

**Research Project Report – Food Waste:**

**A Business Opportunity for Consumer-led Initiatives**

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## List of Abbreviations

CL: consumer-led  
C-L: consumer-level  
FWT: Food Waste Terminators  
ISM: Information System Management  
NPD: New Product Development  
SDG: Sustainable Development Goals

## Executive Summary

Worldwide, 8.2% of greenhouse gas emissions<sup>1</sup> outcomes in unaccompanied food waste. About 6%-8%<sup>2</sup> of all human-caused greenhouse gas emissions could be reduced if wasting food is stopped. Altogether this has radical effects on the economy and environment. Following research explores criticality of food waste and food waste management as a business opportunity for digital, consumer-led innovation.

Part A introduces the food waste challenge and how consumers and industry alike are contributors to the problem, while introducing some innovative aspects that can do wonders on food waste management. Part B dives deeper into the problem and covers how businesses can market open innovation in new product development to consumers based on their negative and constrained perception of food waste behaviors, while being themselves motivated by compliance to regulation and New Product Development for business growth.

Part C highlights the importance of digital sustainability in terms of food waste and it also reflects some gaps in existing techniques and frameworks; such as unavailability of consumer involvement and input and therefore, suggests that a full-time consumer-led framework is a better approach to accelerate the digital transformation for food waste management. A frame food waste management in ICT4D perspective, with an end-to-end e-market place solution that connects all possible stakeholders including consumers as contributors through a crowd sourced model. Thereby, achieving a framework for strong community engagement for environmental protection and social innovation.

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<sup>1</sup> <https://www.earthday.org/our-foods-impact/>

<sup>2</sup> <https://www.worldwildlife.org/stories/fight-climate-change-by-preventing-food-waste>

## PART (A) – THE INTRODUCTION AND PRACTICAL ASPECT

### Introduction

The Zero Hunger SDG focuses on finding sustainable solutions to put a stop towards world hunger. The goals of the Zero Hunger initiative are to end hunger and make sure that by 2030 food security is achieved (Food security and food systems – BMC).



Figure 1. UN SDG 2: Zero Hunger Captured from (End hunger, achieve food security and improved nutrition and promote sustainable agriculture)

The aim is to ensure that everyone everywhere has enough good-quality food to lead a healthy life. Around a third of the food produced for humans is lost or wasted (Koehring). Therefore, the sustainability of food waste is one of the most pressing challenges present in economic, social, and environmental life in light of SDGs leading directly to food insecurity.

| Household      | Food service   | Retail         |
|----------------|----------------|----------------|
| Australia      | Australia      | Australia      |
| Austria        | Austria        | Austria        |
| Canada         | China          | Denmark        |
| Denmark        | Denmark        | Germany        |
| Germany        | Estonia        | Italy          |
| Ghana          | Germany        | New Zealand    |
| Malta          | Sweden         | Saudi Arabia   |
| Netherlands    | United Kingdom | Sweden         |
| New Zealand    | United States  | United Kingdom |
| Norway         |                | United States  |
| Saudi Arabia   |                |                |
| Sweden         |                |                |
| United Kingdom |                |                |
| United States  |                |                |

Figure 2. The statistics representing sector wise distribution of countries where food waste occurs the most (Hamish Forbes (WRAP))

As population is growing rapidly, it will raise into a hunger problem if food is being wasted (PacMoore) (Breene).

### Where our waste comes from:



Figure 3. Where food waste comes from? (Food Waste in America in 2021)

### Impact of Food Wastage in Real-World

Consumption of Food in Food industry - loss, waste or security?

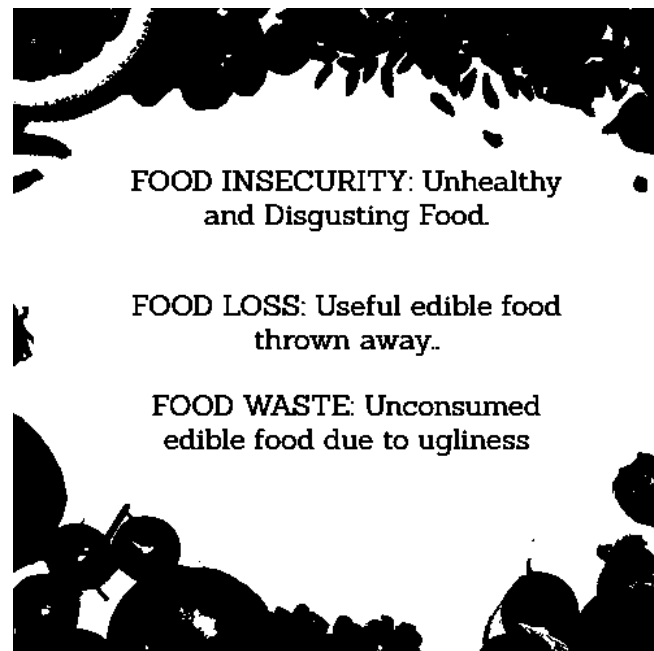


Figure 4. What are different issues in Food Industry?

Although most of the consumers do not anticipate food wasting, it turns out to be a common practice (Food Security - Big Facts). But not only consumers, retailers and manufacturers are also the contributors to food waste issue. Consumers as well as retailers

perform a significant role in influencing the market and must advocate driving transformation (Food waste: how much of it is consumer responsibility?) Consumer involvement has a maximum level of influence on Consumer Company identification (Diana Escandon-Barbosa) from which the benefits begin to emerge for self-propelled sectors. Various theories that affect consumer food waste can be recognized as motivation, ability, opportunity, and distal factors (Borgne).

