

# From Innovation to Implementation: The New Challenges of Active Food Packaging in the Era of Sustainability



Piacenza, Università Cattolica  
del Sacro Cuore  
November, 12<sup>th</sup> 2019

---

Sara Limbo,  
Dipartimento di Scienze per gli Alimenti, la Nutrizione e  
l'Ambiente (DeFENS), Università degli Studi di Milano  
sara.limbo@unimi.it



DeFENS

---

# FROM INNOVATION...



# ACTIVE VS TRADITIONAL PACKAGING

AN INNOVATIVE FORM OF  
PACKAGING

AN EVOLUTION OF THE  
TRADITIONAL ROLE OF  
PACKAGING

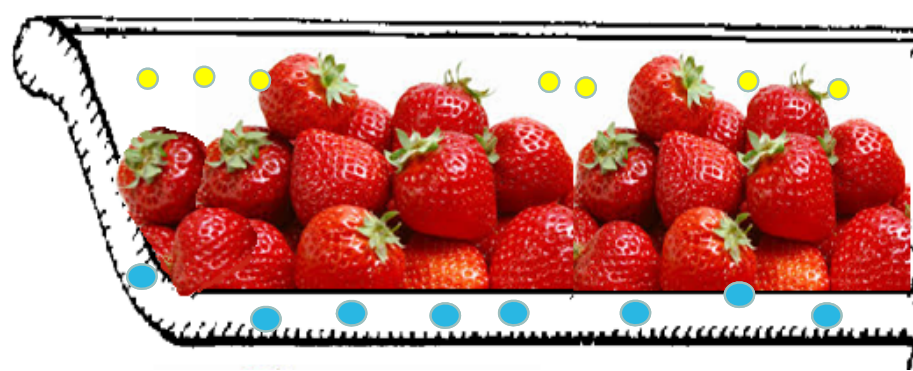
A NEW CONCEPT TO MAINTAIN  
QUALITY AND/OR TO EXTEND  
THE SHELF LIFE OF FOOD

respiration rate control...

mould growth control

off-flavor adsorption

oxidative reaction reduction



The **Active Packaging concept** is based on the **DESIRED** and **MODULATED INTERACTION** between the **MATERIAL** and the **PACKAGED PRODUCT**, or between the internal atmosphere created by the package and the package product.

ARE WE SURE THAT  
ACTIVE PACKAGING IS A  
NEW AND INNOVATIVE  
CONCEPT?

---

1999  
2001

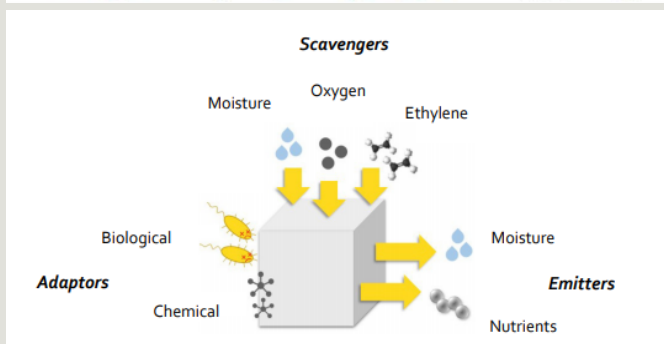
## INNOVATION IN FOOD PACKAGING

### ACTIPACK

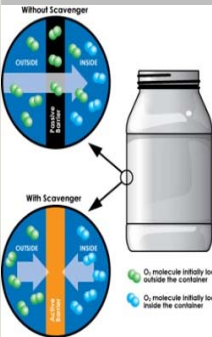
Evaluating safety, effectiveness, economic-environmental impact and consumer acceptance of active and intelligent packaging

Start date:  
1.01.1999  
End date:  
31.12.2001

EU Framework Programme



FUNCTION	ACTION
Oxygen absorbers/ Scavengers	oxidative reactions; bacteria growth;
CO <sub>2</sub> absorbers/ emitters	bacteria growth; shelf life; coadjutant in MAP
Water absorbers	bacteria growth; exudates
Moisture regulators	bacteria growth; texture maintainance



