REFRESH Work Package 4
Behavioural economic approaches and scenarios for food waste prevention, reduction and valorization

REFRESH_WP4
Core team:
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Core partners: UNEW, Wageningen Economic Research

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WP4 – Behavioural economic approaches – **Obj1**

- **WP4_Obj1: Providing new information on consumer and business behaviour by measuring the effects of major tangible factors on food waste, by identifying hidden and emerging profiles of consumer' and business' behaviours** affecting food waste, and by allowing the detection of intangible food waste drivers.

- **Neoclassical economics** hypothesizes the existence of a *representative agent* fully rational, selfish, and not influenced by the social environment

- **Behavioural economics** studies the *idiosyncratic characteristics* of single agents, thus detecting the effects of psychological, social, cognitive and emotional factors on their economic decisions, and the consequences for market conditions and resource allocation

- Instead of starting from abstract principles, it uses *laboratory and field experiments* and *observes* agents' real behaviour (DellaVigna 2009)

- It may help **improve policy design** by suggesting better-framed incentives, producing better knowledge of policy outcomes, and deriving new welfare implications (Chetty 2015)

WP4 – Behavioural economic approaches – Obj2

- **WP4_Obj2: Developing simulation models by integrating methodological – econometric (Bayesian Networks, BNs) and computational (Agent based Model, ABM) – approaches** to ex-ante analyse consumers' and businesses' behaviours of relevance for food waste, the technological and social innovation effects, the socio-economic conditions, and the environmental impacts on a multi-scale level.

- *Better understanding consumer behaviour by integrating the preferences revealed in surveys and social interactions.*

- *Identifying the characteristics that make innovations more effective in addressing food waste reduction.*

- *Identifying the characteristics of business clusters that make them more effective than others in spreading innovations.*

WP4 – Behavioural economic approaches – Obj3

- **WP4_Obj3:** Enhancing the performance of food systems, analysing consumer behaviour and dynamics, and facilitating the design of policies and close-to-the market interventions at Pan-European level **by testing/ simulating the implications of identified major behavioural variables to prevent/reduce food waste (*i.e. D4.8 FW road map*)**.

- "Pan-European" **integrated food waste scenarios** and "Pan-European" **impact analysis of food waste scenarios**.