### Innovative ways for Food Waste Management

There is a need to apply human-centered design thinking strategy to leverage new emerging technologies, platforms for food waste control (Folk). Certain key intersections of trends and commerce dynamics affect the marketplace ecosystems. Through a series of trends and technologies, help consumers to increase their knowledge of relevant context. Therefore, consider the following external development features that are changing market impacts and helping consumers to claim and capture new opportunities for food waste management.

#### Developing crowd-capabilities/generating smart ideas

Product and distribution is two-thirds of the reason why food waste happens. The final third of food waste is at the consumer-level. Implicit in the preceding discussion is the notion that an organization recognizes and is receptive to the value of resources dispersed in crowds (Prpic). Being innovative can be really powerful, but multiplying the idea to numerous crowd-sourced people can make it more interesting.

However, this industries faces some challenges. For example, outlining the interdependencies (Dahlander). Many organizations fail to appreciate the downstream implications of, for instance, vaguely defining the problem of food waste in their companies. Secondly it is very challenging to increase the odds of building a strong and a powerful crowd.

#### Disruptive technologies brings the revolutionary innovation strategies:

- Ignoring new technologies that don't initially meet the needs of their mainstream customers.

One of the most consistent patterns in business is the failure of leading companies to stay at the top of their industries when technologies or markets change. The key to prospering at points of disruptive change (Christensen) is to strategically manage important disruptive technologies in an organizational context where small orders create energy, and where overhead is low enough to permit profit even in emerging markets.

- Small, hungry organizations are good at agilely changing product and market strategies

Companies that can understand disruptive technologies can create new businesses, must give creators of disruptive innovation a free rein to realize the technology's full potential-even if it means ultimately killing the mainstream business (Christensen).

- Strategically, the success rates are dependent on several performance parameters. These could be

Performance of current potential disruptive technology, performance improvement required by mainstream market or the expected trajectory of performance improvement.

- Implications: disruptive technologies consists of tremendous benefits for strategically defined innovation trends in businesses. But on the other hand, there are some of the short-comings as well (Muller). For example,
  - Segment level analysis: It is possible that one category or segment of consumers' disruptive technology would be more affected than others'
  - Market share: One may ask if supplanting the incumbent is really necessary for an innovation to be labeled disruptive.

## Digital Sustainability and Transformation

A sustainable society comprises of a digitized world with transformational acceleration. The academic and managerial theory-based consumer behavior researchers and data mining researchers is necessary (Pappas). A synthesis is desirable and may be possible. The adoption of a range of new technologies has created three main challenges for organizations: high volume of data generated both internally and externally, high velocity in terms of data generation and decision making, and high variety of data (Giles Hindle); and thus the fact that

these are directly affected by consumer's behavior and attitude towards the phenomena cannot be denied.

Smart disruptive management technologies provides better ways to lead a sustainable future, free of waste. Around the world, dedicated food waste apps to smart storage systems (Matchar), these disruptive innovations reduce the amount of food you loss, thus saving it from ending up in the bin. Data-driven methods such as big data analytics (McKinsey) also provides a sustainable development feature in food industries as a digital world can help consumers in a more environmentally responsible manner by improving their waste control decisions and circulate economy solutions in the food chain.

## PART (B) – THE ACADEMIC REFLECTION

It is useful to remember occasionally that life unfolds as a chain of subjective experiences. Whatever else life might be, the only evidence is the only direct data access, and succession of events in consciousness (Beck). The quality of these experiences determines whether and to what extent life was worth living, however, still the world faces the issue of food waste in businesses.

### Food Waste – a Problem in Industries and Potential Innovation Opportunity for NPD and Developing a Food Recovery Hierarchy

Trends in food systems are challenging stakeholders to improve the efficiency of their procedures, if not, find other ways to utilize it. Following are some use-cases where wasted food can be utilized for other purposes.

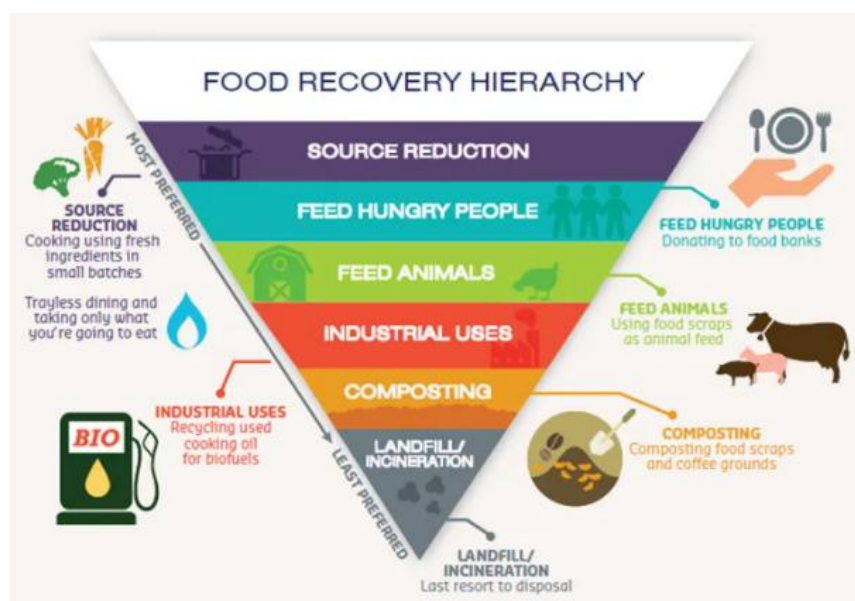


Figure 5. Shows EPA's Food Recovery Hierarchy developed (Zafar).

