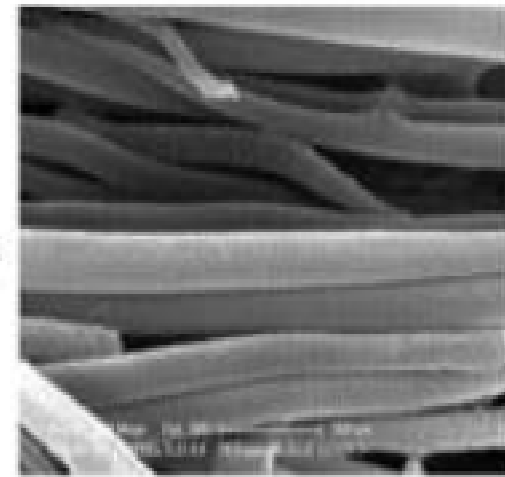
Design Innovation for More Sustainable Food Packaging

SINGLE POLYMER COMPOSITE STRUCTURE WITH NANOFIBERS

- Nanofiber-SPC (single polymer composites)
- One structure with nanovariants with higher order to improve barrier properties and enable recycling
- Replace laminate and structures with nanofibers of same material
- Produced in the same manner as SPCs
- Value chain shift from converters to optimizer of existing polymer



PP and PET



PET nanofibrils (dia. 50 – 150 nm)



PET nanofibrillar SPC

Design Innovation for More Sustainable Food Packaging

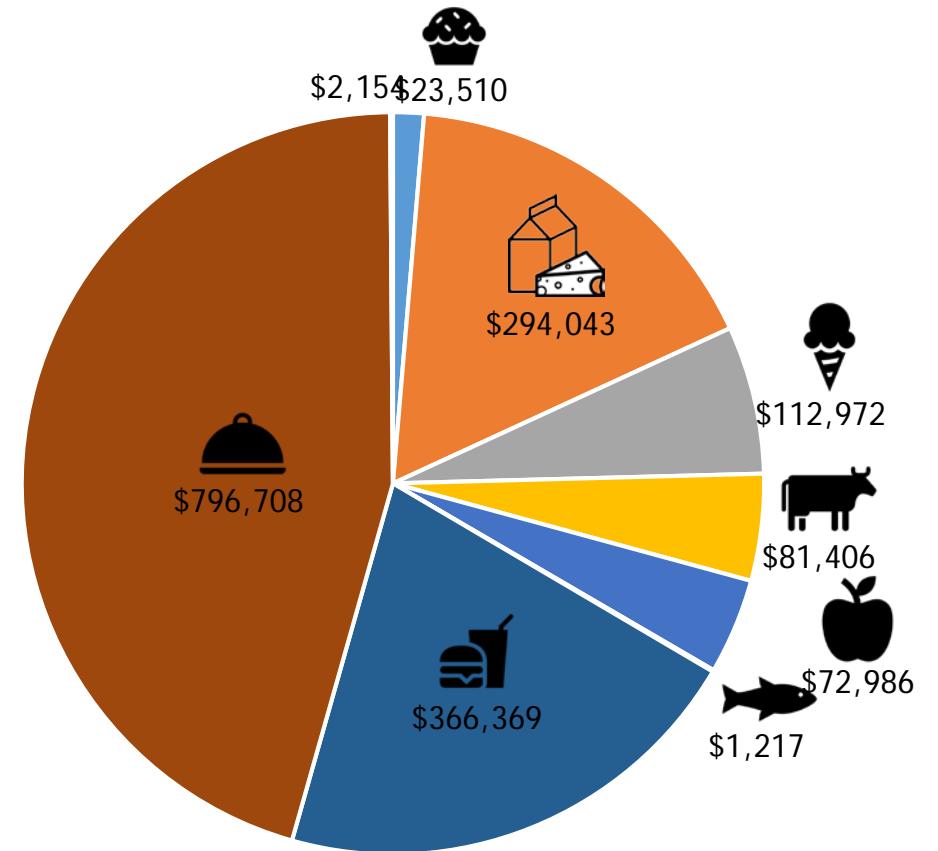
MASTERPACKS

Manufacturers

- Manufacturers separate consumer and manufacturer to retailer packaging from consumer packaging
- Longer shelf life from manufacturer to retailer
- High barrier retail packs opened when product is placed on store shelves or shipped
- Reusable tertiary packaging

