



# City Research Online

## City St George's, University of London

**Citation:** Pickering, J. & Reynolds, C. (2022). Using qualitative methods to inform a household plastic packaging and food waste simulation model. Paper presented at the Global Research & Innovation in Plastics Sustainability (GRIPS) 2022, 15-17 Mar 2022, Online.

This is the presentation version of the paper.

This version of the publication may differ from the final published version. To cite this item please consult the publisher's version.

**Permanent repository link:** <https://openaccess.city.ac.uk/id/eprint/27956/>

**Copyright and Reuse:** Copyright and Moral Rights remain with the author(s) and/or copyright holders. Copies of full items can be used for personal research or study, educational, or not-for-profit purposes without prior permission or charge, unless otherwise indicated, provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way. For full details of reuse please refer to [City Research Online policy](#).



# Using qualitative methods to inform a household plastic packaging and food waste simulation model

Global Research & Innovation in Plastics Sustainability (GRIPS) 2022  
17 March 2022

Speakers:

Dr Jack Pickering  
*University of Sheffield*  
**@jackpickering74**  
[jack.pickering@sheffield.ac.uk](mailto:jack.pickering@sheffield.ac.uk)

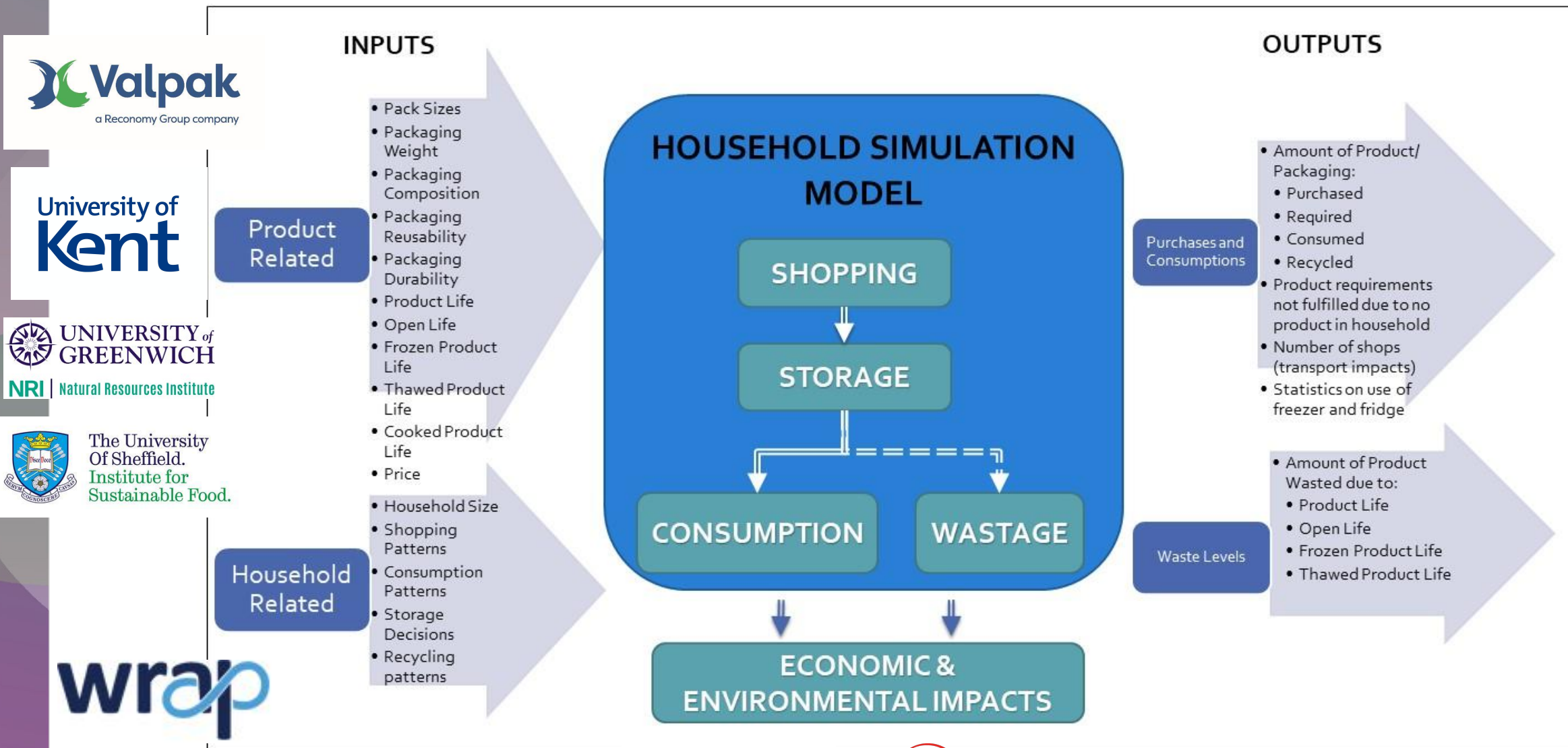
Dr Christian Reynolds  
*Centre for Food Policy, City, University of London*  
**@sartorialfoodie**  
[christian.reynolds@city.ac.uk](mailto:christian.reynolds@city.ac.uk)

**@\_Reduce\_Waste\_**

**Wider project team**

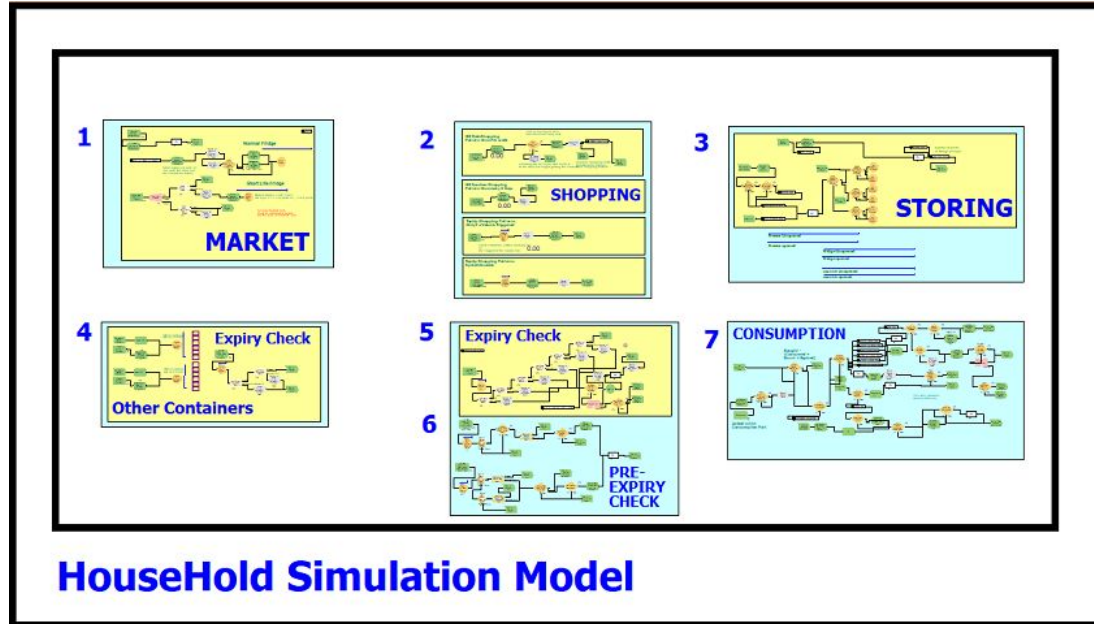
Christian Reynolds, Dr Ramzi Fayad, Dr Jack Pickering, Dr Rorie Parsons, Sarah Greenwood  
Dr Lori Fisher, Dr Cansu Kandemir Dr Deborah Rees ,  
Professor Lenny Koh,

