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Article

WHAT A WASTE!

AN EXPLORATORY STUDY OF THE FOOD WASTE MANAGEMENT IN THE MEAL-KIT INDUSTRY IN NEW ZEALAND.

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ABSTRACT

Food waste is not only a financial and environmental issue but also a social problem. Billions of tons of food are thrown away while millions of people go hungry worldwide and it is costing billions of dollars in losses for businesses in the industry and causing harmful effects to the environment. The meal-kit industry is pushing to eliminate food waste through their business strategy of providing pre-portioned and pre-packed meals to their customers and by shortening the food supply chain using the farm-to-table method. This research examined the status of food waste in their production warehouses and reviewed the food waste management practices within the industry using Root cause analysis tools, supported by industry and internet research. Data gathered shows that there is indeed food wastage occurring within these meal-kit production warehouses. The main factors identified which were contributing to food waste include the low quality of products and ingredients being packed, problems with packaging and labelling, errors by packing employees, and poor inventory management. The research recommends several measures and steps to resolve the identified problems, including the repairing and upgrading of the equipment in the meal-kit production warehouse, the introduction of training for employees regarding food rejections and quality control as well as review of the non-comliant suppliers. In addition, rejected food can be donated to employees or charity organisations, in accordance with the Food Act 2014, thereby creating a new sustainable business strategy that uses imperfect or slightly damaged products, that they can market at a lower price range.

Keywords: food waste, waste management, meal-kit industry, food warehouse practices, warehouse management, inventory management

INTRODUCTION

The meal-kit industry provides a food subscription service that delivers prepacked restaurant-level meals with easy-to-follow recipes directly to their customers' doorsteps (Mate, 2021). It is a business model that revolves around giving customers an easy and convenient way to prepare healthy home-cooked meals by putting together fresh and organic ingredients for various recipes, including vegetarian options, and delivering them directly to their customers. The meal-kits are delivered in boxes containing ingredients placed separately in paper bags according to their respective recipes. On the other hand, meats and other products that need to be insulated are placed in a cool pouch with ice packs to keep the temperature low. Lastly, recipe cards are included which contain instructions for food storage, preparation, and cooking. Meal-kits had a boost in their orders and customer subscriptions during the Corona virus disease (COVID-19) pandemic as people were at home and in lockdown, which made it more appealing to order online and avoid the hassle of going out to the supermarket to line up as per the COVID-19 mandatory restrictions. It was also a more popular option since many restaurants were closed due to the COVID-19 restrictions (MarketLine, 2021).

The mission of the meal-kit industry copanies is to "change the way people eat" (HelloFresh, 2023) using four main pillars including budget, health, taste, and sustainability. The industry's goal is to give its customers access to high-quality food and various tasty recipes without breaking the bank. It also promotes sustainability and less food waste by supplying ingredients that are all pre-portioned into packets or sachets to ensure that all ingredients and products are consumed (Duffy, 2023). Moreover, meal-kit companies utilise carbon dioxide (CO2) neutral delivery methods which reduces the amounts of greenhouse gases into the atmosphere (Levin, 2019).

Food waste is defined by the United Nations Environmental Programme (UNEP) (2021) as products that have gone through the food supply chain and are acceptable for consumption but are thrown away or discarded. It is considered a financial,

environmental, and social issue as it results in revenue losses for food businesses as well as destruction of land and water resources and an increase of greenhouse gases released into the atmosphere (Sood, 2022). Furthermore, global hunger is continually on the rise despite having a surplus of food supply with most of it being thrown away (FAO, 2023). The information and data from this research will be valuable for the meal-kit industry to help them improve their sustainability methods and business model to achieve their environmental, social and governance (ESG) goals, but also benefit humanity.

