

Manufacturing resilience via inventory management for domestic food waste

E. Woolley¹, G. Garcia-Garcia¹, R. Tseng^{1,2}, S. Rahimifard¹

1. Centre for Sustainable Manufacturing and Recycling Technologies (SMART), Loughborough University, LE11 3TU, UK

2. Hyflux Ltd, 80 Bendemeer Road, 339949, Singapore

ABSTRACT

The ability to feed 9 billion people by 2050 will rely on processed foods being delivered through complex and dispersed international supply chains [1]. Currently as much as a third of all food grown is lost as waste at various points along existing supply chains, with roughly half of food waste in the developed world occurring after purchase by the end consumer. Manufacturers need to play a part in reducing this waste. This research describes how the prevention of food waste for certain categories can be facilitated using a Smart Phone App that enables industrial inventory management for the domestic environment.

RESEARCH JUSTIFICATION

It has been estimated that as much as 50% of all food that is produced never actually enters a human mouth [2]. This amounts to a potential two billion tonnes of food waste per year, revealing a significant waste of farmland, time, energy, water and money. In the UK almost half of all food waste occurs after food products have been purchased by the consumer [3-7].

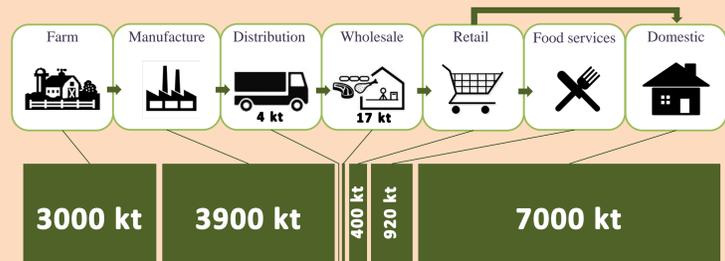


Figure 1. Food waste in the UK supply chain.

Manufacturers have a range of tools and techniques to help reduce the production of waste. Unfortunately consumers do not have access to the same types of tools. The domestic consumer can be envisaged as a micro manufacturer:

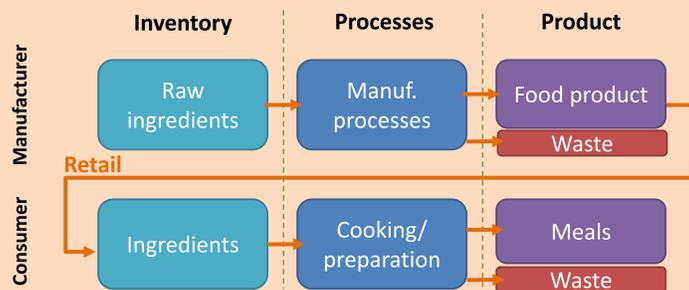


Figure 2. Consumers as micro manufacturers.

The assertion in this research is that an inventory management tool for consumers could help reduce food waste which ultimately reduces stress on (and increases resilience of) existing food supply chains. The challenge is being able to provide the consumer with the *right information in the right format at the right time.*



Up to 50% all food wasted. In UK most by consumers



Milk and dairy large problem due to short self life



Better provision of use by dates (e.g. in barcode)



Use by data transferred by store loyalty system



Consumers better manage food inventory and reduce waste

FOCUS

The way in which food waste is measured varies depending upon who is reporting, and is typically by weight, cost, calorie content, carbon footprint and so forth. Regardless, it is typically meat and dairy products which are one of the biggest wastes due to their high cost, short shelf lives and large environmental footprints.

Due to a lack of published data, a micro survey was undertaken to understand why food is typically thrown away in a domestic environment. The survey found that ~60% of food waste is discarded due to items having gone past their expiry date. The research therefore focussed on providing better awareness of 'use by' dates to consumers.

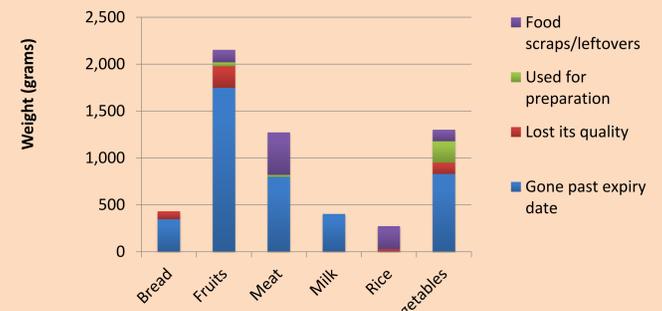


Figure 3. Survey results: common food wastes and reasons for disposal

INVENTORY MANAGEMENT FOR DOMESTIC CONSUMERS

The proposed solution is for manufacturers to provide consumers with electronic access to Use By Dates of (initially) meat and dairy products enabling better tracking of short shelf life inventory within the home. The solution comprises three stages:

- The Manufacturer.** The information requirement is the Use By Date to pass from the manufacturer of the product to the consumer.
- The Retailer.** The data that is ultimately required by the consumer needs to be passed on in a useable/electronic format.
- Consumer.** Once the consumer has access to the required fields, there is a need for an inventory management programme and interface. In this work a mobile phone app has been developed.

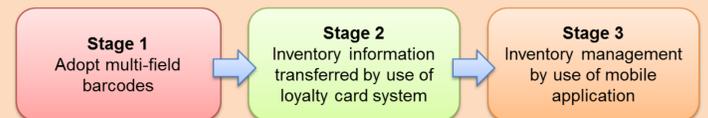


Figure 5. Three stages of information flow for domestic inventory management of food

A mobile application, entitled Pantry, was programmed using graphical interfaced, cloud-based, MIT App Inventor 2. A number of barriers relating to data availability and limitations of the programming software prevented extensive testing of Pantry. However, dry-process testing was carried out on a small scale to demonstrate functionality. Early results showed a reduction of 34% food waste across key food types.

Stock List - allows users to keep inventory of their food items already purchased, including expiry dates. Modifiable to remove consumed items.

Expiry Tracker - notifies the user when items are about to exceed Use By Date. Dependent on settings, alarm activates *n* days before expiry date. Once alarm triggers, four options are provided; consumed, partly consumed, not consumed, wasted. Alarm can be 'snoozed'.

Recipe Recommendation - depending upon the items highlighted by the Expiry Tracker function, a number of recipes are suggested via the internet.

References: [1] Charles, H., Godfray, J., Beddington, J.R., Crute, I.R., Haddad, L., Lawrence, D., Muir, J.F., Pretty, J., Robinson, S., Thomas, S.M., & Toulmin, C., 2010. Food Security: The Challenge of Feeding 9 Billion People, *Science*, **327**, 812-818. [2] IMechE, 2013. *Global Food Waste Not, Want Not*, Institute of Mechanical Engineers, London. [3] Waste and Resources Action Plan (WRAP), 2013. *Estimates of Waste in the food and drink supply chain*. [4] Waste and Resources Action Plan (WRAP), 2014. *Estimates of food and packaging waste in the UK grocery retail and hospitality supply chain*. [5] Department for Environment, Food and Rural Affairs (DEFRA), 2012. *Food Statistic Pocket Book*. [6] Waste and Resources Action Plan (WRAP), 2010. *Waste arising in the supply chain of food and drink to households in the UK*. [7] Waste and Resources Action Plan (WRAP), 2011. *New estimates for household food and drink waste in the UK*.