# Household simulation model



# The HHSM can simulate many innovations

## HH Food // Plastic Waste Simulation Model



HouseHold Simulation Model



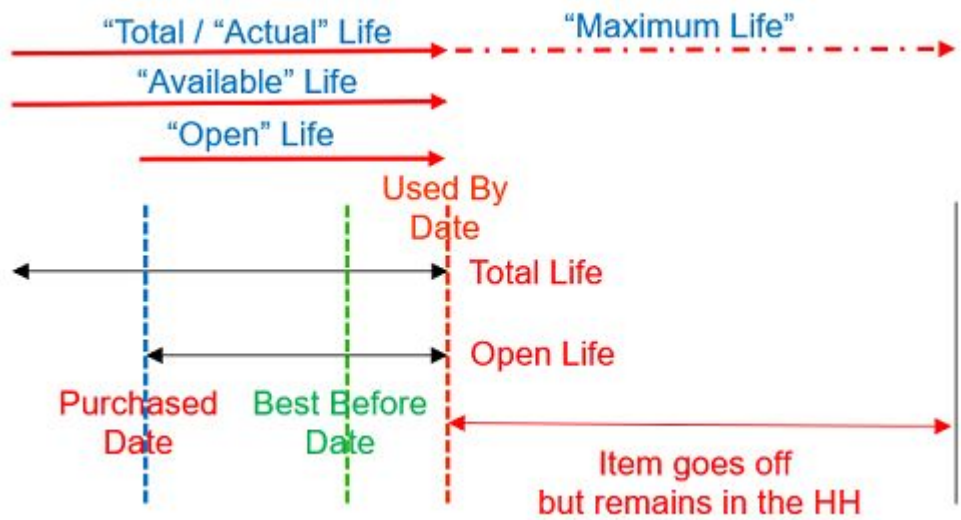
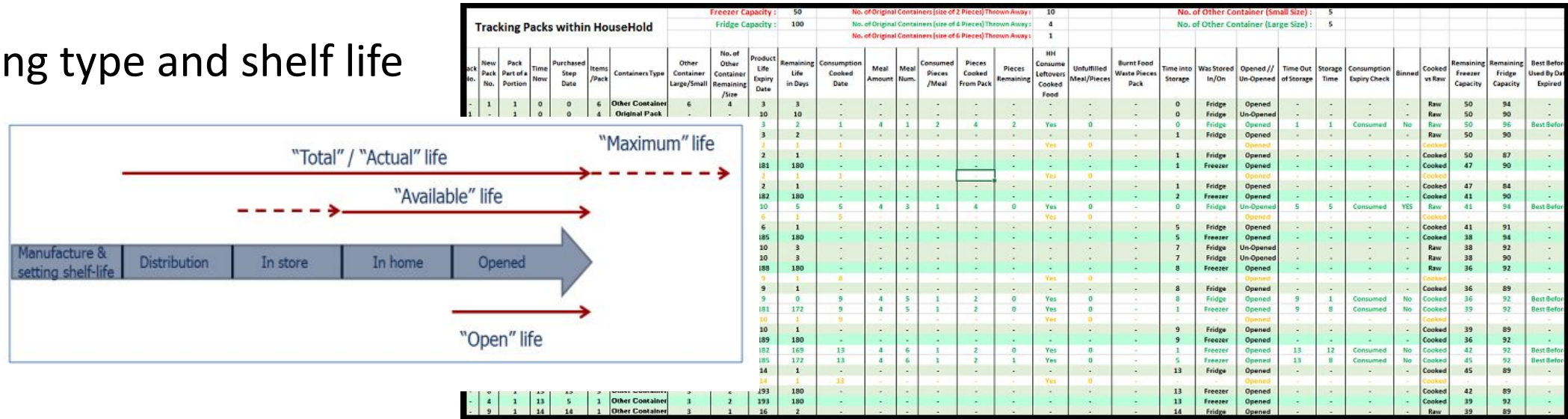
Details	Average	Half Width	Storage Details	Average	Half Width	Consumption Details	Average	Half Width
1 Pieces/Pack Bought	8.67	13.7	1 Pieces/Pack Stored in Freezer	4.67	5.2	Total No of Pieces/Meal Amount	76.00	0.00
2 Pieces/Pack Bought	4.33	13.7	2 Pieces/Pack Stored in Freezer	1.67	13.7	Total No of Pieces/Consumed Amount	33.67	42.46
3 Pieces/Pack Bought	2.00	9.0	3 Pieces/Pack Stored in Freezer	0.00	0.0	Total No of Pieces/Unfulfilled Amount	0.00	0.00
4 Pieces/Pack Bought	15.00	18.0	4 Pieces/Pack Stored in Freezer	2.00	9.0	Total No of Pieces/Consumed During/ Best Before	33.67	42.46
			5 Pieces/Pack Stored in Freezer	0.00	0.0	Total No of Pieces/Consumed During/ Used By	0.00	0.00
			6 Pieces/Pack Stored in Freezer	0.67	5.2	Total No of Pieces/Consumed During/ Expired	0.00	0.00
			Total Pieces/Pack Stored in Freezer	9.00	9.0			
			1 Pieces/Pack Stored in Fridge	3.33	20.7			
			2 Pieces/Pack Stored in Fridge	1.33	20.7			
			3 Pieces/Pack Stored in Fridge	0.33	5.2			
			4 Pieces/Pack Stored in Fridge	0.33	5.2			
			5 Pieces/Pack Stored in Fridge	0.00	0.0			
			6 Pieces/Pack Stored in Fridge	0.00	0.0			
			Total Pieces/Pack Stored in Fridge	5.33	51.9			
			1 Pieces/Pack Stored on Counter	5.33	5.2			
			2 Pieces/Pack Stored on Counter	2.67	10.4			
			3 Pieces/Pack Stored on Counter	1.00	9.0			
			4 Pieces/Pack Stored on Counter	0.33	5.2			
			5 Pieces/Pack Stored on Counter	0.67	5.2			
			6 Pieces/Pack Stored on Counter	0.00	0.0			
			Total Pieces/Pack Stored on Counter	10.00	15.6			
			Number of Days/Freezer is Empty	3.00	0.0			
			Avg Number Pieces/Stored Freezer	35.36	157.8			
			Number of Days/Fridge is Empty	67.33	18.7			
			Avg Number Pieces/Stored Fridge	0.55	0.7			
			Other Container/Min Storage in Freezer	4.00	0.0			
			Other Container/Max Storage in Freezer	33.33	145.2			
			Other Container/Min Storage in Fridge	1.00	0.0			
			Other Container/Max Storage in Fridge	4.00	0.0			
			Other Container/Min Storage On Counter	0.00	0.0			
			Other Container/Max Storage On Counter	0.00	0.0			
			Orig Container/Min Storage in Freezer	10.00	0.0			
			Orig Container/Max Storage in Freezer	11.33	13.7			
			Orig Container/Min Storage in Fridge	5.00	0.0			
			Orig Container/Max Storage in Fridge	7.00	23.8			
			Orig Container/Min Storage On Counter	0.00	0.0			
			Orig Container/Max Storage On Counter	0.00	0.0			

