

Sustainable Business Model to Reduce Food Waste of Agricultural Products in the Retail Chain

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Abstract: Food waste has been a global issue which damages the sustainability of the environment, economy, and human beings from the circular economy's perspective. To reduce food waste of agricultural products in the retail chain, this research tests the effectiveness of five different business models, including for-profit and non-profit types. Be it for-profit or non-profit businesses, the result suggests redesigned regional logistics and e-commerce help reduce food waste. A further investigation on the regional consumer's purchase behavior and lifestyle can also determine the effectiveness of each business model. Most importantly, the realization of circular economy to reduce agricultural food waste in the retail chain relies on the suppliers and consumers working together for the same goal.

Key words: Food waste, circular economy, logistics, business model, e-commerce, sustainable.

1. Introduction

According to Food and Agriculture Organization of United Nations, one-third of food is either wasted or lost every year in the process from farming to being served [1]. In fact, wasting food also means wasting energy and other natural resources, such as land and water, which are just as precious as food. As famine continues to rampage some regions around the world, those who can afford food must take reasonable and responsible consumption of food into consideration. Therefore, the European Commission is currently working on the goal of reducing food waste by one-half throughout the European Union by 2020 [2].

Similar situation is happening in Taiwan. Food worth one billion dollars is wasted every year, especially the food that requires to be stored at low temperature such as agricultural products. Which means food and agricultural product retailers in Taiwan need to take on the responsibility of reducing waste. It is part of the corporate's social responsibility to utilize each kind of food to reach of the goal of circular economy. The results will benefit both the corporate and the environment. Therefore, the research aims to test five strategic sustainable business models to reduce waste of food and agricultural products in the retail chain in Taiwan.

2. Literature Review

Increasing population worldwide and consumption are causing difficulties in agriculture and scarce on natural resources. Nowadays, approximately a billion people are suffering from malnutrition, but our current agricultural systems are degrading land, water, and climate on a large scale. To meet the world's

future food security and sustainability needs, food production must grow substantially [3]. However, focusing on increasing agricultural production may not be the only way to bring an end to famine. Other solutions must be developed before the problem worsens.

Campoy-Munoz *et al.*, (2017) claim that the majority of researches focus on the amount of food wasted rather than on the monetary value of food waste. In other words, if people are aware of the actual price they have to pay for the food waste, they may be able to take the problem seriously. Consequently, a more responsible and reasonable consumption can be cultivated to ease the lacking of food globally if people are provided with meaningful information. Then, the idea of applying circular economy in our daily life can come along to achieve the goal of reducing food waste.

While circular economy is one of the hot topics nowadays, corporates, scholars, and practitioners are in search of sustainable business models that may help the economic growth and protect the environment. The most widely adopted definition of circular economy provided by Ellen MacArthur Foundation (2013) states, "A circular economy is an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models." [4]

The core principle of the definition is to eliminate waste. When waste no longer exists, excess labor and resources can be avoided. Take fruit, with limited shelf life, for example. While each part of the fruit can be used rather than simply being consumed as food, the fruit is capable of reaching its greatest function. However, the imperfect and ugly produce may not be as lucky to make its way to the checkout counter. Its destiny is most likely going to the landfill [5]. Hence, a new system is needed to be developed to reduce food waste (Fig. 1). The flesh of the fruit can be turned into juice, jam, or fruit candy. The peels can be turned into detergent, enzyme, and fertilizer. The goal of the end products not only seeks for more commercial value but also does little harm to the environment. The process keeps the agricultural products and materials in use by turning them into by-products. Eventually, the result can help regenerate natural systems, which leads to reduce the waste of labor, energy, and natural resources from farming.

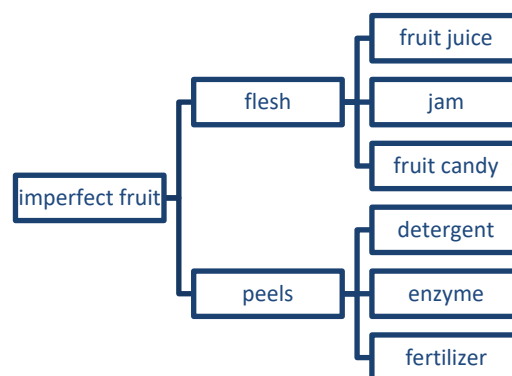


Fig. 1. A system to utilize imperfect fruit.