- **Roadmap** for the prevention, reduction and/or valorisation of food waste: "How is it possible to achieve a 30 percent food waste reduction in the EU by 2025?"
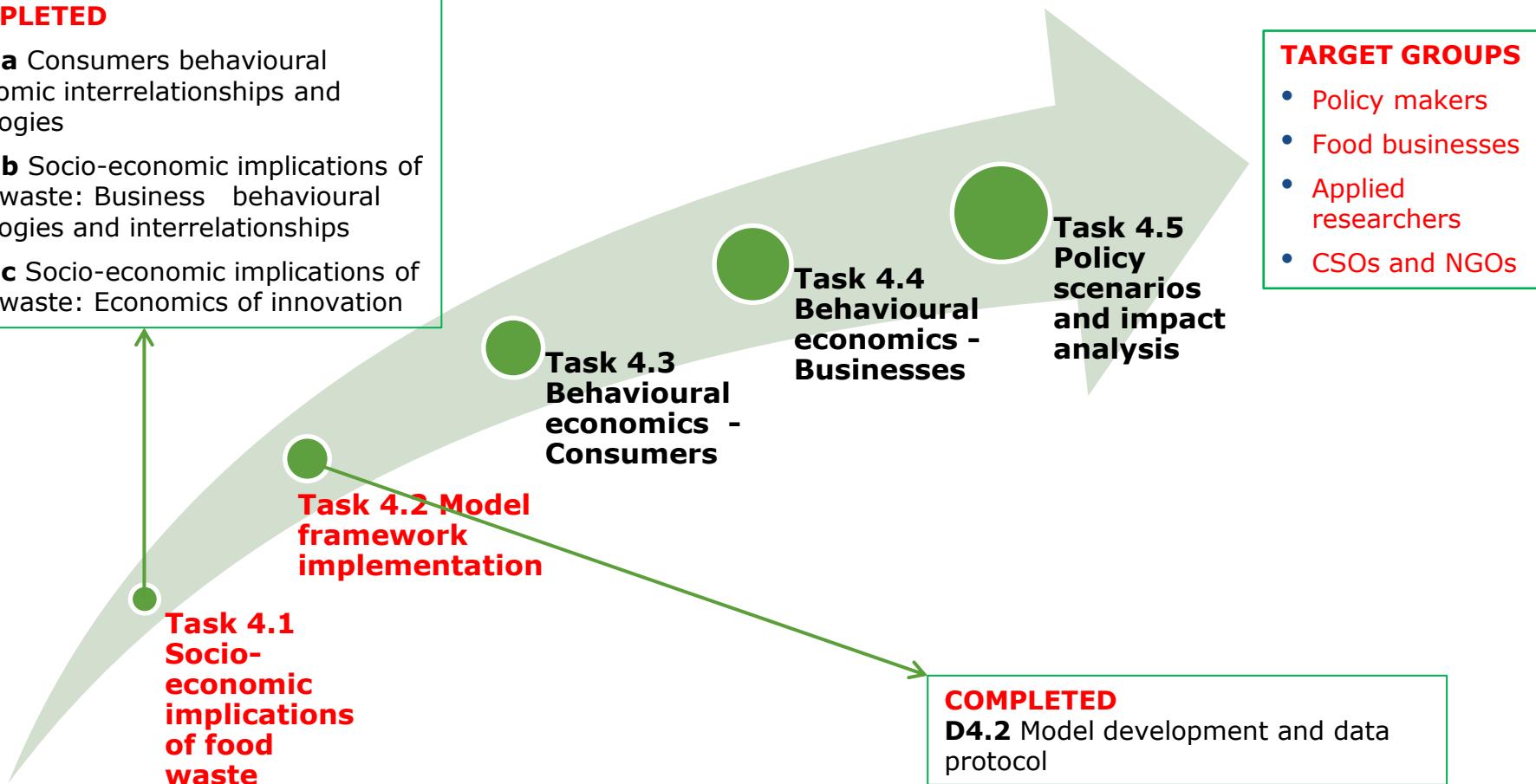
WP4 – Behavioural economic approaches – Where are we?

COMPLETED

D4.1a Consumers behavioural economic interrelationships and typologies

D4.1b Socio-economic implications of food waste: Business behavioural typologies and interrelationships

D4.1c Socio-economic implications of food waste: Economics of innovation

TARGET GROUPS
- Policy makers
- Food businesses
- Applied researchers
- CSOs and NGOs

Task 4.5 Policy scenarios and impact analysis

Task 4.4 Behavioural economics - Businesses

Task 4.3 Behavioural economics - Consumers

Task 4.2 Model framework implementation

Task 4.1 Socio-economic implications of food waste

COMPLETED
D4.2 Model development and data protocol

WP4 – Behavioural economic approaches – Key concepts

- Standard economic theory → *representative agent* - behavioural economics → *idiosyncratic or socially-shared characteristics* of single economic agents

- **Agents**: Food **consumers** (households) and food **suppliers** (processors/ manufacturers and retailers).

- **Behavioural typology**: Idiosyncratic or socially-shared factor characterizing the behaviour of economic agents.

- **Behavioural interrelationship**: Idiosyncratic or socially-shared factor characterizing the activities of coordination (networks, clusters, alliances) among economic agents.

Theoretical background: Socio – economic consequences of Food Waste

- Objective: Define the main drivers of business and consumer's food waste.

- Consumer's Food Waste: Data available → Assessment with Bayesian networks and data reduction techniques.

- Businesses' Food Waste: Data not yet available → Assessment through literature analysis of:

  - the behavioural economics typologies and interrelationships affecting companies' adoption of innovation related to food waste.

  - the relationship between price transmission and companies' food waste behaviour.

  - The economic drivers of innovation in the food waste sector

Consumers' behavioural economic interrelationships and typologies

How

- Identification of the main drivers of consumers food waste and their relationship through Bayesian network and data-reduction techniques.

- Advanced methods applied to currently available database (Wrap-Uk and EuroStat).