Consumers

- Packaging for consumer focuses on shelf life needed by consumer versus entire supply chain
- Less packaging for consumer to dispose
- Lower cost primary packaging
- Potentially more recyclable primary packaging
- Less food waste

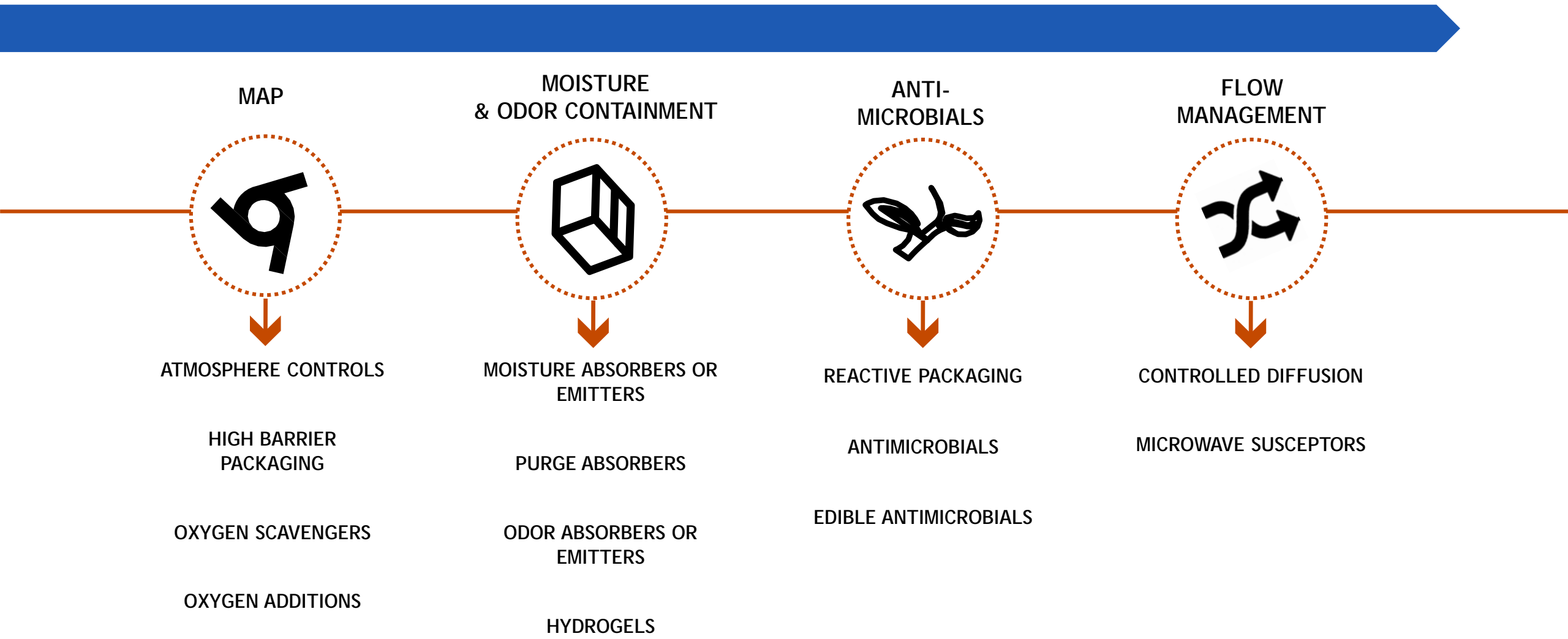


SCIENCE INNOVATION FOR MORE SUSTAINABLE FOOD PACKAGING

Employ active packaging to extend shelf life and reduce food waste
Employ intelligent Packaging to assess food quality/safety and reduce food waste