1999  
2001

## INNOVATION IN FOOD PACKAGING

### ACTIPACK

Evaluating safety, effectiveness, economic-environmental impact and consumer acceptance of active and intelligent packaging

Start date:

1.01.1999

EU Framework Programme

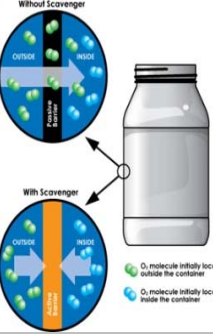
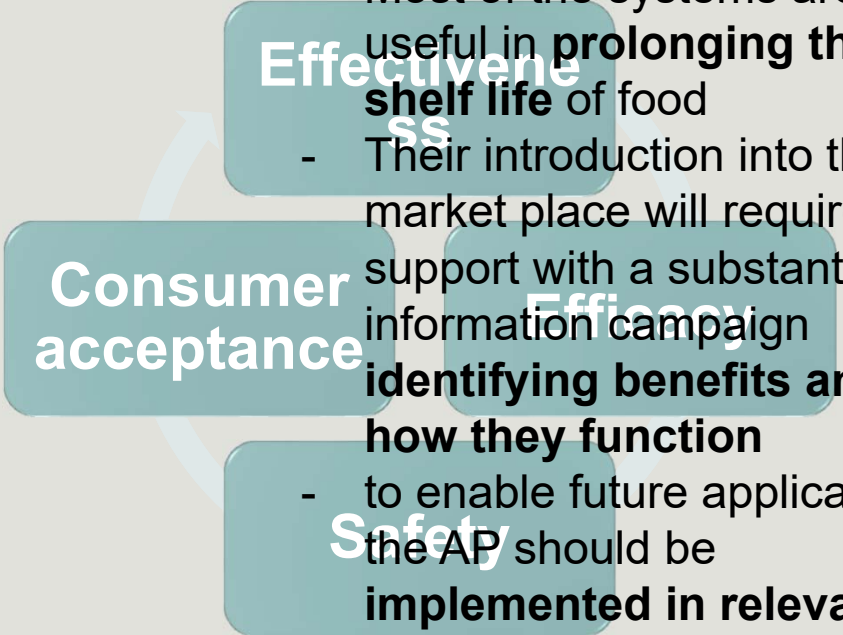
End date:  
31.12.2001

31.12.2001



### MAIN CONCLUSIONS

- Most of the systems are useful in **prolonging the shelf life** of food
- Their introduction into the market place will require support with a substantial information campaign **identifying benefits and how they function**
- to enable future application the AP should be **implemented in relevant European Directives**



1999  
2001

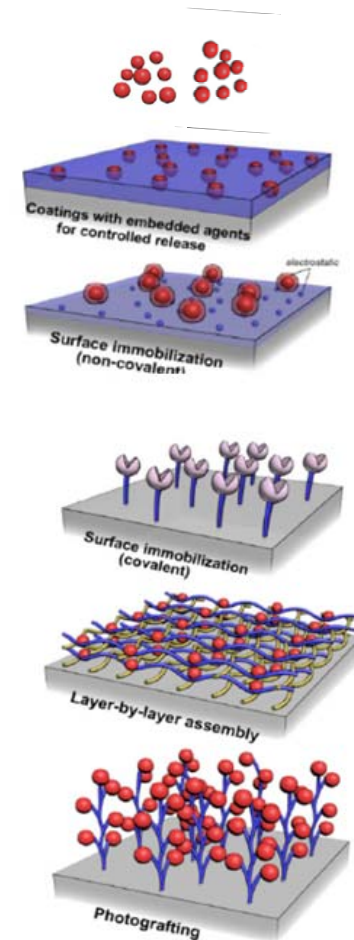
2004

THE MAIN OUTCOME OF ACTIPAK

## Reg. UE 1935/2004: Framework Regulation on Food Contact Materials

**‘active materials and articles’** means materials and articles that are intended **to extend** the shelf-life or to **maintain** or **improve the condition of packaged food**

they are designed to **deliberately incorporate** components that **would release or absorb substances** **into or from the packaged food or the environment** **surrounding the food**