- i. Donation to feed people (Unknown)
- ii. Creation of animal feed (Evan, Animal Feed As a Solution To Food Waste).
- iii. Composting, anaerobic digestion (Fuqing Xu 1)
- iv. Sending to landfills (Evan, Animal Feed As a Solution To Food Waste).

The following initiatives serve as examples of how food waste management is marketed through different channels (Calvo-Porra).



Figure 6. Food waste marketing perspectives

For more on marketing perspective, see [Reflections](#) part.

#### Open Innovation and NPD Strategies for Food Waste

In the food industry, just as any other industry, product and process development is considered a vital part of smart business strategy and innovation is no longer seen solely as a product of scientific research and development, but rather as an augmentation that comes from changes in processes driven by consumers in their expedition search for more custom-made products and services.

Inspired by food waste in manufacturing and farming, a range of small businesses use this waste to make new products. For example, a London-based former chef Tom Fletcher founded Rejuce (Tajmir) in 2012 and since then has turned over 250 tons of ugly wonky fruit and vegetables into smoothies and juices. An eco-friendly Airplane Trays made from coffee grounds (Eco-Friendly Aeroplane Trays Made From Coffee Grounds) uses a

mixture of coffee grounds and husks, and single-use containers for food dishes are made from wheat bran used on commercial flights.

Food industry has the business opportunity to minimize wastage, cut their losses and risks of new product failure by tapping into consumer led innovations for food wastage.

#### How Consumer-Led Innovations are involved in Food Waste?

Open innovation and NPD helps organizations in identifying and reducing risk which leads to better business decision making (Horsfall). The complex causes of consumer food waste make it difficult for commercial actors and public policy makers to develop successful food waste reduction campaigns and hence, consumers are the biggest contributors to the total volume of food waste generated.

#### Creative consumer/Lead-user research in marketplace

The lead-user research method does not only look up to the typical customer, but to those users whose needs and preferences lead the market as well (Eisenberg), leading to the consumer-led innovation strategies. On one hand, they can signify a black hole for future revenue, with breach of copyright and intellectual property (Hippel). On the other hand, they represent a gold mine of ideas and business opportunities.

Lead users or creative consumers are defined as members of a user population who (Nikolaus Franke) (Berthon):

- i. Anticipate obtaining relatively high benefits from obtaining a solution to their needs and so may innovate and
- ii. are at the leading edge of important trends in a marketplace under study and so are currently experiencing needs that will later be experienced by many users in that marketplace
- iii. Defines new strategic directions, such as food products or other various business concepts.
- iv. Adapt, modify, or transform a proprietary offering for business

Many scholars and institutions have researched this issue from different perspectives, but theoretical and empirical research on food waste from the perspective of consumer

perception is still limited (The Effect of Consumer Perception on Food Waste Behavior of Urban Households in China).

## Theoretical Models for Food Waste Management in Industries using Businesses, Open-Innovation and Consumer-led-innovation Strategies

### Food Waste Management Businesses and Initiatives

Consider some industry-based companies currently managing the food waste issues in the food sector.

The European Union *eatFood* (Unknown) FWT funded by World Food Day Foodathon, held a contest on food loss and waste by envisioning edible cups and coconut bowls. *Winnow* (Winnow Mission) is a company that upholds “Our core belief is that food is far too valuable to waste, and that technology can transform the way we use food.” *Wataki* (Wataki) is an organization that offers innovative technologies to increase the shelf life of fruits and vegetables in developing countries. *Gebni* (Gebni) is a smart food app used in cafeterias to reduce the prices in order to reduce the inefficiency of food wastage.

### Innovation to imitation

‘The customer experience is the next competitive battleground’ (Ivens). The reality is that many of the customer experiences that companies are delivering today have a number of gaping holes in them, and will not survive the wave. If those organizations put to sail with their existing customer experience, they will sink without trace. However, there is a need for a preparation for the holes to be repaired without any delay (How Consumer Orchestration Work Creates Value in the Sharing Economy). However, the reality is that this will only put us in a position where our customer experience is just about able to sail on the new wave. In part A, food waste management strategies are highlighted, and the disruptive technologies introduced by customers themselves plays a huge role towards innovation based on their preferences and needs. Therefore, there is a need to analyze some other user-defined elements such as customer expectations<sup>3</sup> as a user-lead theory or creative consumer aspect

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<sup>3</sup> Customer expectations include building customer experiences and blending their emotions with new innovative ideas they might propose.

seen above to innovate new products or services in food industries to control food waste challenge.

Companies crave insights about customers and increasingly rely on big data analytics to provide them with latest data to help for food waste management, but with standard research market tools, these companies cannot reveal the true customer's true motivations that can actually save the world.

Therefore, the solution is to correlate what a customer needs, more precisely introducing a sense-making illuminations that can transform product development and food waste control strategies (Rasmussen).

Following are the stages of how customer experiences are affecting the scenario (Ivens):

1. Expectations set by brand image.
2. Information gathering, pre-purchase interactions.
3. Implementing purchased interaction orders
4. Post-purchase interactions, consuming products or services
5. Post-experience review, intuitive customer experience review and revise expectations

Based on these stages, consider some of the market-built customer-led models for food waste management strategy:

#### Model: Commercial Pre-processing Technologies in Food Wastage Issues

Use Case: The strategy used in (EPA) discusses developing a general management information strategy for food loss and waste. The techniques aim at recycling the wasted food using different pre-processing technologies. However, the techniques don't cover the implications of food waste generators choice to recycle on the use of these pre-processing technologies.