Storage Details	Average	Half Width
6 Pieces/Pack Moved Short Life	266	9.0
Total Pieces/Pack Moved Short Life	789	18.0
2 Pieces/Pack Thrown Away	159	13.7
Total Pieces/Pack Thrown Away	502	43.7
No of Days/Small Other Container is Empty	3.00	0.0
Busy Utilisation/Small Other Container	77.07	65.1
Use of/Small Other Container	71.33	54.9
Used/Small Other Container	136.00	85.7
Used/Small Other Container	1.91	1.1
Large Other Container is Empty	26.33	108.7
Utilisation/Large Other Container	19.64	52.1
Use of/Large Other Container	46.67	163.8
Used/Large Other Container	83.67	317.2
Used/Large Other Container	1.77	0.6

Expired / Thrown Away	Average	Half Width
Total No of Pieces/Thrown Away Expired Wasted	0.67	10.37
Total No of 2 Pieces/Thrown Away Orig Container	8.67	13.72
Total No of 4 Pieces/Thrown Away Orig Container	4.33	13.72
Total No of 6 Pieces/Thrown Away Orig Container	2.00	8.98
Total No of 2 Pieces/Thrown Away Small Other Container	0.00	0.00
Total No /Thrown Away Large Other Container	0.00	0.00
Food Waste /Ending Up As Home Composte	0.07	1.04
Food Waste /Ending Up Land Fill Residual	0.60	9.34
Plastic Waste /Ending Up As Home Composte	10.50	12.58
Plastic Waste /Ending Up Land Fill Residual	4.50	5.39

# The HHSM can simulate many innovations

Packaging type and shelf life



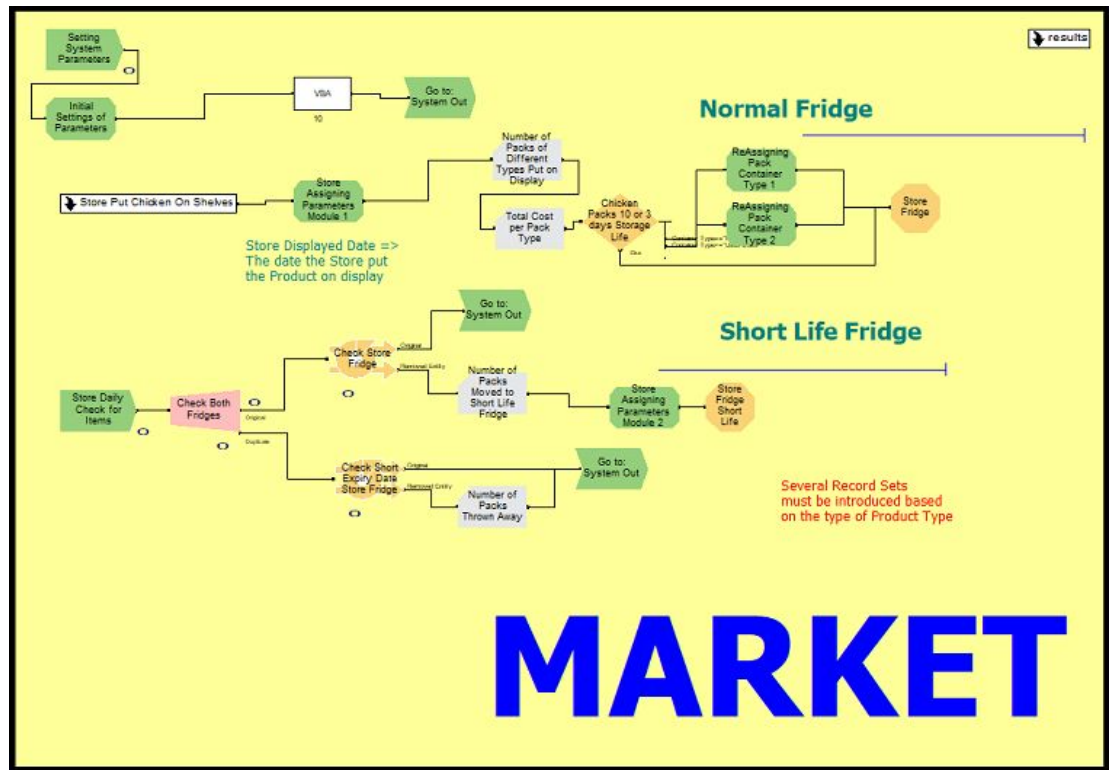
Current Focus:  
Trade-offs between small packages and large packages + storage space