1999  
2001

2004

2008  
2011

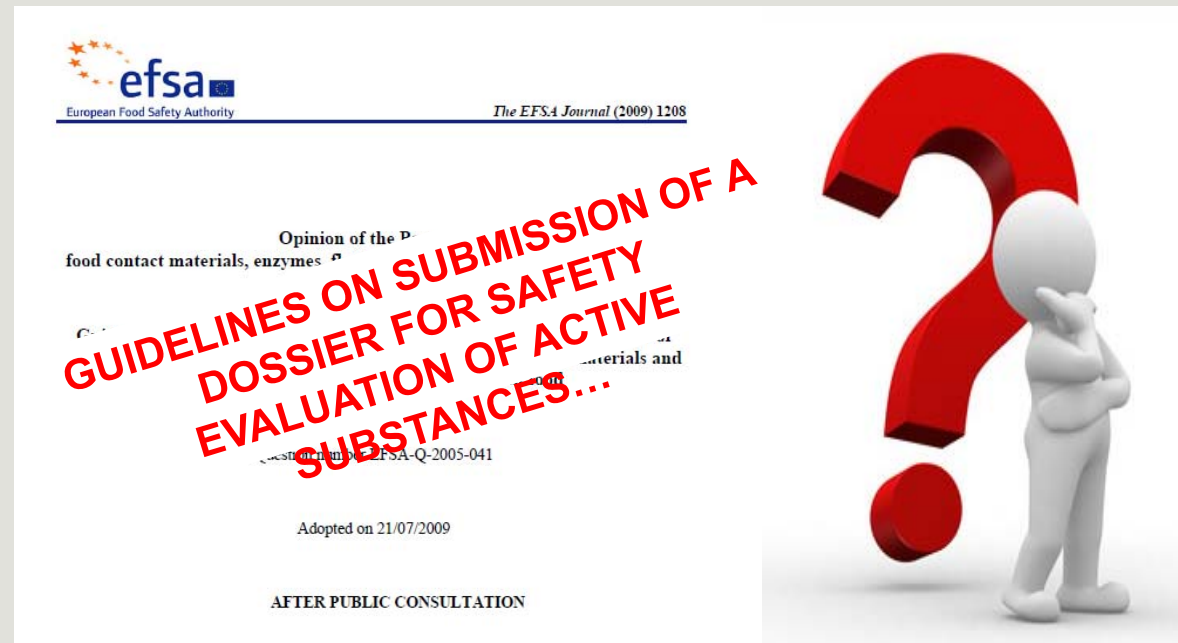
2009

Reg. EU 450/2009: A specific measure  
on Active Packaging

ACTIVE PACKAGING SOLUTIONS ARE  
CONSIDERED AS **FOOD CONTACT  
MATERIALS**....thus...

THEY SHALL ONLY BE AUTHORIZED IF IT  
IS DEMONSTRATED THEY **DO NOT  
PRESENT RISKS TO HUMAN HEALTH**

ONLY SUBSTANCES INCLUDED IN A  
**COMMUNITY LIST** OF AUTHORIZED  
SUBSTANCES **MAY BE USED** IN  
COMPONENTS OF ACTIVE PACKAGING



...WE ARE STILL WAITING...