Model: Online secondary market - A website where the business resells purchased excess food

Use Case: enhancing customer engagement through a software in supermarkets. For example, Click-and-collect service<sup>4</sup>.

Model: Store Secondary Market - A physical store where the business resells purchased and unconsumed food

Use Case: Encourage interactions among consumers and to include support for donating to food banks or charities.

Model: On-site and Off-Site Compost or Energy Recovery - Supporting the conversion of food waste to bioenergy or compost within food businesses

Use Case: Composite bins to reduce food waste. For example, a Zera Food Recycler<sup>5</sup>.

Model: Nonfood Products - Using food waste as an input to produce value-added products in passive/active role <sup>6</sup>

Use Case: From the idea of generating something new out of waste, also to show how waste in general can be used in a positive way. For example, Fruit leather (The Netherlands) <sup>7</sup> or Kaffeform (Germany) (Kaffeform).

Model: Mushroom Cultivation - Using food waste to cultivate mushrooms for human consumption

Use Case: Food Recovery from organic packaging. For example, GroCycle<sup>8</sup>.

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<sup>4</sup>A service where customers place their orders online and collect their basket of items directly from a designated location, e.g. a counter in the central warehouse. <https://www.food.gov.uk/business-guidance/approved-food-establishments>

<sup>5</sup> It turns today's food scraps into tomorrow's fertilizer with easy-to-use recycler that reduces food waste by over two-thirds its original volume in less than 24 hours. <https://wlabinnovations.com/products/zera-food-recycler>.

<sup>6</sup> Consumer and open-innovation perspective

<sup>7</sup> It is a start-up business operated by two young entrepreneurs, Koen Meerkerk (27) and Hugo de Boon (27) who are currently with a passion, creating value to things that have been labelled inadequate <https://fruitleather.nl/>

<sup>8</sup> It provides a way in learning the easiest ways to cultivate mushrooms. It also collects coffee grounds daily from local food retailers and uses converted office space to cultivate the mushrooms which are then sold back to local retailers.

Model: Restaurants Serving Rescued Food - Sourcing unsold food to operate a rescued food restaurant

Use Case: To provide rescued food for everyone, without restrictions in terms of social and financial status, ethnic background or gender and to share values and increase the well-being and knowledge within the community. Examples are Lentil as Anything<sup>9</sup> (Australia).

A CL framework is a new and an improved tactic to deal with the accelerating digital sustainability on consumer-led and technology-driven innovation for food waste considering most of the food is wasted at consumer-end. This section highlights some of the important use-cases that have lead us to creation of our proposed model.

Model: Tracking and connecting Platform.

Use case: Software that records inventory to ensure efficiency in ordering and reductions in wasted produce and Information and communication technology (ICT)-mediated excess food sharing from food businesses to potential customers. For example, Spoiler Alert, 222 Million Tonnes (Francois), Eatby (Team), and Prep & Pantry (Patrik).

Model: The waste collector provides assurances that wastes are disposed of correctly through partners

Use Case: On-demand waste collection. For example, Eco Friends (Sri Lanka)<sup>10</sup>.

In the next part, a framework is proposed - enhancing existing business models and initiatives.

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<sup>9</sup> The founder of this initiative aimed to challenge the agreement by not pricing his meals but by giving the guests the freedom of donating on the basis of trust. One of the main challenges faced was handing over 10% from the donations for the 'goods and services' tax<sup>9</sup>. However, after five years they won the legal battle against the tax office and accomplished a change in legislation to make allowances for the 'Pay-as-you-Feel' philosophy, which was a momentous success.

<sup>10</sup> Is an app acts as a platform where consumers can indicate their waste amounts and types ready for collection from Eco Friends. Waste is collected in separate categories and so is segregated by consumers prior to collection. <http://www.ecofriends.lk/>

## PART (C) - Proposed Framework

A major driver of global environmental challenge is our current food system, thus the explicit practical aspects of the food industry has been comprehended and acknowledged exactly how it is leading to food waste issues. The enterprises need to thrive in the new digital economy, such as digital nudging technologies for clear strategies to tackle food-waste. Research in this domain lacks a comparative analysis of different nudging elements (Markus Weinmann) and their effectiveness towards different consumers. Technologies based on nudging elements will assist businesses to minimize wastage and cut their losses and risks of new product development as the design of digital choice environments always (either deliberately or accidentally) influences people's choices, understanding the effects of digital nudges in these environments can help businesses lead users to the most desirable choice. Businesses are continually looking for new and impactful ways to better connect with, learn from, and influence the behaviors of employees and customers. By definition, digital nudging focuses on guiding the behavior of individuals, but the effects of digitally nudging individuals can extend to organizational or societal levels whereas gamification is a concept of changing any stakeholder's behavior in non-game settings (Thomas Leclercq) as it taps into motivational drivers of human behavior in two connected ways: *reinforcements and emotions*. It deploys three interrelated game design principles: mechanics, dynamics, and of course, the emotions (Robson) as they are the powerful motivators for a behavioral change in a human, thus a user or a customer in our case. In addition, customer behaviors which lead to satisfying outcomes are more likely to lead to repeated or ongoing behavior changes while ones with unsatisfying outcomes are far less likely to be sustained (Ian McCarthy).

To compete in a digitally transformed world that will require certain innovative ICT technologies to reshape the traditional IT platform architecture for future innovations and improve the customer experience; as this necessitates tapping into consumer-led innovations to open up new opportunities for business growth. Some of the disruptive trends to show how through the appropriate use of above defined gamification principles can make traditional consumer experiences more gamified to include the elements of significance in food industry and manage food waste.