LITERATURE REVIEW

According to the UNEP (2021) Food Waste Index Report for 2021 shows that 1.3 billion tons of food is wasted yearly and yet, the World Health Organization (WHO) (2021) estimates that there are 690 million people who are hungry and undernourished. Food waste is defined as food products that go through the complete supply chain cycle and are of acceptable quality but are not consumed (UNEP, 2021). The effects of food waste go beyond throwing away food that could feed the hungry, it also has a negative effect on the environment as food discarded into landfills emit greenhouse gases which are harmful to the environment and exacerbate climate change (Love Food Hate Waste, 2021). In addition, according to the Food and Agriculture Operations of the United Nations (FAO), other negative effects of food waste include squandering all the resources used in the different stages of the supply chain such as land, freshwater, and petrol for transportation (Levin, 2019).

The fundamental aspect of sustainability within meal-kit companies is to reduce food waste at home by providing pre-measured, pre-packed, and pre-planned meal-kits which ensures that all ingredients and products are used and there would be little to no leftovers (Safdie, 2023). Their business model revolves around reducing food waste within their customers' households (MarketLine, 2021), but it would be interesting to look at what is going on in their backyard, the production warehouses, where the meal-kit boxes are packed and manufactured. As an example, according to the HelloFresh sustainability report, in 2021, they donated over 10,000 fresh edible unsold food products to charity, which accounts for 68% of the total surplus food (HelloFresh Group, 2023). Considering that the meal-kit companies have several packaging facilities worldwide, this means that these facilities are each producing approximately 1% food waste which could pose a risk to the food waste reduction and sustainability efforts of the industry thus it is in the best interest of meal-kit companies to manage and resolve this issue.

Root cause analysis (RCA) tools and management concepts were used to gather baseline data and identify issues or concerns within or which the meal-kit companies is facing. This research used brainstorming with peers to gather all possible ideas and opinions regarding the topic. The information gathered was then organised into different categories using a fishbone diagram to give a clearer picture of the issue at hand (Tableau, 2023). Lastly, a strength, weaknesses, opportunities, and threats analysis (SWOT) was conducted to identify areas that the meal-kit company needs to focus on and to verify if the details gathered using the RCA tools were accurate (Business Research Methodology, 2023). On the other hand, the management concepts such as the 3Cs (company, customers, competition) allowed the researcher an opportunity to conduct an in-depth analysis of the three key factors that are associated with business success (Ōmae, 2007). The use of the 3Cs framework provided valuable information on the companies within the meal-kit industry, their customers and their competition which could be used to ensure the viability and sustainability of the meal-kit industry. Another management framework the researcher used is Henri Fayol's 14 Principles of Management (Carter & Fayol, 1986), which focused on fair remuneration, order, and stability of tenure and how each is relevant to food waste management within the meal-kit industry. The selection of the RCA tools and management concepts for this research as well as how each tool was used in relation to food waste management and is explained further in the results and analysis section.

METHODOLOGY

The data collection methods utilised for this research were observations and internet research both used to gather primary data and secondary data. Observation is a research method that involves collecting data by studying and noting down the behaviours of individuals within their natural setting (Allen, 2017). On the other hand, internet research is a data collection method using information found online from reliable resources such as academic journals, articles, reports, and statistics (Macdonald, 2023). The data gathered was then collated and analysed using quantitative methods such as tables and figures for the information gathered from observations as well as qualitative methods such as narrative analysis for the data from online sources (Dawson, 2009).

The researcher chose the observation method as she was an employee of a meal-kit company and this data collection method gave a first hand experiences of the identified issues and challenges. The researcher was able to observe and study the production processes in the different assembly lines within the meal-kit production facility. The various roles within the meal-kit company also gave the researcher a broader insight into the various circumstances and challenges occurring during the stages of production. The data gathered was limited to observable behaviour and procedures occurring within the meal-kit company's packaging warehouse facility during the work shift of Fridays and Saturdays, 2:15 p.m. to 10:00 p.m. The observation period covered a total of six (6) evening shifts over three (3) weeks.