1999  
2001

2004

2008  
2011

## INNOVATION IN FOOD PACKAGING



www.nafispack.com

**FOOD SUPPLY CHAIN**

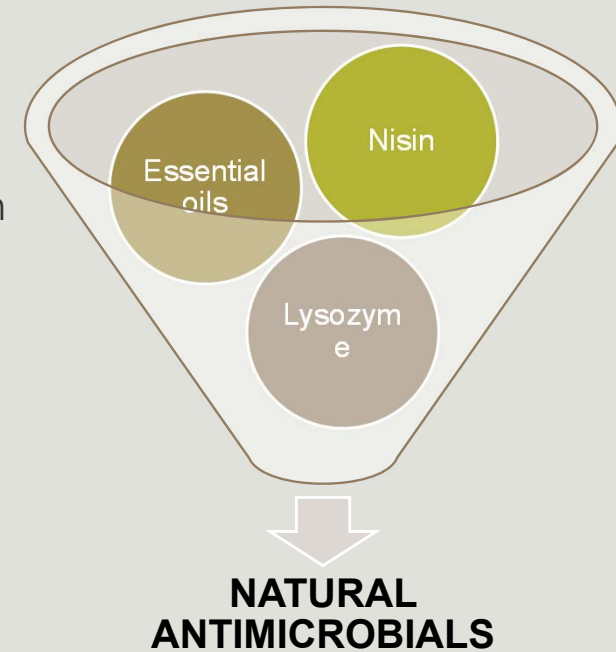
PRODUCTION    PROCESSING    PACKAGING    DISTRIBUTION    CONSUMPTION    RECYCLING

nafispack

The advertisement features a collage of fresh food items: a tray of raw chicken, a bowl of salad, and a bag of 'Verdifresh ENSALADA 4 ESTACIONES'. Below the collage is the website 'www.nafispack.com'. The bottom section is titled 'FOOD SUPPLY CHAIN' and shows a circular process with six stages: PRODUCTION (factory), PROCESSING (lab), PACKAGING (bags), DISTRIBUTION (truck), CONSUMPTION (shopping cart), and RECYCLING (recycling symbol). The 'nafispack' logo is centered above the cycle.

## NAFISPACK

The main objective of the project was to develop novel active packaging technologies based on **NATURAL ANTIMICROBIAL SUBSTANCES** that will avoid/reduce the growth of pathogens and spoilage microorganisms responsible for product lost in **fresh fish, fresh chicken** and **minimally processed vegetables**.



FP7-KBBE - Specific Programme "Cooperation": Food, Agriculture and Biotechnology

1999  
2001

2004

2008  
2011

## INNOVATION IN FOOD PACKAGING

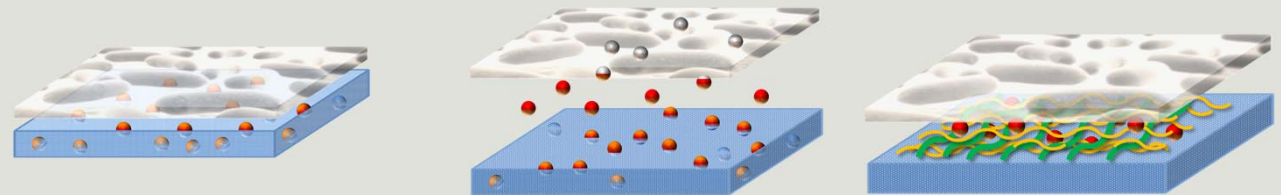


FP7-KBBE - Specific Programme  
"Cooperation": Food, Agriculture and  
Biotechnology

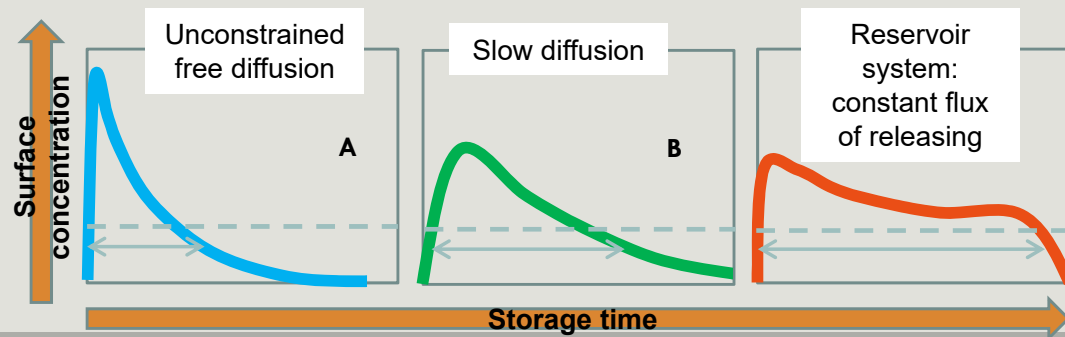
\*Mousavi Khaneghah et al. 2018. Efficacy of Antimicrobial Agents for Food Contact Applications: Biological Activity, Incorporation into Packaging, and Assessment Methods: A Review.