With the 3R framework, reduce, reuse, and recycle, widely applied in production, Kirchherr *et al.* (2017) suggest that enablers, which are defined as business models and consumers, must be taken into consideration in the development of circular economy. The role of the enablers is not yet widely discussed in literature [6]. However, Ghisellini *et al.* (2016) argue that consumer responsibility is critical for implementing circular economy successfully [7]. In short, reducing food waste is not the responsibility of a business, but a mission for all human beings. The effort must be made with support from the logistics and consumers in order to achieve the preferable target.

3. Methodology

Heyes *et al.* (2018) suggest that the service sector can help encourage the formation of circular economy. With supporting methodologies and real-life applications, the principles of circular economy are able to be adopted by service-oriented companies [7]. To eliminate waste of agricultural products, a business, in the project, a supermarket, must explore innovative business models and service ideas, such as developing local e-commerce platform and applying agile logistics, that can attract and include potential consumers, the enablers. In other words, the business has to investigate and analyze different types of consumers in the local region and their styles of operation. In addition, a platform of shared product information must be set up to meet the needs of both suppliers and consumers. With the goal of reducing waste in the retail chain, a sustainable business model must help consumers manage their inventory and provide job opportunities for logistic providers. Which matches the positive and ultimate results of circular economy: to protect the environment, to enhance economy growth, and to provide social benefits.

3.1. Preliminary Preparation

Prior to testing the strategic business models, three retail chain stores are invited to join the operation in central Taiwan area, where the network of logistics has not yet fully developed. Job opportunities from logistic providers still have room to grow. In addition, the purchase habits of local people remain traditional. That is, people and businesses tend to run places to look for goods and compare prices. Which wastes time and energy in the process. In fact, with the idea that companies can lower the cost of investment, reduce risks and share information by working jointly towards mutual goals [8], the research would like to involve suppliers and consumers to realize the possibility of sustainable business models. One of participating suppliers is a chain supermarket with over 1,000 stores nationwide. Each of the branch supermarkets is able to provide services to a small region. The other two retail chain stores are known locally in central Taiwan. The platform of product information, an app and a website, is set up, updated and maintained constantly by the participating retail stores; therefore, the local consumers are able to have an access to the product information at any time anywhere. In addition, several local consumers, including businesses and communities, with special needs are interviewed and invited to join the operation.

To make logistics more flexible based on the needs and quantity of produce, three different modes were set up for delivery: refrigerated trucks, scooters equipped with cooler box, and self-pickup. When a consumer, such as a restaurant, orders a large amount of agricultural product, a refrigerated truck is used for delivery, making sure the freshness of the products. The main focus of the research is on the scooters equipped with cooler box, which provide more timely, agile and flexible ways of delivery. While some consumers still prefer self-pickup, this kind of delivery is still available but not encouraged.

3.2. Five Strategic Business Models

From the perspective of industrial circular economy, the focus has been on how different manufacturers are about to share and reduce the usage of limited resources, creating a more sustainable environment. However, from the perspective of social science and management, encouraging the customers' sustainable behaviors is a key factor in achieving long-term circular economy [9]. Therefore, the strategies adopted in the project focused on latter which is to boost customers' awareness of sustainability.

There were five strategic business models set up in the project with the goals embedded (Fig. 2). Each business model was tested to determine its effectiveness and deficits. In general, the strategic business models can be divided into two categories: for-profit and non-profit. The for-profit oriented strategy was designed for the suppliers to make tangible profits. The suppliers were still able to make profit by selling the close-to-expiration food and agricultural products at lower or discounted prices; therefore, the loss can be limited and reduced. However, the non-profit oriented strategy is to help a supplier make intangible

profits, such as building a positive corporate image and reducing the amount of close-to-expiration inventory.