Science Innovation for More Sustainable Food Packaging

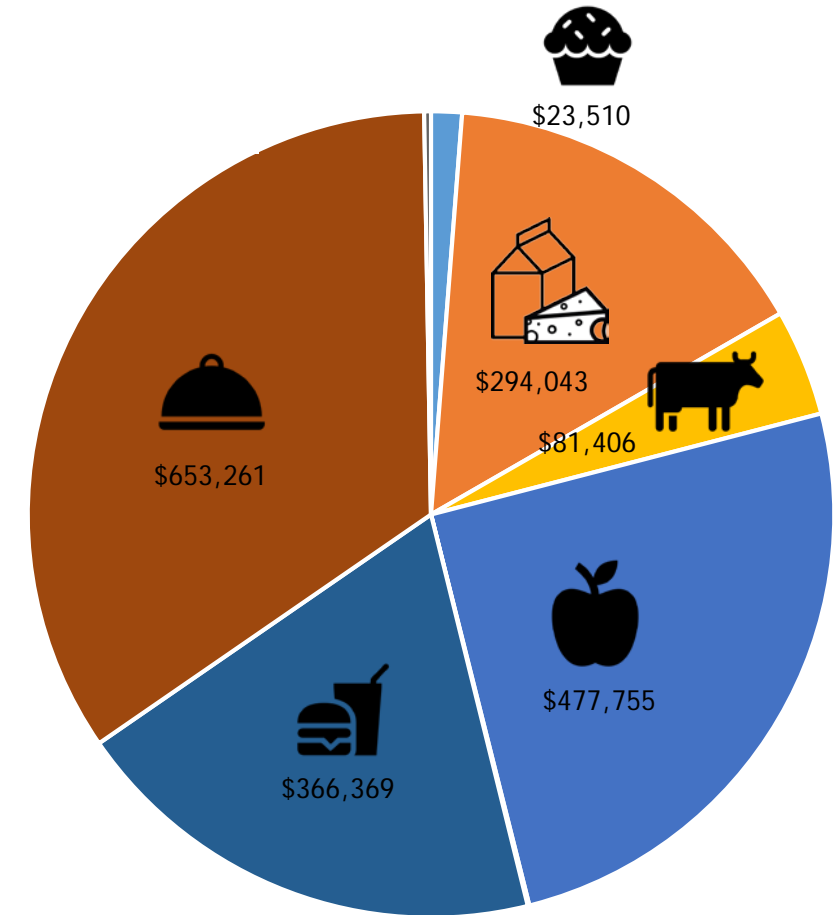
ACTIVE PACKAGING



Science Innovation for More Sustainable Food Packaging

ACTIVE PACKAGING: O₂ absorbing sachets and CO₂ emitters

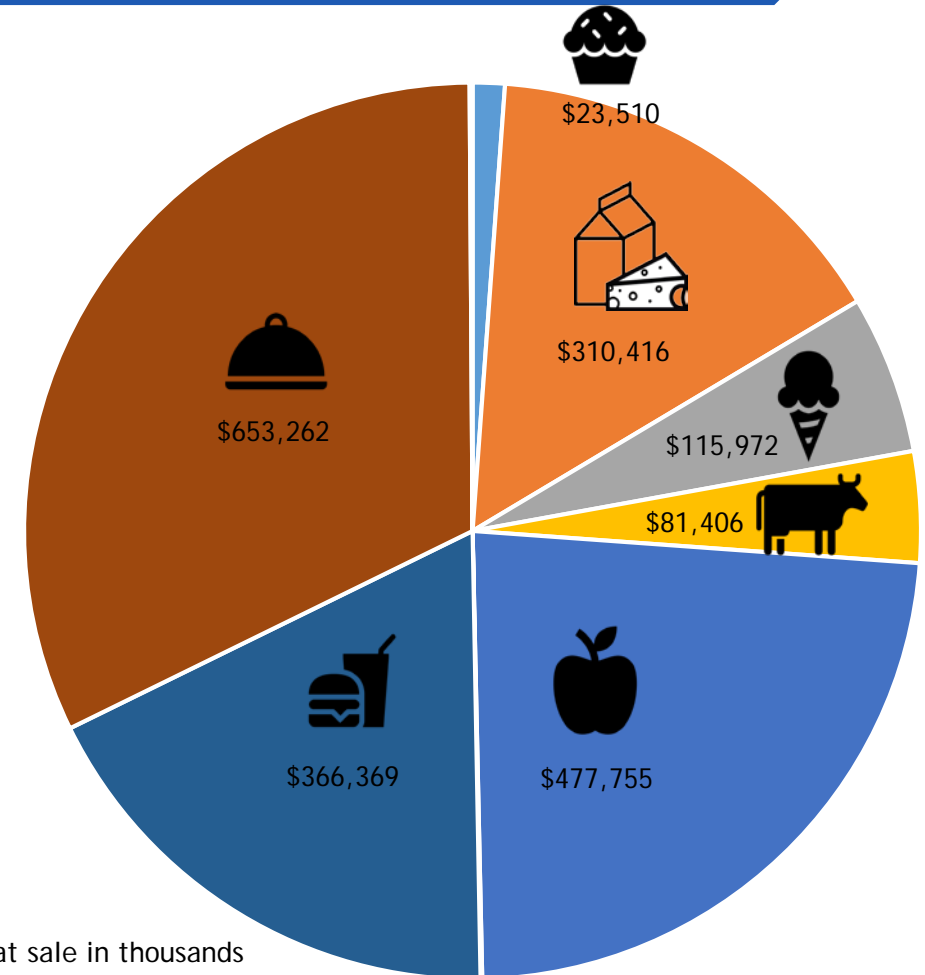
- Oxygen related spoilage is the primary cause of food spoilage
- Sachets are **drop-in solutions** to absorb O₂, release CO₂, ethanol, ethylene that to decrease food waste with minimal environmental impact