Online resources were used to gather information on food waste and food waste management within the meal-kit industry in New Zealand as well as global conditions to create a baseline data. The researcher also reviewed research studies and recommendations by scientists and experts using internt research, on sustainability and how to minimise food waste.

Ethical Consideration

The researcher followed strict ethical standards to ensure the safety and privacy of all stakeholders. The research does not include any names or personal details of any participant and the information about the meal-kit industry has been taken

from the company websites and has been referenced. The research included observation of processes and behaviours towards sustainability initiatives of the employees in the meal-kit production line, but no participants were invited to take part in any formal or informal interviews. The documents observed have been highlighted for the data analysis without the company or location details. Furthermore, the research only used publicly available company information, no classified document was used (Dawson, 2009).

Limitations

This research research was limited in terms of the following variables, time constraints, limited access to internal information, data collection methods, sample bias, and scope of discussion. Resources in terms of the labour force, funding and data were restricted as this was student-led academic research which can only utilise the information that was publicly available and there was no financial support available. In line with this, time was also limited as there was a schedule that had to be followed for paper submissions and deadlines. Data gathering was also controlled in that the only participants allowed for interviews or surveys were students from the researchers class or those studying at Otago Polytechnic Auckland International Campus (OPAIC) which created sample bias given that the participants were chosen for convenience due to ethical considerations. Although, it should be noted that the researcher was allowed to use their workplace observations and experience to include in the analysis. Lastly, the scope of discussion is limited by the sparse experience of the researcher on the topic of food waste management thus the analysis would not be as in-depth compared to the works of experienced researchers.

RESULTS AND ANALYSIS

The data gathering using the RCA tools, management concepts, observations and internet research are discussed subsequently.

Root Cause Analysis Tools

Brainstorming

Brainstorming is a group problem-solving methodology introduced by Alex Osborn in 1953, and it involves gathering pqrticipants and getting them to share their thoughts and ideas related to a particular subject or issue (Besant, 2016; Osborn, 1953). It is critical to encourage the participants to think freely and creatively and make everyone feel that their input will be accepted without judgment and criticism (Gregersen, 2018). An advantage of brainstorming is having different participants with different backgrounds who can offer varying perspectives about a chosen topic thus obtaining diverse points of view regarding the matter at hand.

The brainstorming activity was a tool that helped the researcher gather additional information on the probable causes of food waste within the meal-kit industry as shown in Figure 1 below. The varying points of view and opinions of the participants enabled the gathering of new ideas and perspectives regarding the topic. Given that the researcher was mainly able to observe the production process within the meal-kit packaging facility, the main issues identified were about the employees and the working environment, but the brainstorming activity presented other problems such as those concerning inventory, production planning, hardware, and software trouble.