# The HHSM can simulate many innovations

## HH Food // Plastic Waste Simulation Model

# 1. Market

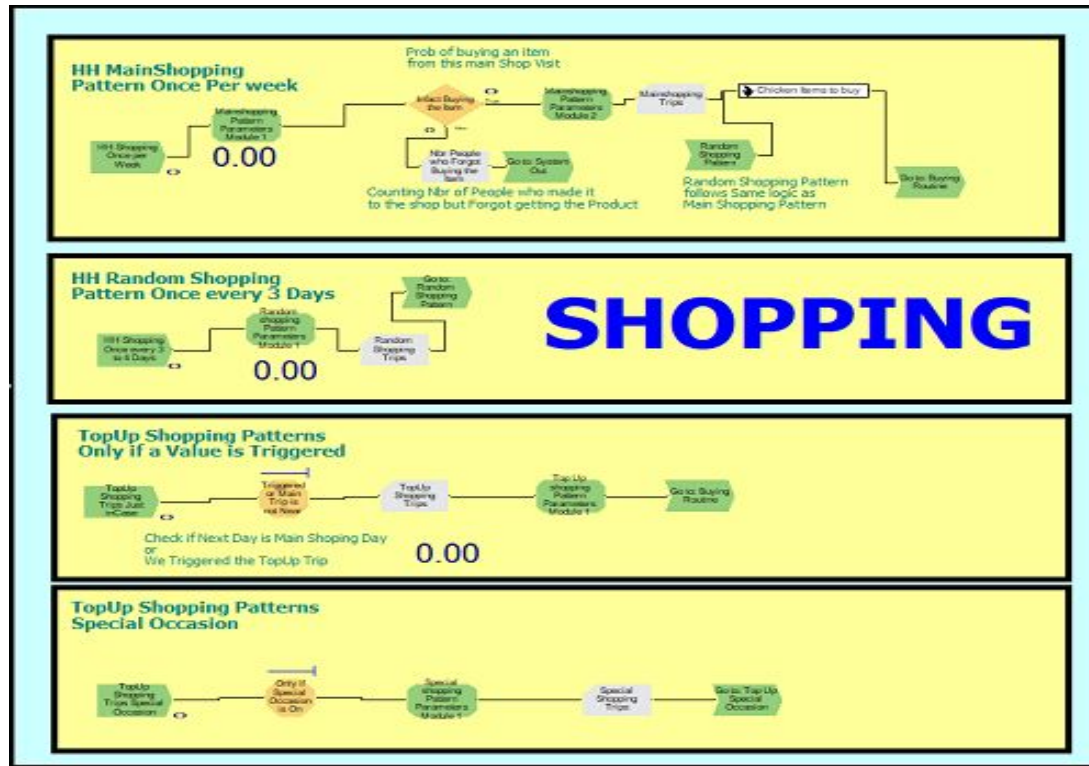


Market Related Information		
Input Parameters	Condition	Value
Products Sizes in Pieces on Display	2 Pieces	2
	4 Pieces	4
	6 Pieces	6
Products on Display Daily	2 Pieces	4
	4 Pieces	4
	6 Pieces	4
Cost / Pack	2 Pieces	2
	4 Pieces	2
	6 Pieces	2
Selling Price £ / Pack	2 Pieces	4
	4 Pieces	6
	6 Pieces	8
Selling (Reduced Price) £ / Pack	2 Pieces	4
	4 Pieces	6
	6 Pieces	8
Duration of time to Move Packs to Short Life Fridge	2 Pieces	
	4 Pieces	2
	6 Pieces	
Remaining Product Shelf Life to Throw Away Packs	2 Pieces	
	4 Pieces	0
	6 Pieces	

# The HHSM can simulate many innovations

## HH Food // Plastic Waste Simulation Model

# 2. Shopping



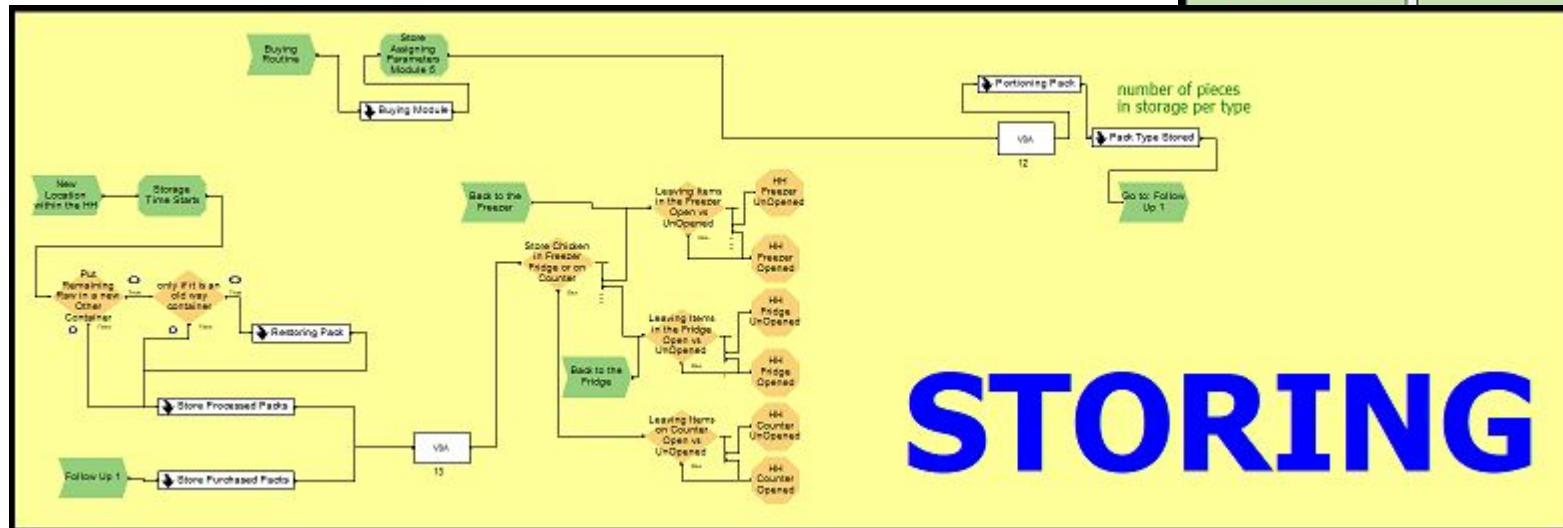
Purchasing Related Information		
Input Parameters	Condition	Value
Shopping List / Storage	Checked	100
Main Shopping Trip	Trip Frequency	1
	Switched On	1
	Max No. Trips	100
	Amount to Get Forgot to Get The Item	10
Random Shopping Trip	Switched On	0
	Trip Frequency	1
	Max No. Trips	100
	Amount to Get	10
TopUp Shopping Trip	Switched On	1
	Trip Frequency	1
	Max No. Trips	100
	Amount to Get	4
TopUp Special Occasion Shopping Trip	Switched On	0
	Trip Frequency	1
	Max No. Trips	100
	Amount to Get	10