## NAFISPACK: some key-points

### INCORPORATION & MECHANISMS OF RELEASE\*



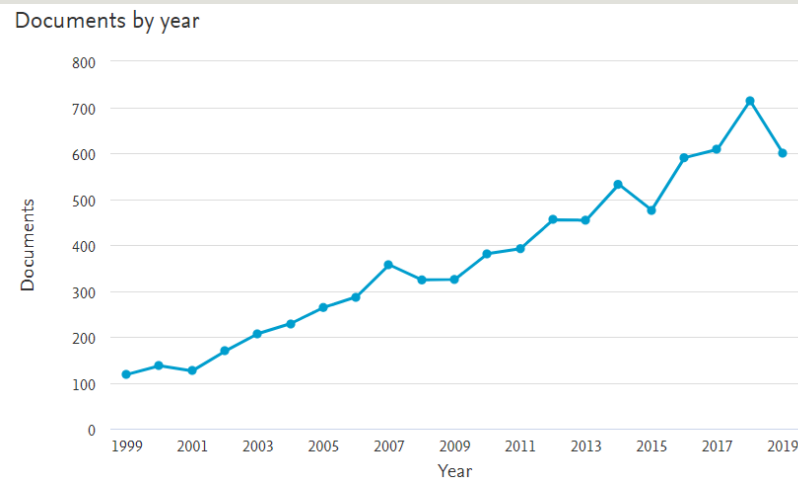
### THE CONTROL OF RELEASE



# INNOVATION



So many researches, so many patents and a weak Regulation but **so little evidence of successful market introduction** in Europe. Why?



Data from Scopus  
Active+Packaging



Antimicrobial  
France



Wrapping paper  
Germany



Oxygen Scavenger



FreshPaper  
USA

<http://www.actinpak.eu/>

1999  
2001

2004

2008  
2011

2009

2015  
2019



COST is supported by  
the EU Framework Programme  
Horizon 2020

**cost**  
EUROPEAN COOPERATION  
IN SCIENCE AND TECHNOLOGY



COST (European Cooperation in Science and Technology) is a funding agency for research and innovation networks.

<http://www.actinpak.eu/>

## ActInPak

The main objective of the Action of COST FP1405 ActInPak is to develop a **knowledge-based network on sustainable, active** and intelligent fibre-based packaging in order to **overcome current technological, industrial, and social limitations** that hinder the wide deployment of existing and newly developed solutions in market applications.