Science Innovation for More Sustainable Food Packaging

ACTIVE PACKAGING: Edible Antimicrobials

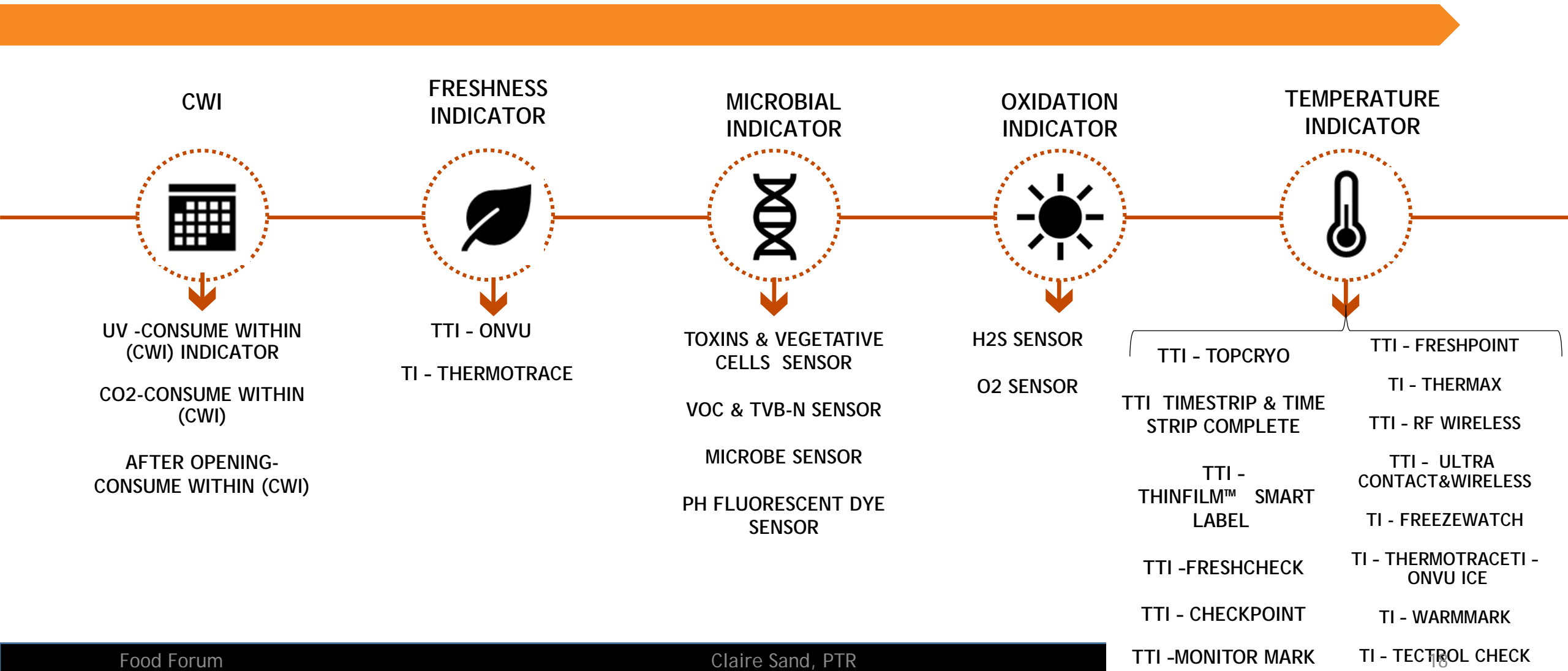
- Microbial growth is a major food safety issue
- Edible antimicrobials can eliminate and keep microbial activity low **extending the shelf life and making foods safer with less traditional packaging**