# The HHSM can simulate many innovations

## HH Food // Plastic Waste Simulation Model

# 3.

## Storing



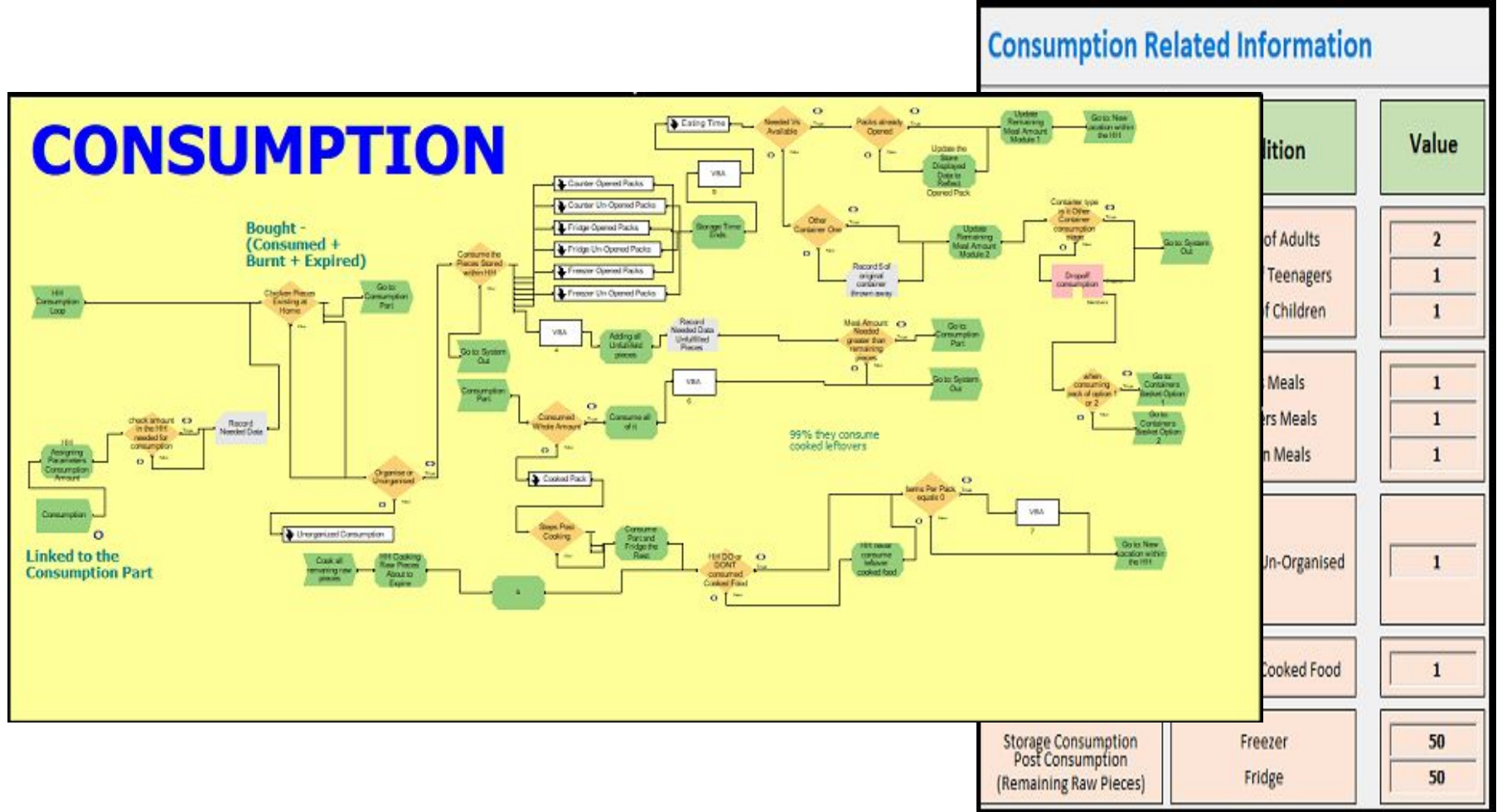
# STORING

Storing Related Information		Value
Number of Packs		1
Probability of Storage Type	Freezer	25
	Fridge	50
	Counter	25
Probability of Storing Portioned Packs	Freezer	25
	Fridge	50
	Counter	25
Prob of Storing Remaining Raw in Other Container	put raw remaining pieces in other container	100
Initial Origin		100

# The HHSM can simulate many innovations

## HH Food // Plastic Waste Simulation Model

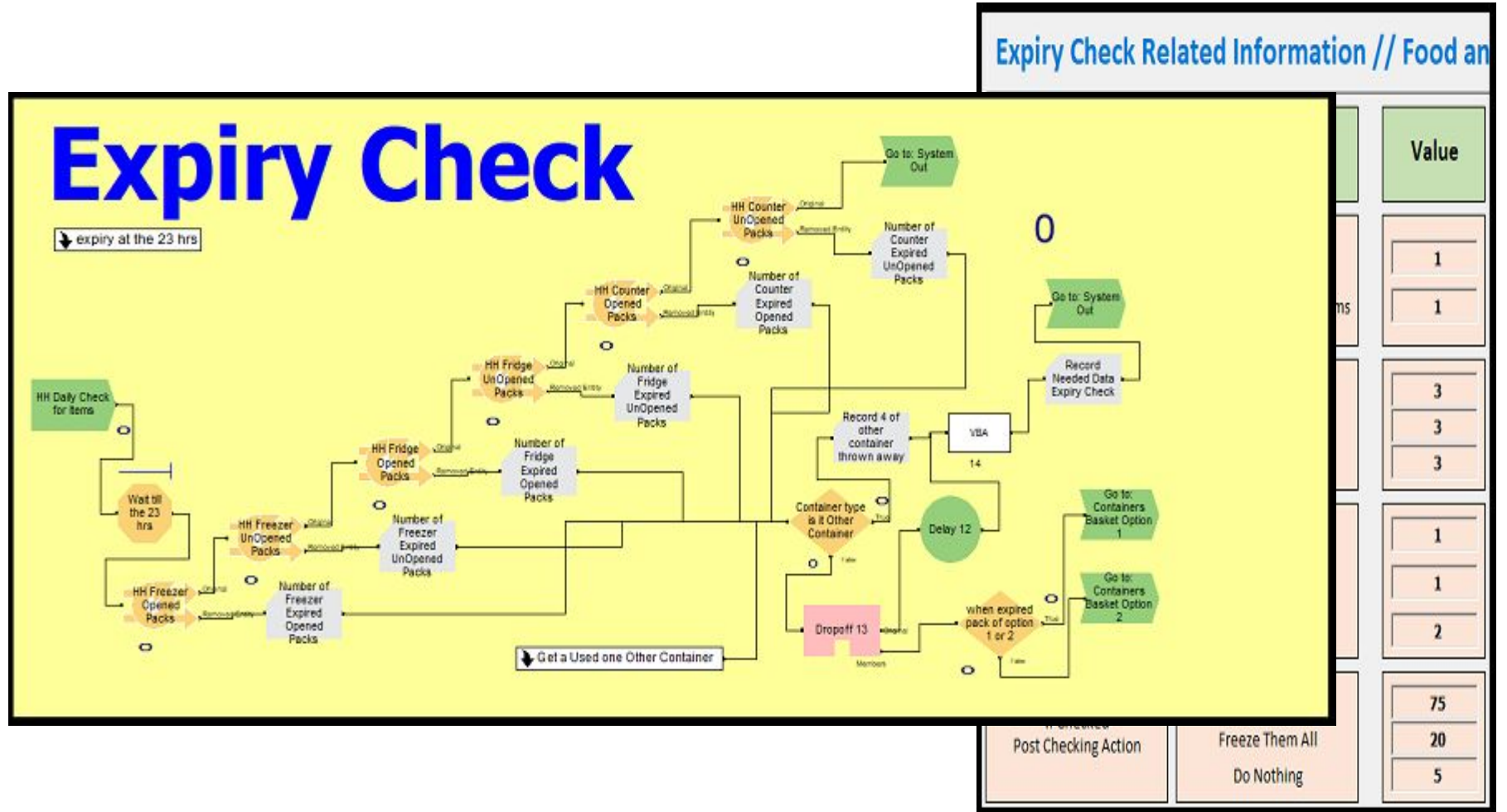
### 4. Consumption



# The HHSM can simulate many innovations

## HH Food // Plastic Waste Simulation Model

# 5. Waste



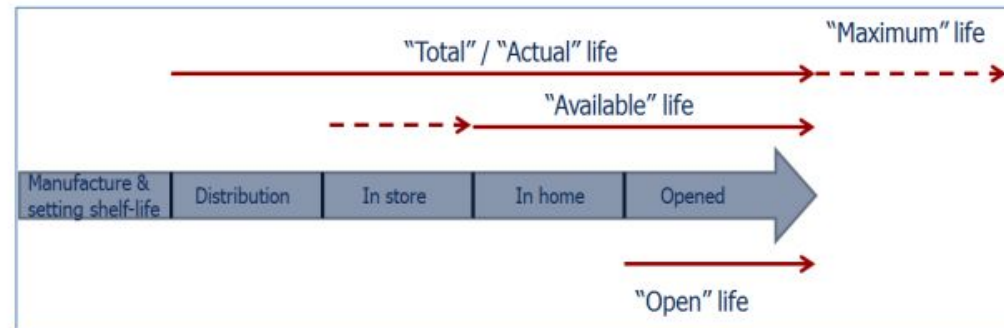
# Work packages

*A discrete event simulation model for 30 food products/packaging combinations*

(10-15 of the products will be fresh fruit and vegetables due to the large packaging and food waste reduction potential)