Main Findings

- Tendency to focus on **household size**, **age** and level of **education** as major drivers of consumer food waste.

- High **variation among countries** (data from one country not easily applied to another).

- High incoherence between self-reported waste and current waste levels observed.

Next Steps

- Use of the methodological framework to analyse WP1 data.

- Address country-level variation in a hierarchal model.

- Build predictive spatial models based on EU model and WP1 data in combination.

Business behavioural economic interrelationships and typologies

*Which **behavioural economics typologies and interrelationships** may influence, either as a driver or as a barrier, the decision of food businesses to innovate and/or coordinate for addressing FW?*

- While the drivers of consumers' FW have been extensively enquired (Hebrok and Boks 2017), the dynamics behind the FW generated, directly or indirectly, by **businesses** have been **studied less**

- A **literature review** was carried out based on the following steps:

1. Setting of **limits and priorities**: innovation typologies and FW quantities not enquired; firms treated as unitary entities; proxies of FW (e.g. recycling) also considered; processors and retailers analysed with priority; geographical focus on developed countries

2. Two-step **search on** the **online databases** Scopus and ScienceDirect (April-May 2016), based on keywords from literature reviews on behavioural economics

3. Summarizing of the pieces of literature, classification by behavioural factor, and identification of **stylized facts** related to innovation against FW

Business behavioural economic interrelationships and typologies

BEHAVIOURAL TYPOLOGIES:

1. **Deviations from the assumption of rationality of economic agents**

- Firms avoid choosing (**status quo bias**) and demand more to renounce to a good than they would pay to acquire it (**endowment effect**)

- They rely on **heuristics**, like assessing the likelihood of events based on similar ones, retaining previous decisions, and *imitating* 'the majority' or 'the successful'

- They are affected by the **framing** of the problem

- They change their mind from virtues to vices (**time-inconsistency**)

2. **Deviations from the assumption of selfishness of economic agents**

- **Satisficing** firms consider a set of options censored *ab initio*, without adjusting its size

- Firms' action may be driven by **values** if they experience cognitive dissonance

- Innovation adoption depends on instrumental and symbolic features, firms' **beliefs** about its usefulness, and pressure by salient referents

- **Norms** depend on the socio-cultural context; observance is driven by awareness and reputation

- Waste prevention is driven by *purely* **altruistic** *motivations*, recycling by external incentives; the latter could crowd out the former

Business behavioural economic interrelationships and typologies

BEHAVIOURAL INTERRELATIONSHIPS:

3. **Deviations from the assumption of isolation of economic agents:**

- *Trust* arises from *cooperation*, then they become mutually reinforcing; it may represent an alternative to formal governance to reinforce alliances

- Small firms build trust on personal relationships and informal communication; large ones favour formal governance and impersonal communication

- *Reputation* fosters cooperation by favouring the identification of altruists to be rewarded and defectors to be punished, and is transferred across groups

- Early adopters have low thresholds, become opinion leaders in their 'personal networks', and drive innovation adoption by neighbours with high thresholds

- Social networks' internal boundaries (cultural, geographical, social, etc.) may prevent innovation diffusion, causing inefficient innovations to prevail

- Early adopters are 'independent thinkers' driven by values, imitators are driven by legitimacy concerns, late adopters implement a cost-benefit analysis

Food value chain management: food waste and price transmission

- **Imperfect price transmission and price asymmetry:** Prices do not always adjust one to one in throughout the supply chain or spatially creating imperfect vertical and horizontal price transfers

- **Types of price transmission:**

  ❖ *Vertical transmission* → prices at one level of a supply chain react to changes at another level

  ❖ *Horizontal or spatial transmission* → transmission through horizontally related markets, e.g. between retail firms, between processing firms