Different business model use-cases such as commercial pre-processing technologies have been highlighted; sourcing unsold food to operate a rescued food restaurant or a physical store or a website where the business resells purchased excess food. However, this research introduces some gaps in these existing techniques and frameworks; such as unavailability of consumer involvement and input and therefore, suggests that a CL proposed framework is a better approach to accelerate the digital transformation for consumer-led and technology-driven innovation for food waste.

As most of the food is wasted at the consumer-end, therefore, models that record inventory<sup>11</sup> to ensure efficiency in ordering and reductions in wasted produce. A framework that facilitates information and communication technology (ICT)-mediated excess food sharing from food businesses to potential customers, or using food waste as an input to produce value-added products in passive/active role for new food product development, would bring new innovations for food waste management.

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<sup>11</sup> Inventories of various distributed Retailers, organizations or companies.

# Business Model

## Food Waste Management Digital Market Place Platform - Business Model Canvas

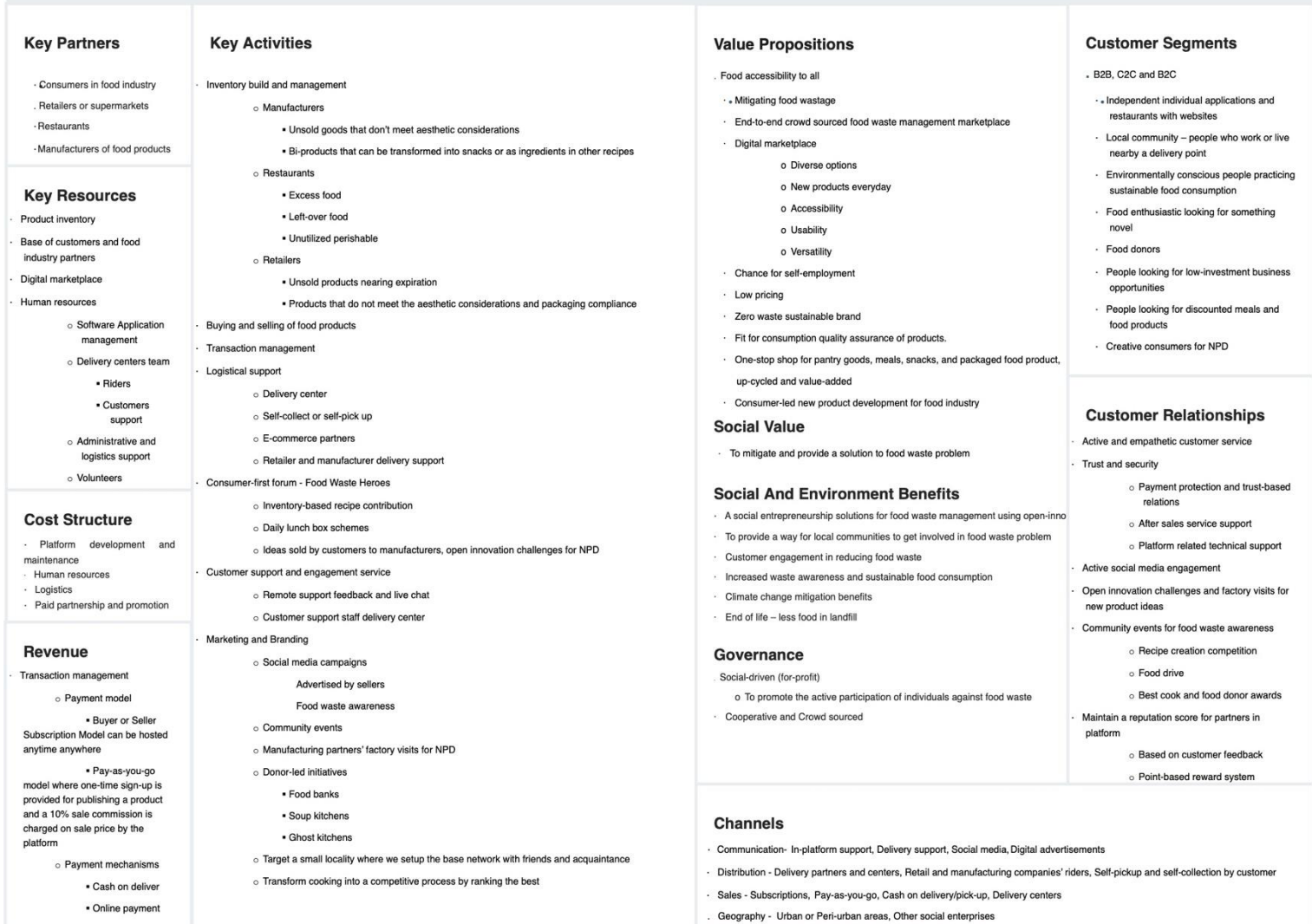


Figure 7. Business Model Canvas of our Proposed Platform.

## Components of Proposed Framework

### Identified Stakeholders or Key Partners

- Consumers<sup>12</sup> in food industry.
- Retailers or the supermarkets<sup>13</sup> and their role.
- Restaurants<sup>14</sup> in the food industry.
- Manufacturers<sup>15</sup> manufacturing the food products.

### Value Propositions

- Food accessibility to all
- Mitigating food wastage
- End-to-end crowd sourced food waste management marketplace
- Digital marketplace
  - Diverse options
  - New products everyday
  - Accessibility
  - Usability
  - Versatility
- Chance for self-employment
- Low pricing
- Zero waste sustainable brand
- Fit for consumption quality assurance of products.
- One-stop shop for pantry goods, meals, snacks, and packaged food product, up-cycled and value-added.
- Consumer-led new product development for food industry.