**WP 1** Development, enhancement, and expansion of HHSM **WP 2** Knowledge Exchange **WP 3** Academic impact

**WP 4** Quantifying food quality and packaging trade-offs - additional data collection (Kent/Greenwich)



**WP 5** Household-packaging interaction, behaviour and practice - additional data collection (*the rest of this talk*)

# Qualitative Data Collection - Intentions & Design

- Qualitative Research can validate and provide insights for Quantitative modelling.
- Practice Theory can provide a sociological approach to the different models within the HHSM, due to understandings of eating and food waste as compound practices.
- What considerations are taken into account before the food enters the home?
- What happens to the food and its packaging once it enters the home?
- How do food and plastic packaging become waste differently?
- 28 people recruited for online interviews, 25 completed food and plastic waste diary after screening questionnaire.
- Semi-structured interviews with photo-elicitation elements. Interview guide focussed on different aspects of food waste as compound practice, e.g. food provisioning, meal organisation, and judgement/tastes.
- Diaries based on remote ethnographic methods. Ethnographic/observational methods ideal for this kind of project, but present own challenges.

# Qualitative Data Collection - Findings

- Specific information about how different products and package types are treated and talked about.
- Detailed breakdown of these findings by the archetype each participant is in.
- Additional information about how meal planning may be affected by the flexibility of meals.
- Aspects of consumer behaviour and opinion about packaging which are counter-intuitive to packaging experts and against “best practice”; including removing produce from packaging as soon as it is brought into the home.
- Insight into how households store fresh items once they have been removed from packaging.

# Previous Results Change packaging size –

Results 25% waste decrease

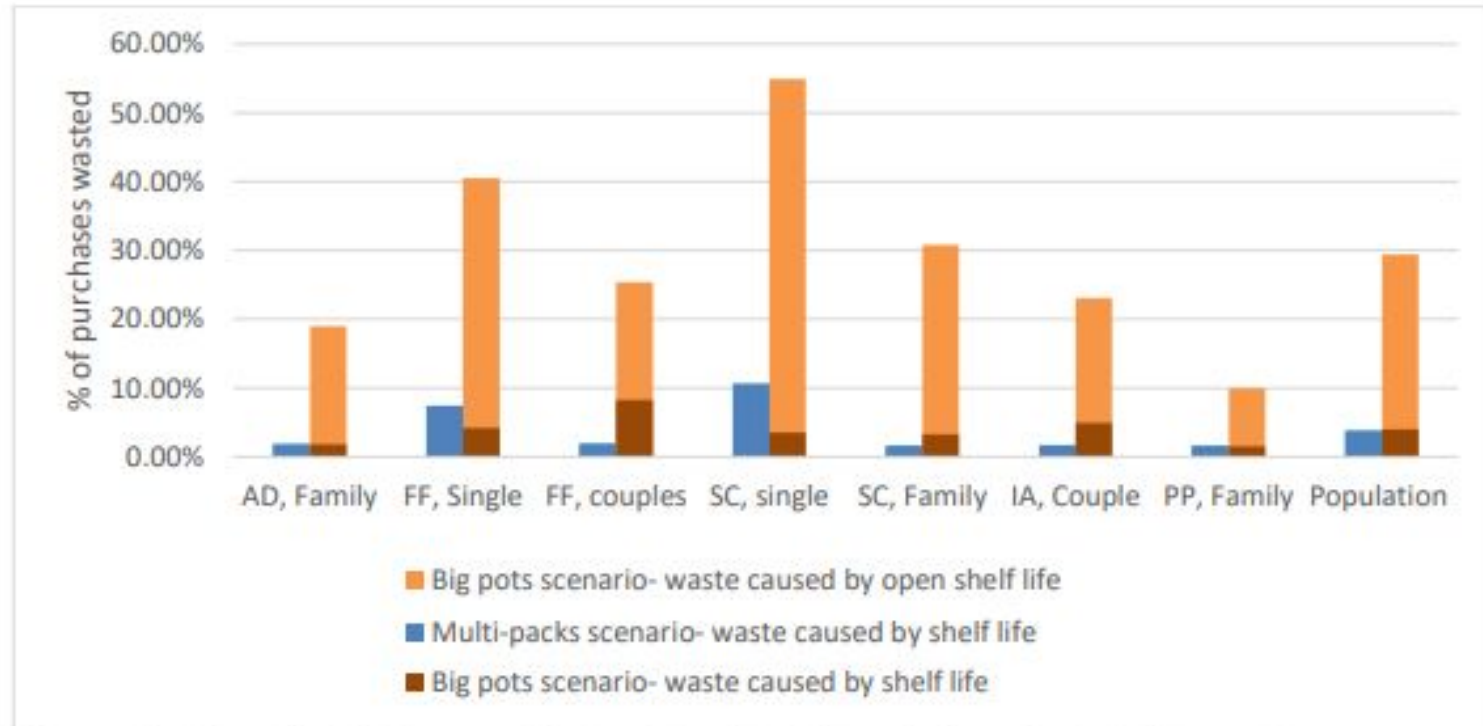
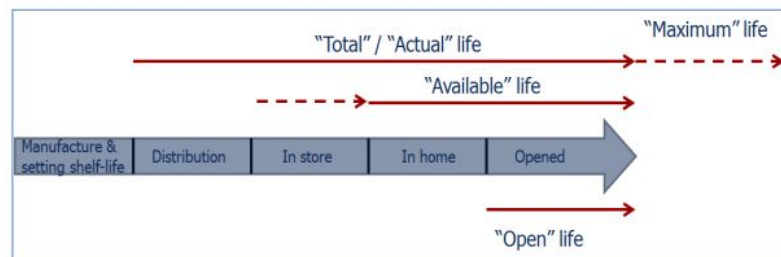


Figure 3 - Waste levels from purchasing "small multi-packs" vs. "single big pots"



# Previous Results - Evidence Matrix

Table 1: Summary of progress against priority action areas for a selection of key products