The four major consumers of the for-profit oriented strategy are local restaurants, alternative food services, local offices and residential communities as well as FoodNet ethnic group.

Unlike chain restaurants across the nation, local restaurants, because of their relatively smaller business scales, require more precise inventory control to reduce cost and to maintain the quality of food. Negotiating prices with suppliers may not be as easy for them. However, their menus appear to be more flexible than the large chain stores. Therefore, they are able to adjust their menus based on the product information provided on the information platform.

Alternative food services are caterers who provide lunch to local schools and offices. Since the price of each meal has always been the major concern of their customers, the caterers need to pay close attention to the cost of materials. Similar to the local restaurants, the product information platform serves to help them lower the cost by modifying their menus.

Local offices and residential communities are the groups consist of small families that may visit the markets once a week or even more frequently. Most of the members in the research are working women who have limited time to do grocery shopping. With the information platform, they may be able to do grocery shopping online without physically visiting the markets, which may operate only during the business women's working hours. While the agricultural products provided by the chain stores are checked, properly stored in low temperatures, and certified, the quality of food can also be guaranteed.

Finally, the FoodNet ethnic group is a special community in central Taiwan. The members were mostly Muslims from foreign countries, such as Indonesia and Malaysia, with strict food regulations. Occasionally, purchasing food can be problematic because of the food's resources. In addition to special needs for food, the language barrier is a concern. The majority of the members in the community cannot read Chinese. Therefore, the platform that provides product information in English can be helpful for the FoodNet members to search for edible food at reasonable prices.

The only participant of the non-profit oriented strategy was the OProSS Charity, which continuously helps poor people in the south African region. From the research, OProSS Charity collects close-to-expiration food products from the suppliers for free and sells the products at low prices to college students. OProSS aims to help the poor with the money made. At the same time, the close-to-expiration food can be utilized, and the college students can save some money on food.

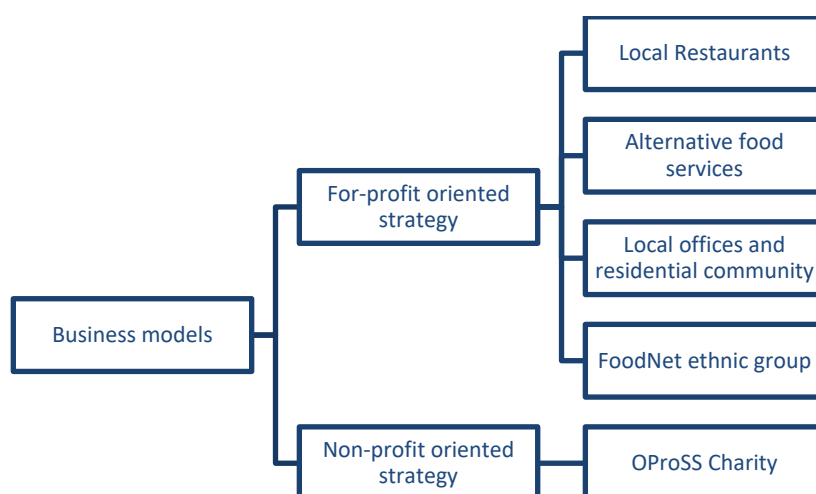


Fig. 2. The five strategic business models

3.3. The Performance Index

To test the effectiveness of the give strategic business models, the performance index was established based on the three dimensions of circular economy: environment, economy, and social equity. Frosch and Gallopoulos (1989) claims that the modern linear flow of material and energy would cause trouble to the sustainability in environment, economy, and society [10]. The focus of the development of circular economy has been placed on those three dimensions in the past decades [11], [12].

- 1) The waste agricultural products is reduced. (economy and environment)
- 2) The profit is created. (economy)
- 3) The time is saved. (economy)
- 4) The cost of logistics is lowered. (economy and environment)
- 5) Job opportunities are created. (social equity)

4. Results

Overall, the results varied in each business model; however, the outcome demonstrates that each business model can be sustainable and helpful to reduce waste of agricultural products in the retail chain. The results are provided through interviewing the participants of the research.