### Key Activities

- Inventory build and management

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<sup>12</sup> Consumers are the biggest contributors of food waste issues and thus exploring different consumer roles (such as keeping a track of what has been bought and checking the manufacturing dates of products when bought.) to reduce the effect of food waste can be considered in markets/households etc.

<sup>13</sup> Unsold food products being thrown out because they have passed their expiration date

<sup>14</sup> After consumers, restaurants are considered to be the biggest contributor in food waste issues such as producing an oversized portions, inflexibility of chain store management and extensive menu choices

<sup>15</sup> Manufacturers can value-add on products not meeting the aesthetic considerations such as via re-packaging or positive branding.

- Manufacturers
  - Unsold goods that don't meet aesthetic considerations
  - Bi-products that can be transformed into snacks or as ingredients in other recipes
- Restaurants
  - Excess food
  - Left-over food
  - Unutilized perishable
- Retailers
  - Unsold products nearing expiration
  - Products that do not meet the aesthetic considerations and packaging compliance
- Buying and selling of food products
- Transaction management
- Logistical support
  - Delivery center
  - Self-collect or self-pick up
  - E-commerce partners
  - Retailer and manufacturer delivery support
- Consumer-first forum - Food Waste Heroes
  - Inventory-based recipe contribution
  - Daily lunch box schemes
  - Ideas sold by customers to manufacturers, open innovation challenges for NPD
- Customer support and engagement service
  - Remote support feedback and live chat
  - Customer support staff delivery center
- Marketing and Branding
  - Social media campaigns
    - Advertised by sellers
    - Food waste awareness

- Community events
- Manufacturing partners' factory visits for NPD
- Donor-led initiatives
  - Food banks
  - Soup kitchens
  - Ghost kitchens
- Target a small locality where a base network with friends and acquaintance is setup
- Transform cooking into a competitive process by ranking the best

#### Key Resources

- Product inventory
- Base of customers and food industry partners
- Digital marketplace
- Human resources
  - Software Application management
  - Delivery centers team
    - Riders
    - Customers support
  - Administrative and logistics support
  - Volunteers

#### Customer Relationships

- Active and empathetic customer service
- Trust and security
  - Payment protection and trust-based relations
  - After sales service support
  - Platform related technical support
- Active social media engagement
- Open innovation challenges and factory visits for new product ideas
- Community events for food waste awareness
  - Recipe creation competition
  - Food drive

- Best cook and food donor awards
- Maintain a reputation score for partners in platform
  - Based on customer feedback
  - Point-based reward system

#### Customer Segments

- B2B, C2C and B2C
- Independent individual applications and restaurants with websites
- Local community – people who work or live nearby a delivery point
- Environmentally conscious people practicing sustainable food consumption
- Food enthusiastic looking for something novel
- Food donors
- People looking for low-investment business opportunities
- People looking for discounted meals and food products
- Creative consumers for NPD

#### Distributive Channels

- Communication
  - In-platform support
  - Delivery support
  - Social media
  - Digital advertisements
- Distribution
  - Deliver partners and centers
  - Retail and manufacturing companies' riders
  - Self-pickup and self-collection by customer
- Sales
  - Subscription
  - Pay-as-you-go
  - Cash on delivery/pick-up
  - Delivery centers

#### Governance

- Social-driven (for-profit)

- To promote the active participation of individuals against food waste
- Cooperative and Crowd sourced

#### Revenue

- Transaction management
  - Payment model
    - Buyer or Seller Subscription Model can be hosted anytime anywhere
    - Pay-as-you-go model where one-time sign-up is provided for publishing a product and a 10% sale commission is charged on sale price by the platform
  - Payment mechanisms
    - Cash on delivery
    - Online payment

#### Cost

- Platform development and maintenance
- Human resources
- Logistics
- Paid partnership and promotion

#### Social Value

- To mitigate and provide a solution to food waste problem

#### Social and Environmental Benefits

- A social entrepreneurship solutions for food waste management using open-innovation and digital transformation
- To provide a way for local communities to get involved in food waste problem
- Customer engagement in reducing food waste
- Increased waste awareness and sustainable food consumption
- Climate change mitigation benefits
- End of life – less food in landfill

#### Geography

- Urban or Peri-urban areas
- Other social enterprises

## Reflections – Digital transformation and Consumer-led Innovation

Our proposed framework contributes to the ICT for development (ICT4D) or Digital development movement which utilizes ICT for social, environmental and economic uplift initiatives. ICTs also promote innovation and NPD enabling people to enjoy the socio-economic dividends brought-on by the technology.

The application connects buyers and sellers of excess food and food products creating value for social good. Value-added features include a shopping list within the application and multi-user capabilities or recipes to use items that are approaching their expiry date. For example, managing the groceries bought by the customers, and keeping a track of what is in their cabinets at home avoids purchasing duplicate items and allows them to receive notifications about expiration dates. This includes waste made in the kitchens of restaurants during preparation and excessive produce left in storage that is not served before it spoils. Consumers can be sellers as well as drivers of food waste management innovation. They can interact through the *food waste heroes* forum on the platform and partner with manufacturers for by-products utilizations, recipe competitions, continuous feedback for point's accumulation, etc.

This end-to-end digital market place solution for food waste management connects all possible stakeholders under one roof; where everyone is both the contributor and a beneficiary in a crowd-sourced digital disruptive application. In contrast to the previous models and solutions which targets a particular industry or customer segment with either very limited scope of application, or having no consumer-involvement or using traditional methods instead of innovative technologies.

### Limitations

However, despite the merits of existing framework, there exists some limitations and considerations.