* Values are given at sale in thousands

Science Innovation for More Sustainable Food Packaging

INTELLIGENT PACKAGING



Science Innovation for More Sustainable Food Packaging

INTELLIGENT PACKAGING: CWI

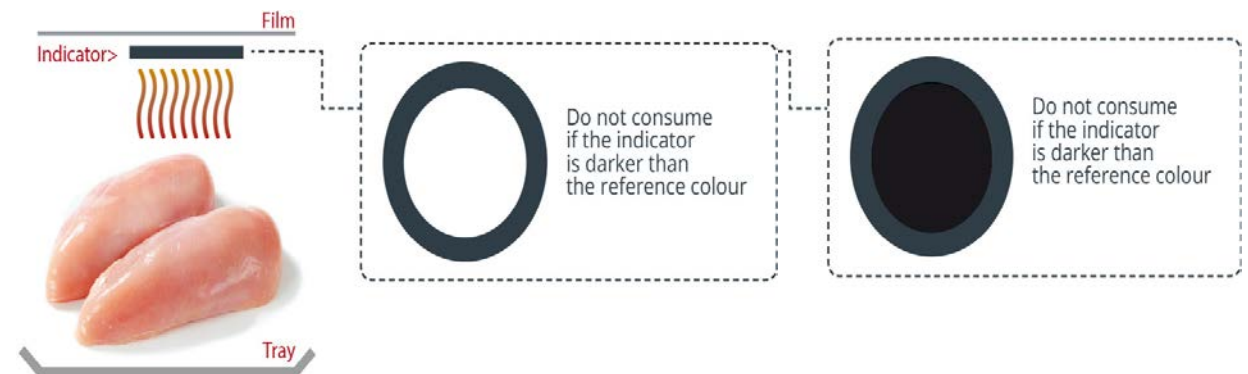
- Activates when package is opened
- **Consumer activated**
- Mechanism, beyond time, is undefined
- NOVAS Freshness Indicators
- Insignia Technologies



Science Innovation for More Sustainable Food Packaging

INTELLIGENT PACKAGING: CWI

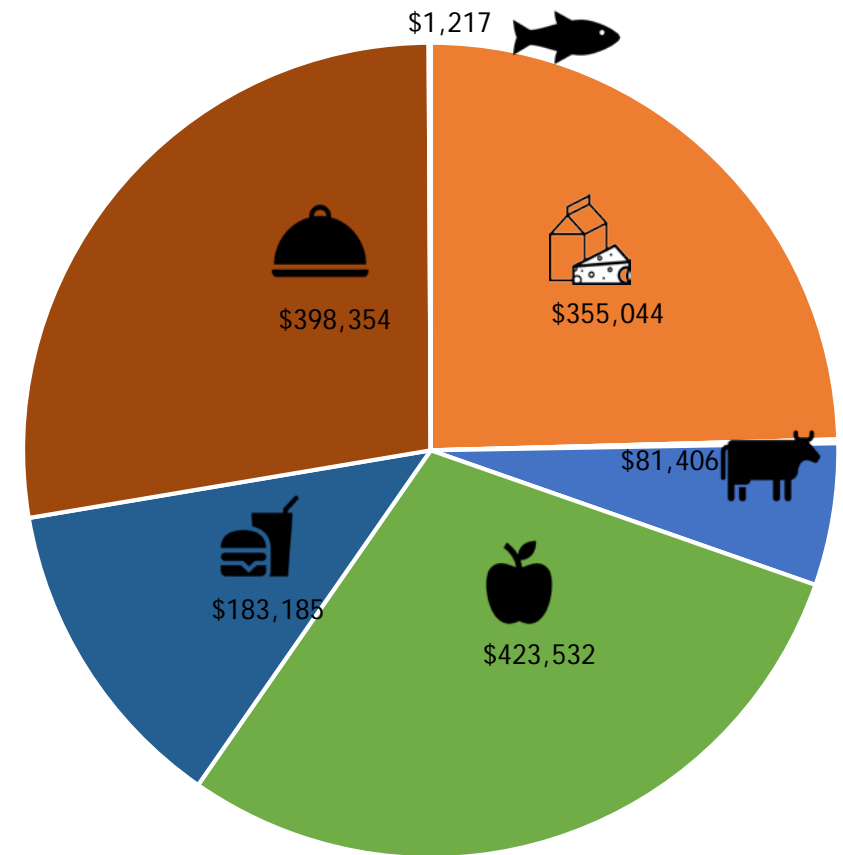
- Activation methods vary
 - CO₂ drops below certain limit
 - Aluminum layer dissolves
 - Amount of volatile gases
 - Hydrogen sulfide release
 - Presence of the bacteria
 - Change in pH