Figure 1: Brainstorming on the Food Waste in the Meal-Kit Industry

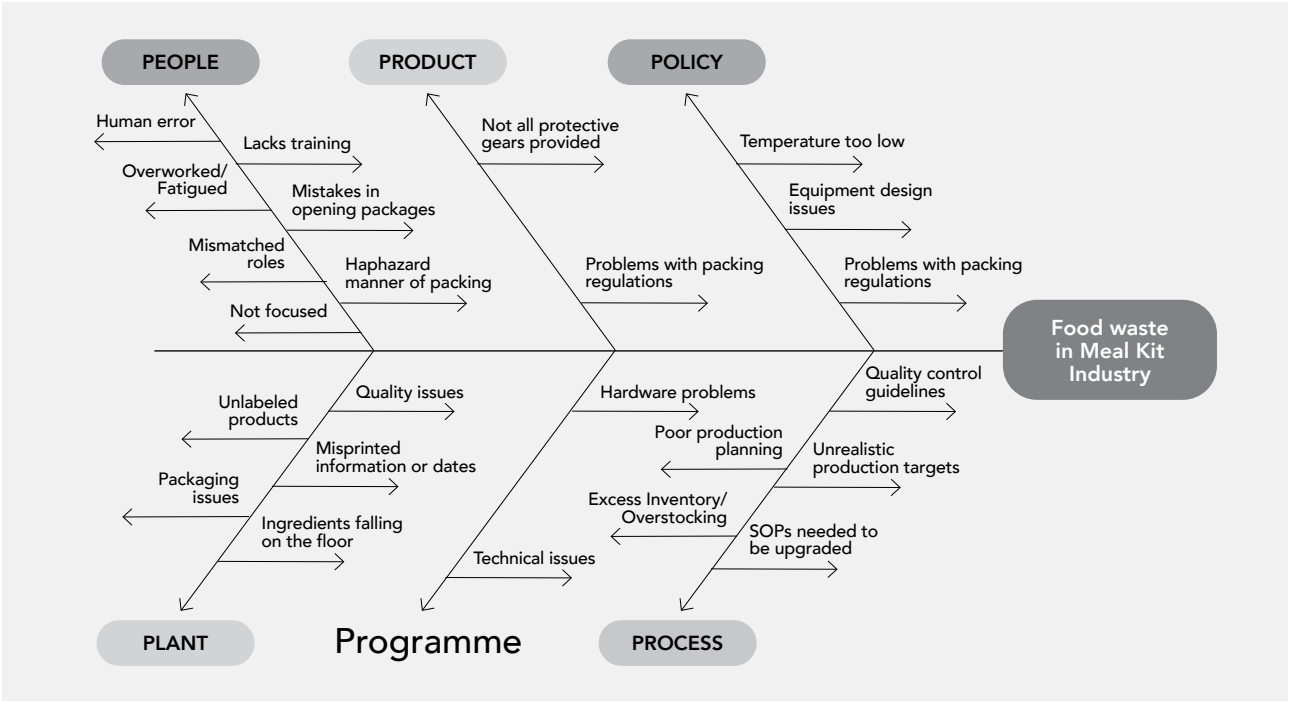
Note: The figure shows all the possible causes for the food waste in the Meal Kit business.

Fishbone Diagram

The Fishbone diagram also known as Ishikawa diagram is a cause-and-effect analysis tool created by Kaoru Ishikawa in the 1960s (Ishikawa, 1976). The diagram is named as such because it resembles a fish bone with the selected topic or problem placed on the rightmost side or the "head of the fish" and the ribs denote the principal classification or categories of the identified root causes. The sub-causes can then branch out from the leading root causes and the spread would depend on the diversity of the identified sources of the problems. The fishbone diagram is useful in identifying the possible causes and sub-causes for a problem. It is also helpful in sorting ideas into categories for a more organized and objective analysis (Ishikawa, 1976).

The fishbone diagram was used to organise the ideas from the brainstorming activity into six categories to make it wasier and more convinent to identify the main causes: People, Product, Policy, Programme, Plant, and Process or the 6Ps as shown in Figure 2 below. The data in Figure 2 shows that food waste is associated with three groups which are people, product, and process. The employees working at the meal-kit packaging facilities are mostly in charge of handling the food and putting it in bags or boxes, thus they are an important aspect of the production process. Their overall physical and mental state as well as their training are factors that affect the amount of food waste during production. On the other hand, the quality and condition of the ingredients being packed are other elements that can influence the amount of food wastage. Lastly, processes in place at the meal-kit packaging facility such as production targets and inventory also greatly impacted on the amount of food waste, such as the overstocking of perishable goods. These subjects will be the three main focuses of the discussion.