**Limitation 1- Food waste at source i.e. agricultural output, farmers are not covered in this model**

Food waste is an economic, environmental, and social disaster. Much of this waste is created at the consumer and retail stages, but a significant amount of produce is also lost in the production and post-harvest stages. There are, however, ways for the agricultural industry to tackle this food waste which the proposed model lacks.

Limitation 2 - Despite a positive brand image strategy, market might still perceive as platform for selling rotten or rejected food.

Brand image and brand equity always exist side-by-side, with the brand image being the key driver of brand equity. For marketers, whatever the marketing strategies of their company may be, their main purpose is to influence the perception of consumers and their attitude towards a brand, establish the brand image in consumers' minds and stimulate their actual purchasing behavior of the brand. All of this consequently increases sales, maximizes market share and develops brand equity. In light of that, while the frameworks marketing strategy is based on consumers' negative perception of food waste, the possibility still exists that it may not be well received particularly from customer segments that holds the quality and aesthetics of food products in high regard.

Limitation 3 - Perishing food industry have limited geographic location as it have limited time and shelf-life

Since food gets easily rotten, their self-life is limited. Various innovative ideas have been approached so far, but nothing has been done on this issue, which is why, it still remains a limitation for this research as well.

## Considerations

### Consideration 1 – Legal and Compliance

In some jurisdictions like European Union, there may be regulatory and conformance checks that the platform owners need to additionally incorporate in their quality control systems.

### Consideration 2 – Information System Management

The digital solution will inevitably entail ISM factors to be regarded and maintained.

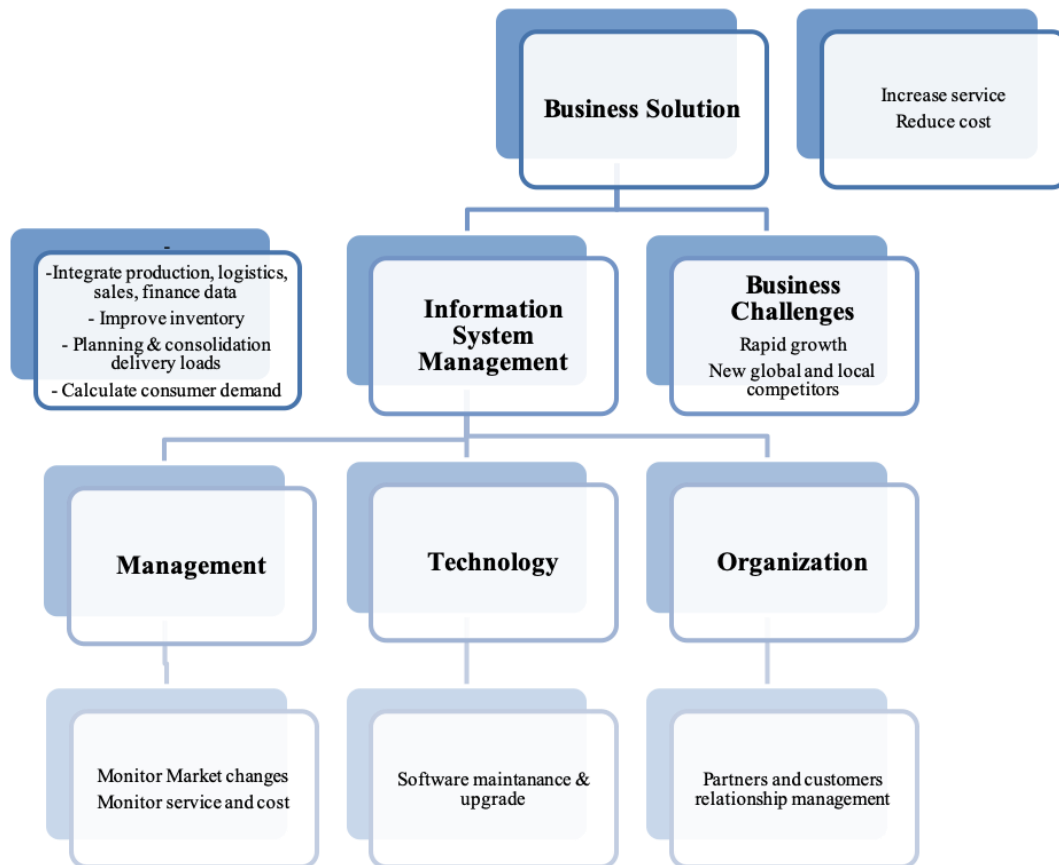


Figure 8. Some of the Information Systems Management considerations. Adapted from (Alkhafaji)

### Business Intelligence for IMS growth and scalability

This research aims at significantly reducing food waste in businesses using latest innovative trends and techniques, as already discussed. However, among these trends comes another consideration of highlighting the business intelligence aspect for the platform for an increased overall businesses profitability (Sarfraz).

Therefore, analyzing the BI trends such as gathering location data, preferences data etc. can help the platform grow by targeting communities which are more active or by identifying the top locations for holding food banks and charity events, or even organizing innovation challenges.

## Recommendations

The application's potential can be truly realized if it's implemented within a well-connected, well-functioning eco-system comprising of food industry partners, public sector and an active community. Consider the following recommendations,

- Establishing stronger partnerships and relations with donors and distributors.
- Effective digital literacy training for volunteers to ensure food security guidelines.
- Collect and synthesis marketed quality assurance<sup>16</sup> factors and issues.
- Establish a cohesive list of Food recovery<sup>17</sup> actions available in businesses to reduce food waste.
- Inspiring new Food innovation<sup>18</sup> actions.