# New CHALLENGES

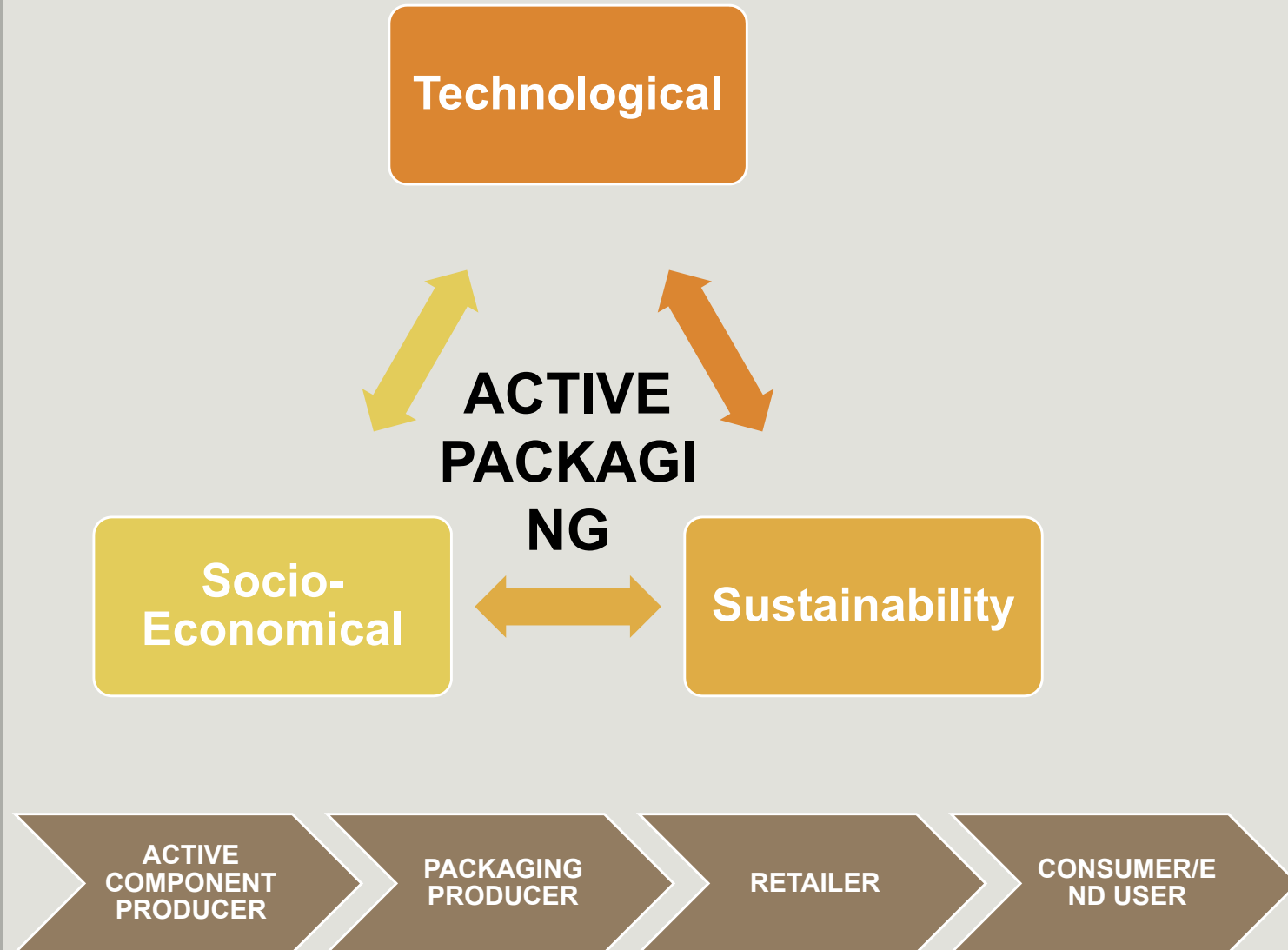
---

INNOVATION



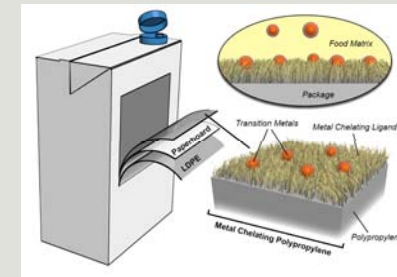
IMPLEMENTATION

# The new challenges and opportunities for Active Packaging





## Technological challenges



### ACTIVE COMPONENT PRODUCER

- Most Challenging: antimicrobial packaging systems
- **Transition** towards **bio-based and biodegradable**
- Thermal and Chemical Stability
- Controlled Release
- Product **Availability**
- Nano-size of active particles
- **Migration/Toxicity evaluation**

### PACKAGING PRODUCER

- **Biggest Challenge: scale up!**
- **Transition** towards bio-based and biodegradable
- **Adapt** current production processes with the integration of active components
- **Activity**: integration in polymer films
- Functional properties of the final materials: barrier, transparency, mechanical, etc.
- **Stability** over time