Food value chain management: food waste and price transmission

Main Findings

- Asymmetric price transmission affects FW drivers mainly by two factors:
  - ❖ Underlying cost-conditions → vertical price transmission
  - ❖ market power & structure→ vertical and horizontal price transmission
- Transaction costs related to contracts and agreements, & uncoordinated supply create FW
  - ❖ Introducing supply-based contracts will reduce and prevent FW
- Market power and structure in a sector must be studied in order to select appropriate interventions since different market situations & structures require different interventions
  - ❖ Example: Returns/rejections due to market power may be solved through legal instruments, encouraging or enforcing a fairer treatment of suppliers
- The adverse impact of asymmetric price transmission on FW generation can be addressed through economic incentives (negative and positive)

Economics of innovation: food waste generation in relation to innovation diffusion

Main Findings

- The ultimate reason for innovating is related to economic factors: **improving firm performance, productivity & international competitiveness**

- Cost factors & risk are the main determinates of tech. & org. innovation

- Product and process innovations do not always have a positive effect without org. innovation

- Combination of both tech. & org. innovation activities determines productivity gains

- Geographic scope or territorial specificity is important determinant affecting both types of innovations.
  - ❖ Cultural difference increase the difficulty of implementation of new management practices (i.e. org. innovation)
  - ❖ Tech. innovation depending on the enabling environment can be quickly adopted and spread in one place while in other place the adoption and diffusion may be restricted

Overall, the adoption and diffusion of innovation to prevent and reduce food waste is an on-going process and, like in other sectors, business will divide into adopters of new technologies and organizational innovations, and those that lag behind.

Current work

Task 4.3 Behavioural Economics – Consumers: Preliminary findings from machine-learned focus group data

- Machine learning techniques were used routinely to explore large bodies of text

- Using the German focus groups data

  - ❖ Words associated (>75%) with "food waste" include

    - ▪ "dispose anything"

    - ▪ "go(es) shop(ping)"

    - ▪ "never thought"

  - ❖ Words associated (>50%) with "leftover" include

    - ▪ "shame"/"ashamed"
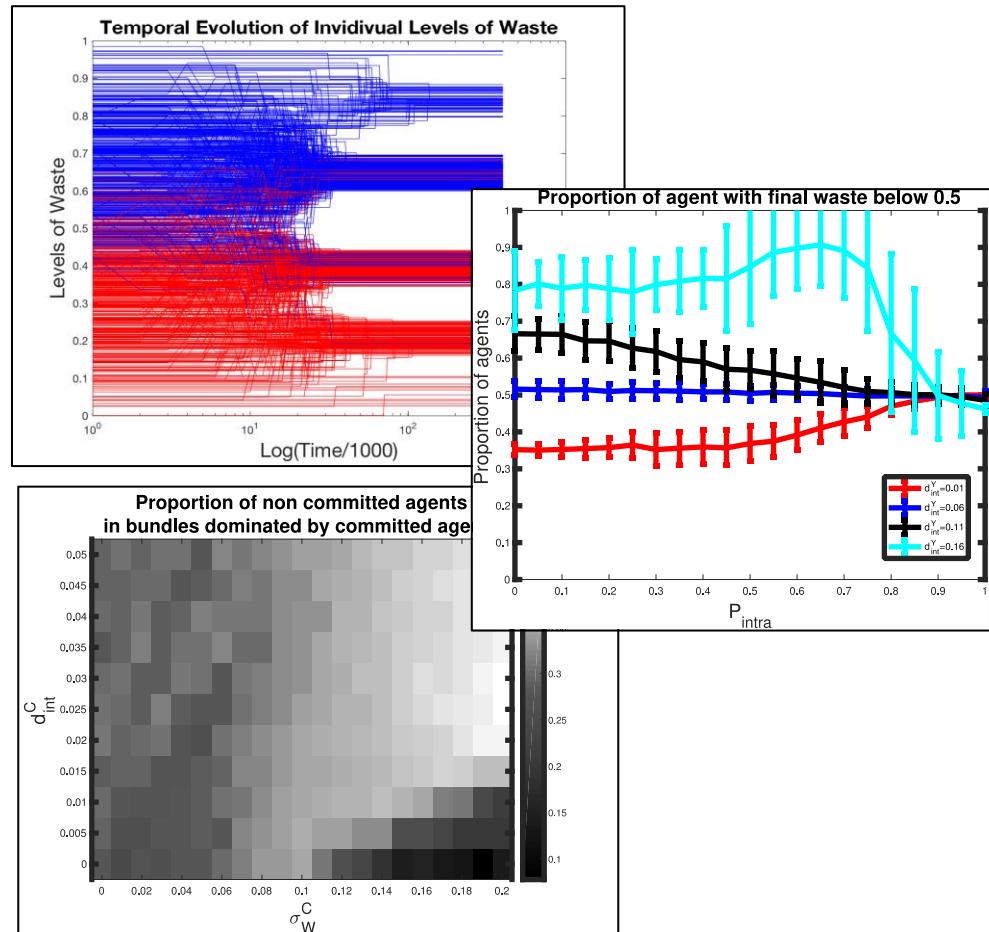
    - ▪ "Africa"