Science Innovation for More Sustainable Food Packaging

INTELLIGENT PACKAGING: CWI via TTI

- Most degradative food reactions are a function of both time and temperature and provide an accurate depiction of product safety and quality to decrease food waste
- CWI TTIs provide direction for the **actual date of consumption** after purchase by consumers with minimal environmental impact



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Focused compelling food packaging expertise

Claire Sand is a Global Packaging Leader with 30+ years of broad experience in the food science and packaging spectrum. She leads food packaging efforts involving packaging solutions to food waste and more sustainable packaging, as well as provides compelling technology business cases and implementation roadmaps to ease the path of innovative technologies. Dr. Sand is Owner and Founder of Packaging Technology and Research, LLC and an Adjunct Professor at the University of Minnesota, Michigan State University and CalPoly as well as Food Technology's monthly Packaging columnist. She is an IFT Fellow, serves on numerous Editorial Boards, is the author of the Packaging Value Chain, and is cochair of pacfoodwaste. Claire has held previous positions in basic research, development market research, and marketing in Germany, Colombia, and Thailand and at Total Quality Marketing, Nestle, General Mills, Kraft Heinz, Safeway, and in academia. Dr. Sand holds a doctorate degree in Food Science and Nutrition from the University of Minnesota and MS and BS in Packaging from Michigan State University.



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Packaging columnist for
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Food Packaging
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Journal of Food
Science Reviewer



Phi Tau Sigma
Strategic Relations &
Chapter Affairs



Packaging Science and
Technology Editorial Board



"I am passionate about leading efforts to reduce climate change by shrinking food waste with more sustainable packaging."

- Solutions using Strategy, Technology, Consulting, Coaching, and Technology Evaluations
- Learn from PTR with presentations and articles at <http://www.packagingtechnologyandresearch.com/thought-leadership.html>



Strategic Direction

Paper Company



60+

PRODUCTS

Identified OTR and MVTR requirement within 30 categories



1-5

YEARS

Built R&D pipeline to direct existing and new material development using new switching drivers



1

PACKAGE

New chilled ready meal patented package launched to replace CPET



Science Advisor

Niche Food Company



2x

SHELF LIFE

Using product, process, MAP and barrier technologies



12%

LOWER

Packaging costs by optimizing packaging materials



3

PACKAGES

Launched C-Store and Club Store packaging



Technology Advisor

Frozen Food Company



5

QUICK

High impact / low effort solutions to reduce freezer burn



4

SOLUTIONS

Analyzed to refine go/no go on freezer burn solutions using nano-edible coatings, alternative packaging and HPP



1

ASLT

Protocols to increase product confidence and shorten time to market



Executive Mentoring

Polymer & Additive Company



30+

YEARS

Helping executives apply their business acumen by bridging the gap between management and science



4

ACQUISITIONS

Resulted from strategic technology assessment that identified and screened prospective opportunities

1



BOARD

Position

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