Figure 2: Fishbone Diagram (6Ps) Used to Analyse Food Waste Issues in the Meal-Kit Industry from the Outcomes of Brainstorming as the guiding points



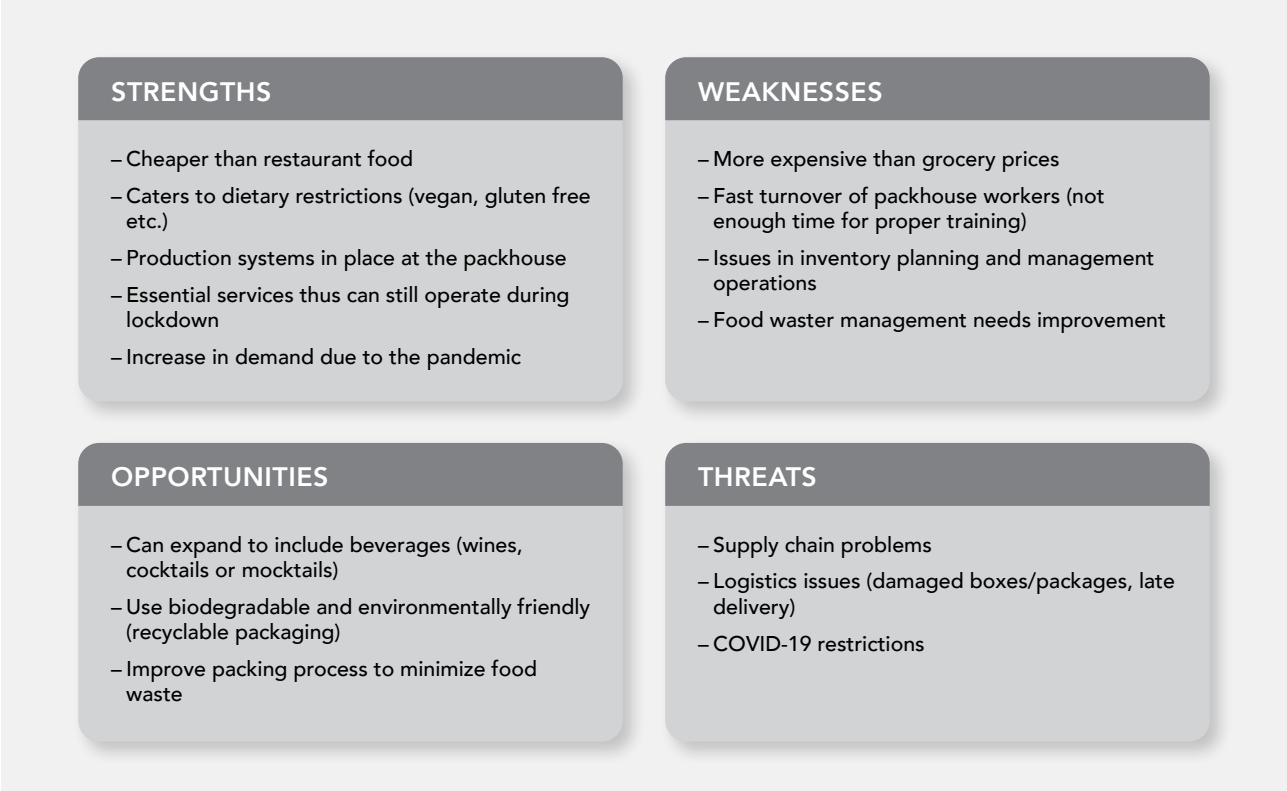
Note: The Figure 2 above shows the mapping of the possible causes on the 6Ps on a Fishbone Diagram. The possible causes from the Brainstorming ideas from Figure 1 have been used.

STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS ANALYSIS

A SWOT analysis is a strategic analysis and planning tool that summarises the strengths, weaknesses, opportunities and threats within a company (Schooley, 2019). The strengths describe internal factors that the company is doing well or their practices which are successful, while the weaknesses are also internal elements that the company is lacking, these are the identified areas for improvement. On the other hand, opportunities are external aspects which could be advantageous for the company and threats are also external components that could be potential risks for growth or success (Schooley, 2019).

The SWOT analysis results produced a baseline assessment for the meal-kit industry as shown in Figure 3 below. It provided a picture of what the meal-kit industry was doing right and what areas needed improvement. In addition, it also lists the elements that could be used to leverage success and those that could disrupt its future growth and viability. This research will focus on the identified weaknesses and opportunities for the meal-kit industry in New Zealand, this includes issues and complications within the meal-kit packaging facilities, which results in food wastage such as problems in inventory and the production processes.