    - ▪ "embarrassed"
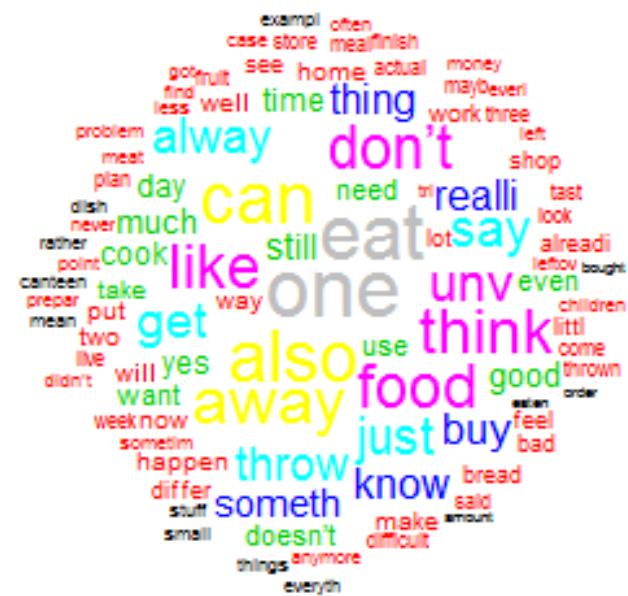
Behavioural Economics - Consumers:
Food Waste and opinion interactions: an applied ABM

Elements of the model:
- An agent-based model considering interactions **between** and **within** groups of heterogeneous individuals is created.
- Individuals engage in discussions about in-home FW. However, their actual behaviour remains **hidden** to others.
- Agents are **heterogeneous** in their sociability, initial opinion and behavior and openness of mind.

Results so far:
- In presence of sufficiently open-minded individuals, a small degree of mixing between groups can **significantly reduce** the extreme actions about food waste.
- A small group of individuals with strong commitment to reduce food waste and limited within-group difference can significantly **reduce average FW** even without further public policies.

Temporal Evolution of Invidivual Levels of Waste

Proportion of agent with final waste below 0.5

Proportion of non committed agents in bundles dominated by committed agents

Integrated Model: design

- Different options explored for models design;