4.1. Local Restaurants and Alternative Food Services

With the updated information platform, the local restaurants and alternative food service caterers are able to manage inventory better. It was no longer necessary to reduce cost by purchasing and stocking up a large number of agricultural products and materials. Which saves them storage space and manpower on inventory control. While they were in need for small amount of ingredients, making frequent trips to the markets is not necessary because the ingredients can be delivered by the suppliers using scooters. Moreover, the prices of agricultural products and food were crystal clear on the information platform, saving the restaurant owners time and energy on comparing prices from different suppliers. Which means, the frequency of delivery from different suppliers or the trips to visit different suppliers is reduced. That is, carbon dioxide emission from cars can be lowered. An interesting side effect is that the restaurants and caterers are encouraged to change their menus from time to time, making their customers interested in the “new” menus.

4.2. Local Offices and Residential Communities

This business model works the best in the research. While a group of people in the same office or residential community order from the platform, excessive trips and time to visit supermarkets are saved, especially for working women. The consumers browse the information platform during lunch break and place order, making shopping fast and easy. The agricultural products and food can be delivered to the designated location at the designated time, preferably in the late afternoon. The services save them time and energy to do grocery shopping after work or during the weekend. The only logistic trip made is the participating supermarkets delivering goods to the office or the residential community. Moreover, the close-to-expiration agricultural products with discounts attract attention of the working women and housewives because they can help save the household budget. In other words, carbon emission can be reduced and food wasted are limited; the collective effort has made circular economy possible and sustainable in such business model.

4.3. FoodNet Ethnic Group

As for the members of FoodNet, the information platform served as an additional resource to look for affordable agricultural products and food. The cost of logistics fails to reduce as tremendously because the

members tend to make purchases and pick up goods individually. However, the information platform still helps reduce waste if FoodNet is able to recruit more members and its members had access to the platform.

4.4. OProSS Charity

OProSS Charity successfully helps the chain supermarket solve the problem of food waste by selling the close-to-expiration food to college students. Although the chain supermarket is not able to make profit out of the sale, the positive image of corporate social responsibility is created, making consumers more confident with their food products. The function of logistics does not involve much in this business model because volunteers from the Charity pick up the close-to-expiration food from the supermarket branches.

5. Implications

According to the findings, sustainable business models which promote circular economy are highly possible when suppliers and consumers work hand in hand towards the same goal.

First of all, the development of local e-commerce can help develop circular economy at a local region; however, careful study of the local people and businesses remains a task that requires effort to determine the effective business models. People in central Taiwan may have different shopping habits and preferences from those who are in Northern Taiwan, especially the metropolitan area. Therefore, understanding the demography plays an important role in developing successful local sustainable business models for the retail chain.

Moreover, an access to a platform that provides clear product information helps reduce agricultural products and food waste in the retail chain. With more people knowing the information, the possibility of selling close-to-expiration food is higher. Hence, waste can be reduced. In order to attract more users, the information platform must be designed in different languages based on the needs of the local population.

Furthermore, agile logistics is critical in helping reduce food waste and promote circular economy in the local region. While consumers can make less trips to the supermarket, the more likely they are willing to become part of the circular economy. By using less refrigerated truck but more scooters with cooler box, logistics becomes more flexible. While the delivery routes can be carefully planned, it is possible to reduce greater carbon emission and increase more delivery job opportunities for the local people.

Finally, with data collected from the information platform, the supermarkets are able to determine the real-time shopping habits of the local people. Therefore, it may help the supermarkets with their own inventory management. They may be able to make better prediction when ordering agricultural products. Consequently, possible food waste can be reduced from the very beginning.

6. Conclusion

Circular economy can be realized at any scale, including the local region, as long as business models are well planned in advance. A detailed research based on the local needs provides a greater chance to educate local people to make joint effort to save the environment. With the support of flexible logistics and technology, circular economy at the local region can be sustainable. Hence, carbon emission can be lowered and food waste can be reduced. Saving the environment is not necessarily equal to higher cost for the society. In other words, when each party in the circular economy can benefit from its operation, the environment, the economy and the social equity will sustain and continue to grow.

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