Sustainability

Socio-Economical

RETAILER

CONSUMER/  
END USER

Environmental impact

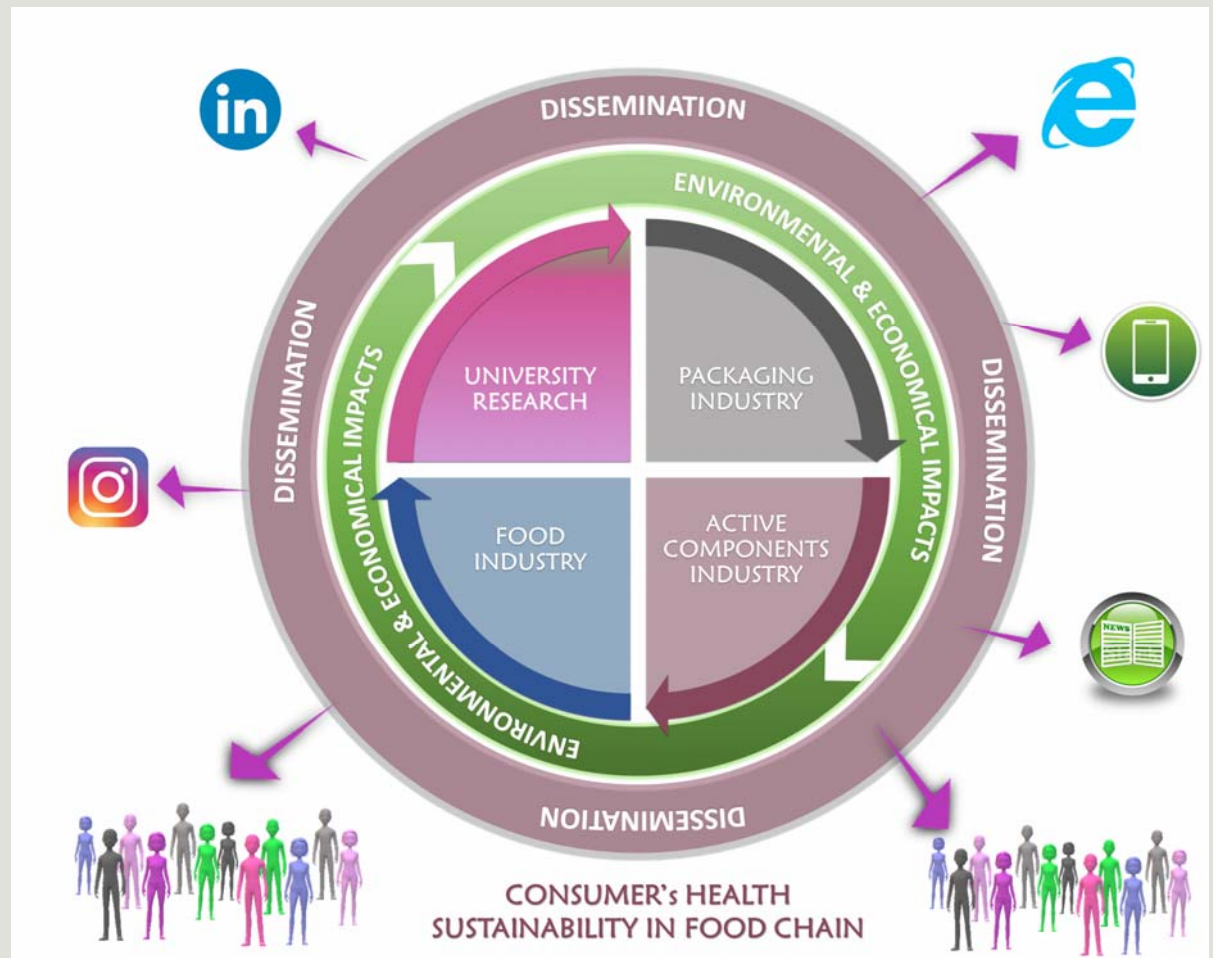
Active  
Food  
Packaging

Active role in  
reducing food  
wastage

- Health and Safety!
- **Reduce food wastage**
- **Impact assessment methods and data availability**
- New processes in logistics
- **Recyclability**
- **Compostability**
- **Recovery of Active components**

“The next generation of food packaging **should significantly contribute to reduced waste in both food and packaging materials**, and its negative impacts on the environment (e.g., resource utilization, greenhouse gas emissions, pollution) by 2050”. (Guillard et al., 2018)

- ❑ Consumer's health
- ❑ Real (measurable) effects on Primary and Secondary Shelf-life (i.e. on wastage reduction)
- ❑ End of use
- ❑ Environmental & Economic Impact
- ❑ Education & Dissemination of results



---

Thanks for your attention