## Alternative Applications

This research model is approached from the best it can, yet there are some alternative applications the system or model can be applied to. For example,

### Digital eco-system marketplace platform – same model application

Digital platforms are an omnipresent phenomenon<sup>19</sup> that challenges incumbents by changing how we consume and provide digital products and services. Whereas traditional firms create value within the boundaries of a company or a supply chain, digital platforms utilize an ecosystem of autonomous agents to co-create value.

### Agricultural supply chain – platform catering to farmers, retailers, producers.

Expression of support for group of people who have been subdued for a long period of time<sup>20</sup>

**For farmers**

Access to markets

Better economic value

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<sup>16</sup> A simple way to recycle food scraps (household composites) in producing a nutrient-rich fertilizer.

<sup>17</sup> Reducing the surplus food, feeding the hungry people, composing re-cycled industrial-use products, landfill disposals

<sup>18</sup> Crowd-sourcing ideas: Identifying innovation as a major driver in increasing the reduction, recovery and re-cycling of food waste economically.

<sup>19</sup> <https://link.springer.com/article/10.1007/s12525-019-00377-4>

<sup>20</sup> <http://www.jiyekisan.com/>

Faster liquidity and  
efficient logistics

Digital payments

**For businesses**

Better quality

Time deliveries

Better economic value

Visibility and

transparency

**For location**

Reduction of food  
wastages

Retail market efficiencies

Technology inclusion

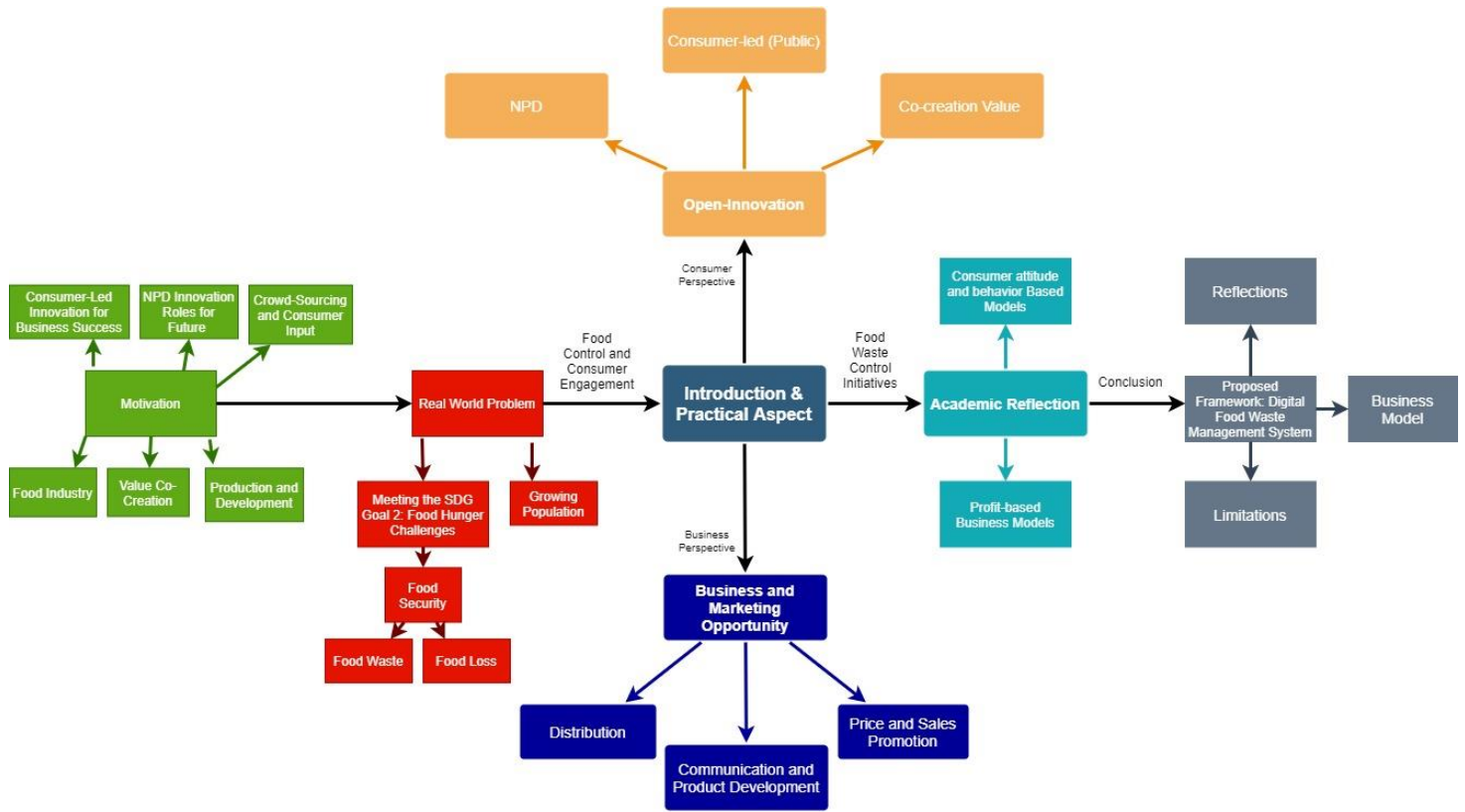
### Competitor pricing models: advanced gamification strategy

A technique known as captive product strategy, it means pricing a product and is one of the most important aspects of marketing strategy. Gamification technique can be used for financial marketing strategy as in involves different gaming algorithms that can bring a shift to realm.

### Charitable campaigns and cultures

Certain campaigns and perishable charities are dwelling into the promotion of food waste control mechanisms, especially in bulk that is being transferred to villages.

# Conceptual Mind Map



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