- Next steps:
 - ❖ Explore strategies of interaction between BNs and ABMs.
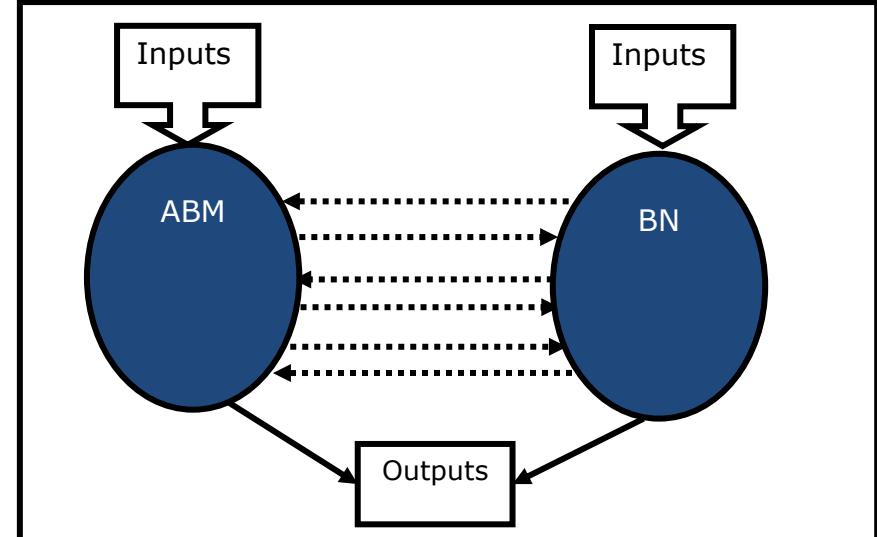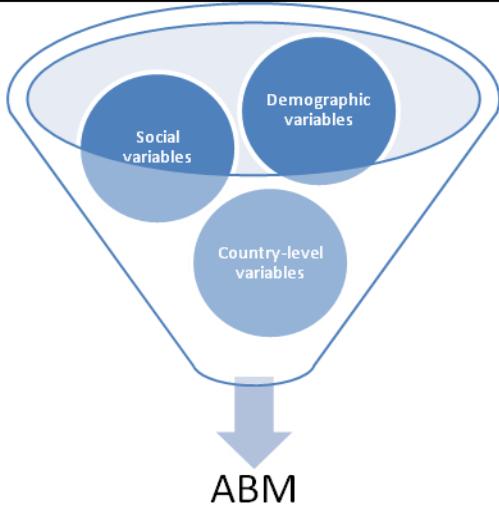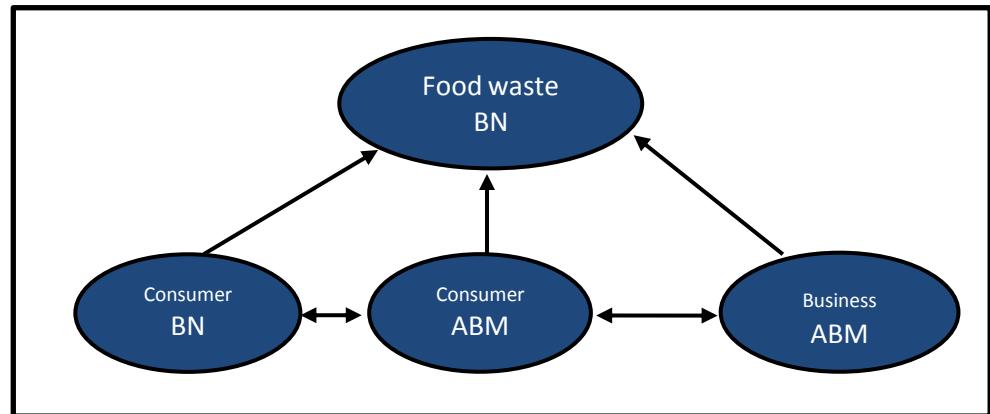
Integrated Model: development

Next Steps

- Get data on consumers (from WP1)

- Test the structure of BNs in selected countries

- Explore potential interactions between BNs and ABMs

- Build predictive networks/models

- Integrate "decision relevant nodes" into the model (to facilitate decision support)