Figure 3: SWOT Analysis for the Meal-Kit Industry



Note: The figure shows the application of the Strength, Weaknesses, Opportunities and Threats for the Meal Kit Industry which has been use to map the strategic position of the meal kit business.

Management Concepts

3Cs (Company, Customers, Competition)

The 3Cs is a strategic management concept focused on three key factors for business sustainability: company, customers, and competition (Ohmae, 1982). It is crucial to incorporate these three elements to ensure a successful business strategy and help a company maintain a competitive advantage. The model was created by Kenichi Ohmae, a Japanese management consultant and organisational theorist to aid in long-term and short-term strategic planning for companies (Ohmae, 1982). The 3Cs framework for the meal-kit industry is discussed below.

Company

The mission of the meal-kit industry is to change the way people eat by providing convenient and healthy options within budget (Duffy, 2023; Mate, 2021). They offer prepacked ingredients and seasonings with recipe cards delivered to customers to make cooking quick and easy (MarketLine, 2021). The meals can be customised depending on the number of people consuming the food as well as their dietary requirements and taste preferences (Mate, 2021).

Customers

The demographics of the target market of the meal-kit industry are customers between the ages of 30 and 50 who are mainly working full-time, young professionals and families where both parents are employed. These are customers with a hectic lifestyle who do not have enough time for grocery shopping and preparing everyday meals. They are also the group who have extra income which can be allotted to meal subscription services (Gitnux, 2023).

Competition

Over the past years, there has been an increasing demand for meal-kit delivery services worldwide. The convenience of having ready-to-cook meals on your doorstep with just the click of a button has been appealing for a segment of the market (Gitnux, 2023). The main competitors in the meal-kit industry in New Zealand include World on Our Plate (WOOP), HelloFresh, MyFoodBag, and FoodBox among some other small players (Junn, 2021). All these meal-kit companies offer similar meal-kit delivery services with varying recipe selections and offerings as well as slight price differences. In addition, MyFoodBag uses packaging that is more environmentally friendly such as paper sachets and wrappers although relative to other meal-kit providers, HelloFresh uses fewer plastic containers and there is room for improvement in this aspect in order

to provide better environmental sustainability. WOOP on the other hand produces the least amount of waste during meal preparation, has packaging materials suitable for kerbside recycling and lets the customer return the packaging with the next order which is recycled after sanitisation (Junn, 2021).

Henri Fayol's 14 Principles of Management

The 14 Principles of Management were developed by Henri Fayol who is recognized as the father of scientific and modern management (Fayol, 1917). Managers use this tool as a guide in the decision-making process, to improve their management practices, and to help improve the motivation of their employees (Rodrigues, 2001). Of the fourteen principles, the research will mainly focus on three principles: remuneration, order, and stability of tenure.

Fair Remuneration

Work compensation, which can be monetary such as salary and pay or non-monetary like compliments or credits, are some of the identified motivators for productivity (Bacud, 2020). In the meal-kit industry, the pay rate per hour of the employees would vary depending on their assigned job and the amount of manual labour involved, although there is not much difference between the pay rates, approximately $1 per hour. The team leaders would also encourage the employees to motivate them to work faster to reach the quota for the shift. The pay rate within the industry is generally above minimum wage but for some employees, this is not enough to cover the high cost of living in New Zealand.

Order

The concept of order in the workplace can be classified into material order which is concerned with the arrangement of equipment and social order which involves the appropriate roles and resources (Juneja, 2023). The meal-kit company's meal-kit production facility is systematically organised with each production area allotted its own space. Although in the meal-kit company observed, some of the equipment was damaged and needs repairing or upgrading. An example of worn-out equipment is the rail system in the production line, which makes it difficult for the employees to push the boxes along the line as some of the boxes get stuck in broken areas. This in turn disrupts the production process and can cause the employee to lose focus. On the other hand, the social order in some of the meal-kit production warehouses could use some improvement as the roles would change daily depending on who is present during the shift. The line leaders also shuffle employees around if they observe that they are not performing well in a particular assigned task, although this eventually helps speed up the production work it can also cause disruption at the start as employees are pulled in and out of the production line.