KEY ACTION AREAS	Estimated potential food waste savings *	Bread	Milk	Yogurt	Hard cheese	Fresh chicken	Bacon/ sausages/ ham	Potatoes & other uncut fresh produce
Remove the date label where not needed ( <i>fresh produce only</i> )	>150,000 tonnes/year	n/a	n/a	n/a	n/a	n/a	n/a	c.75% with date labels
Use a Best Before where Use By is not needed. Don't use Display Until	>150,000 tonnes/year	100% Best Before	0% Best Before (but recent change in advice to risk assess for BB)	16% Best Before	100% Best Before	n/a (no Display Until)	n/a (no Display Until)	13% Display Until to be removed
Maximise available product life		No change (average 3.6 days)	Increase since last survey	No change	Increase since last survey	No change (average 5.2 days)	No change	Decrease in life on potatoes since last survey (ave 3.9 days)
Remove open life statements where not needed, or change to 'best within'.		None present	All Use Within	All Use Within	All Use Within	Extended since last survey	Some removal on bacon / sausages	None present
Clear storage advice – where to store, how to store, numerical fridge temperature, etc.	>100,000 tonnes/year (underestimate)	Consistent advice not to store in fridge	27% with temperature advice 10% with fridge logo			48% with temp advice 17% with fridge logo		10% with temp advice 17% with fridge logo
Clear freezing/thawing /cook from frozen advice	>200,000 tonnes/year	Big increase in snowflake	Very low prevalence	n/a	Very low prevalence	Some increase in snowflake	Some increase in snowflake	n/a
		More Cook from Frozen needed; 26% FODOP to remove				35% FODOP to remove. More CFF needed	30% FODOP to remove. More CFF needed	
Small packs available at the right price point	>200,000 tonnes/year	Low availability and 74% more expensive /kg for small packs	Widely available at range of price points	Widely available at range of price points	Widely available Some price difference	Widely available at range of price points	Widely available at range of price points	For most – loose more expensive per kg than pre-packed
On-pack recipe ideas, hints and tips (as well as in-store, other channels)	No firm estimate (>300,000 across all food types)	Positive trend towards adopting	Low prevalence	Low prevalence	Positive trend to adopting	Low prevalence	Low prevalence	Positive trend towards adopting

**KEY**

- Good practice adopted or positive trend seen - high impact area [≥10,000t savings potential]
- Good practice adopted or positive trend seen - lower impact area
- Shortfall or no change seen - high impact area [≥10,000t savings potential].
- Shortfall or no change seen - lower impact area

FODOP – Freeze on Day of Purchase. CFF – Cook from frozen. \* NOT ADDITIVE. See Appendix 2 for method and assumptions.



RETAIL SURVEY 2019

**HELPING CONSUMERS REDUCE FOOD WASTE THROUGH BETTER LABELLING AND PRODUCT CHANGES**

In 2019, WRAP undertook a survey of UK retailers following on from previous surveys conducted in 2009, 2011 and 2015. A range of own-brand and branded food products was assessed to understand changes in packaged products since the previous surveys and how these could influence household food waste.



Research date: February 2019- July 2019  
Publication Date: November 2019

Project code: BCP003-002

# Previous Results - Evidence Matrix

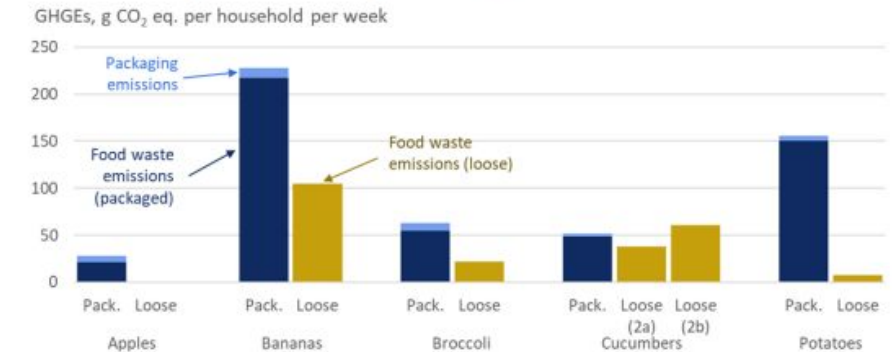
**Table ES1:** Predicted impact on 'not used in time' HHFW of selling loose (final row), and effects of individual changes (first three rows), percentage point difference

Change:	Difference in HHFW compared to packaged, expressed as percentage-point difference				
	Apples	Bananas	Broccoli	Cucumber	Potatoes
Change in shelf-life from packaging removal	0.0 pp	+3.3 pp	+1.9 pp	0.0 pp	0.0 pp
Removal of BB date	-0.8 pp	0.0 pp	-7.1 pp	-3.5 pp	-4.5 pp
Change in pack-size options	-2.7 pp	-9.9 pp	0.0 pp	0.0 pp (or +7.2 pp)*	-8.8 pp
<b>Selling loose (All three changes combined**)</b>	<b>-3.1 pp</b>	<b>-7.5 pp</b>	<b>-4.7 pp</b>	<b>-3.5 pp (or +4.0 pp)*</b>	<b>-13.0 pp</b>


\*0 pp / -3.5 pp if smaller (half-sized) cucumbers available loose; +7 pp / +4.0 pp if no smaller cucumbers available

\*\*This is not simply the sum of the three changes above: this scenario includes interactions between all three changes

**Figure ES2:** Estimated Greenhouse Gas (GHG) emissions for packaged and loose scenarios, splitting emissions relating to packaging and HHFW



# Please do get in touch

 @\_Reduce\_Waste\_

Dr Christian Reynolds

*Centre for Food Policy, City, University of London*

 @sartorialfoodie [christian.reynolds@city.ac.uk](mailto:christian.reynolds@city.ac.uk)

Dr Jack Pickering

*University of Sheffield*

 @jackpickering74 [jack.pickering@sheffield.ac.uk](mailto:jack.pickering@sheffield.ac.uk)