- Identify or elicit utility values for consumer and business decisions
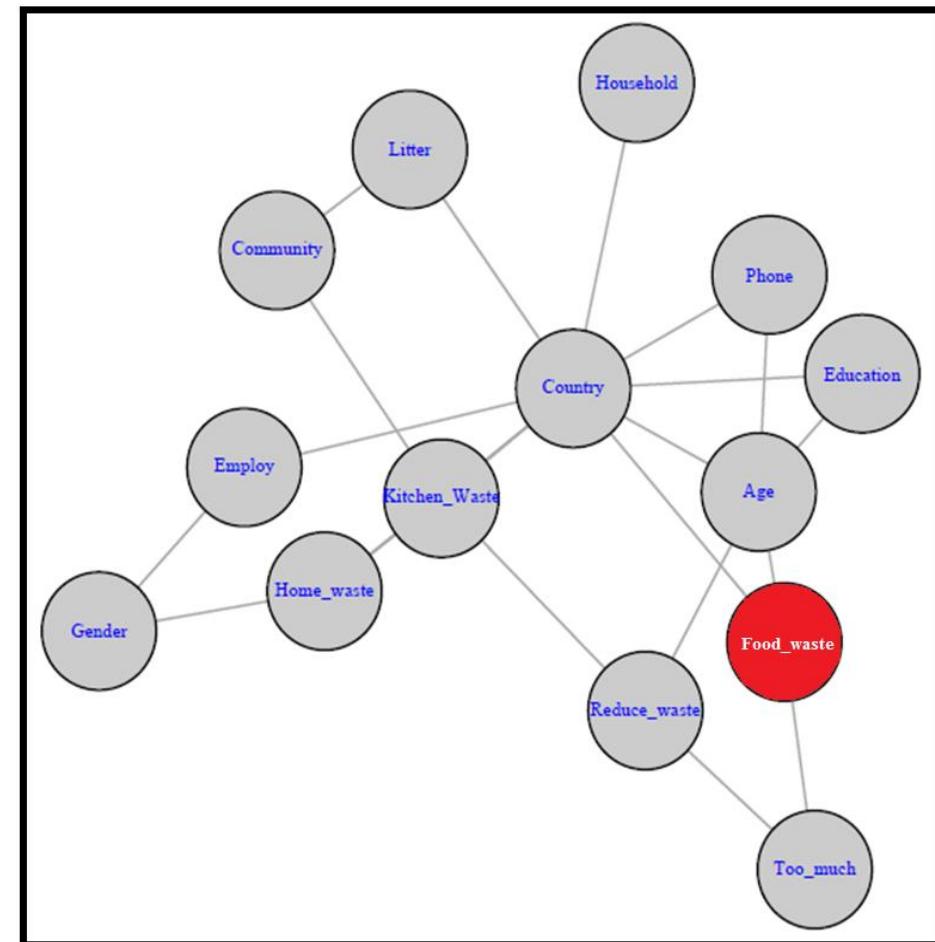
Next major steps

- Extend current consumer model to fully exploit newly available data.

- <u>Build an integrated business ABM-BN model to study diffusion of Food Waste related innovations in companies (retailers and processors).</u>

- Assess the impacts of major food waste prevention policies and interventions, FAs, environmental implications, waste valorisation elaborated by the rest of the project.

WP4 Consultation

WP4 Consultation

Aim of the WP4 Consultation

ABM is aimed at assessing the adoption of **technological innovations** for preventing or reducing the food waste generated by companies of the retail sector.

The WP4 consultation is aimed to provide inspiration and support in the development of the ABM on **innovation**.

What innovation?

- Innovations introduced in the processing and/or retail stage of the FSC

- Innovations recently introduced and still not commonly adopted OR innovation that could be introduced in a near future

- Innovation related to the following product categories:
  - ✓ Grains
  - ✓ Vegetables
  - ✓ Fruits
  - ✓ Meat, fish, eggs and alternatives
  - ✓ Milk and alternatives

- Innovations should be as specific as possible (examples):
  - ✓ An app that connects eaters with unsold, unexpired food at a discounted price. It helps retailers and restaurants make additional revenue while reducing their food waste, and it offers eaters access to perfectly good food that would otherwise be wasted.
  - ✓ A new type of packaging that improve the conservation of fruit and veggies increasing their shelf life.

WP4 Consultation

5 tables

20 minutes: each table will have about 20 minutes to identify and discuss the TOP 3/4 **technological innovations** in terms of potential impact on food waste reduction (ref: quantity)

For each of the TOP 3/4 innovations the related impact should be discussed (see the matrix below).

Each table will have 1) facilitator; 2) a guiding matrix. The facilitator will provide additional information and guide the work.

Details of the matrix

Type of innovation	FSC stage (retailer / processor)	Product category	Expected reduction of food waste (% range)	Mechanism through which the innovation helps to reduce / prevent food waste	Motivations for adoption (economic, reputational, environmental, etc.)	Potential obstacles to adoption (technological, economic, normative, etc.)	Impacted sectors in the food supply chain (production, processing, retail, consumption)

Restitution of the results in the plenary via https://www.mentimeter.com/

Enjoy the discussion in your group and thanks for your participation and support!!!