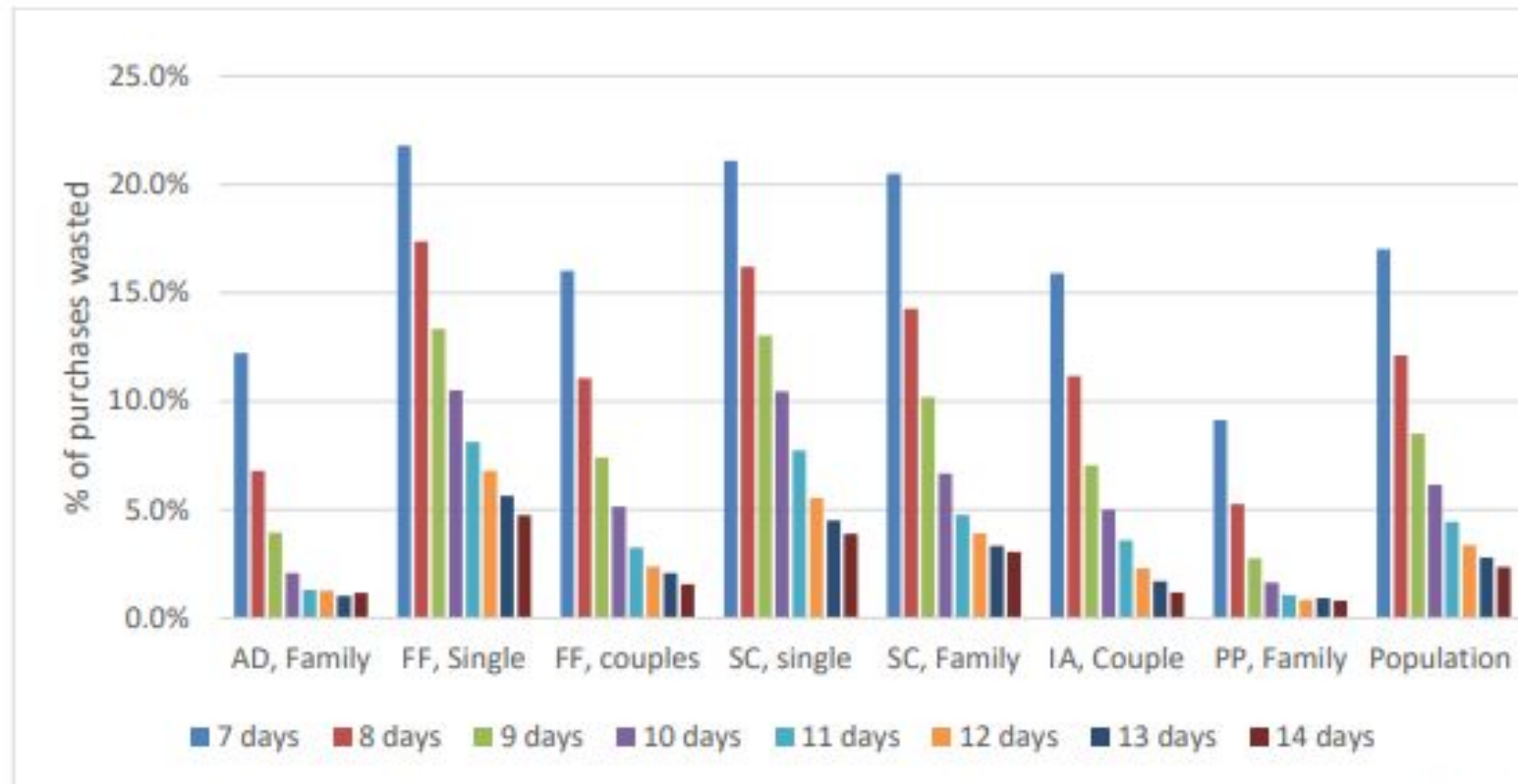
The Centre for Food Policy, City, University of London offers the following courses

- **Nutrition and Food Policy BSc (Hons)**  
Undergraduate degree
- **Food Policy MSc/PGDip/PGCert/MSc Distance Learning**  
Postgraduate taught degree
- **PhD/MPhil Food Policy**  
Postgraduate research degree

<https://www.city.ac.uk/prospective-students/courses/postgraduate/food-policy>



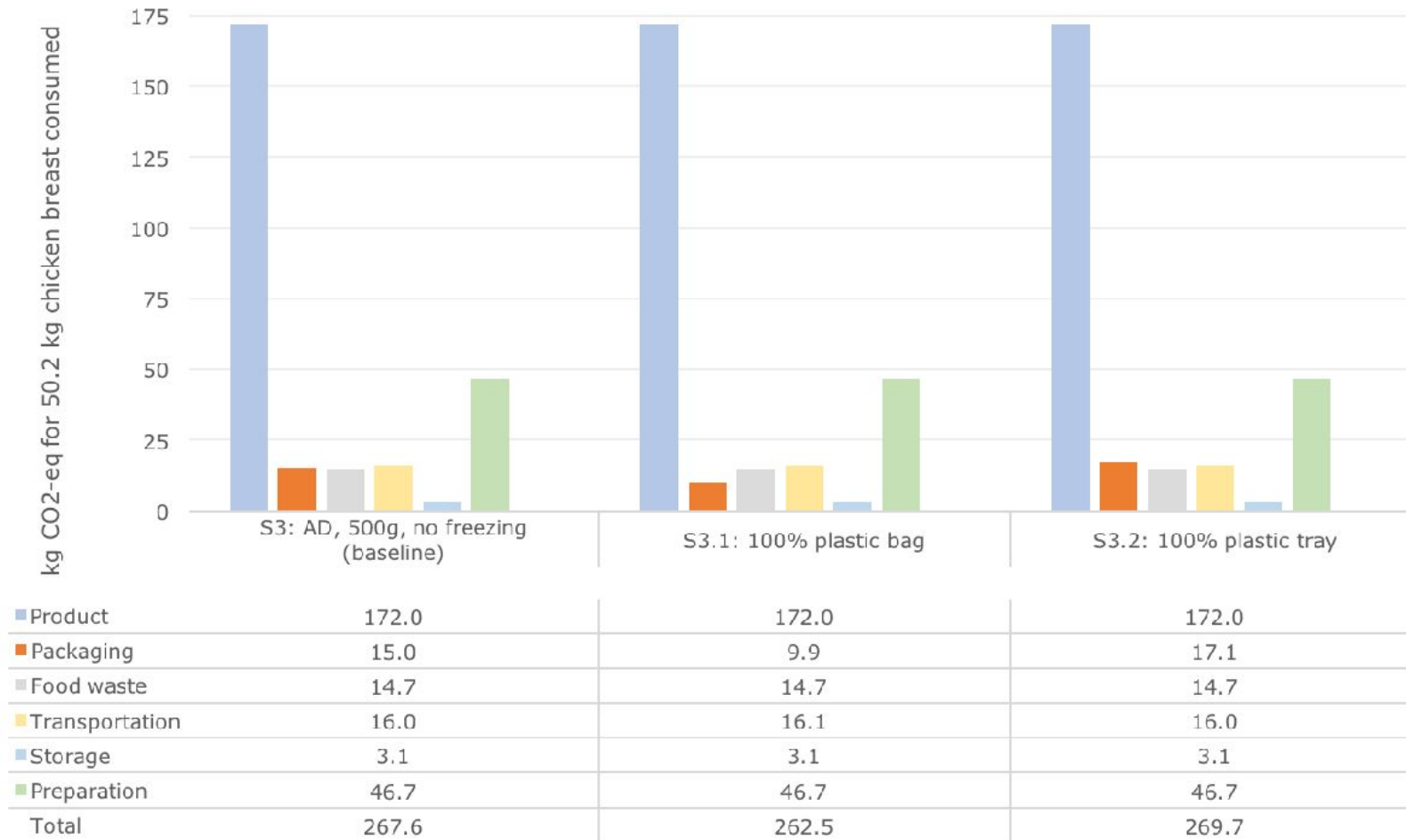
# Change product life— Results 15% waste decrease



*Figure 1 - Waste level outputs of hard cheese across the household archetypes and whole population as the open shelf life varies from 7 to 14 days*

# HHSM evidence – from Masters student project<sup>+</sup>

**AD Family Chicken Scenarios - Packaging - Global Warming**



Normalised (per year) results for Global warming in the Aspirational Discoverers family chicken breast scenarios, for two packaging trade-off scenarios in the AD family buying 100% plastic bag or 100% plastic tray packaging for 500g.