Stability of Tenure

Tenure is defined as having a permanent position within an organisation or company, and means employees having job security in their place of employment (Cambridge Dictionary, 2023). In terms of Fayol's management principle, this concept is associated with having higher retention rates for employees, thus less time and money is allocated for recruitment and training (Juneja, 2023). Based on my observations, the majority of the employees in the meal-kit companies are hired on a contractual basis with the majority outsourced from employment agencies offering temporary jobs and there are only a handful of full-time permanent employees who are directly hired. Thus, the rate of employee replacement is quite high at the production plant, which means that new employees are hired on a regular basis and the induction for the job is quite brief and lacking.

OBSERVATIONS

Amount of Food Wastage

Table 1 below shows the kind of food products and the corresponding amount which were disposed of in the enviro-waste bins located in the production area. Food inside these enviro-waste bins is discarded or thrown away during an evening work shift which is a total of 7.5 hours. Food waste includes vegetables, fruits, herbs, canned goods, sauces, spice blends, meat and dairy products. Looking at the number of pieces of food rejected and disposed of, one can conclude that the amount is not big, but it is still significant considering there are two shifts in a day and production is ongoing six days a week and this is only one meal-kit production facility out of the fourteen company currently operates in New Zealand. Adding up all the daily wastage within this meal-kit company increases dramatically the total amount of food waste across this New Zealand meal-kit company. These figures serve as an example of the food being wasted typically while preparing the meal-kits.

Table 1 below also shows the number of pieces/packages rejected of the raw ingredient while completing a quality check and not used in the meal-kit preparation and the explanations of the reasons are as follow:

Legend 1 (Quality): The quality of the ingredient does not meet the specifications or standards in terms of freshness, blemishes, or size as per the purchase specifications.

Legend 2 (Packaging): The size of the ingredient is either too large or too small and cannot be used as per the recipe being prepared for the meal-kit.

Legend 3 (Human Error): Indicates the rejection reason is due to a human error and includes dropping the product to the floor, cross-contamination possibility, dropping on the floor or any such error which does not correspond to Legend 1 and Legend 2 and is the result of carelessness while handling the ingredients.

Legend 4 (Combination of Quality/Packaging or Quality/Human Error): Indicates a combination of the above described Legends

A combination of the above legends were used for documentation and training purpose and have been captured in the below table accordingly.

Table 1: List of Wasted Products and Their Corresponding Amount and Reason for Rejection

S NO	FOOD ITEM	NO OF PIECES	REASON FOR REJECTION (LEGENDS)
1	Basil (15 gms)	35	1,2
2	Oregano (10 gms)	22	1,2
3	Coriander (10 gms)	43	1,2
4	Mesculin (30 gms)	40	1,2
5	Spinach (60 gms)	7	1,2
6	Green Chilli	22	1,3
7	Tomato	5	1,3
8	Cauliflower	156	1
9	Capsicum (Red)	96	1,3
10	Cucumber	6	1
11	Carrot	87	1,3
12	Parsnips	16	1,3
13	Potato	177	1
14	Ginger	5	1,3
15	Garlic	350	1
16	Onion (Red)	80	1
17	Lemon	53	1
18	Spices (Various)	55	2
19	Sauce	50	2
20	Rice	8	2
21	Couscous	11	2
22	Cheese (Feta)	9	3
23	Pork	45	1
24	Chicken	30	1
25	Corn (Can)	14	1
26	Tomato Paste	5	1
27	Coconut Milk	36	1

Note. Table generated by Mendoza. Own work.

Reasons for Food Wastage

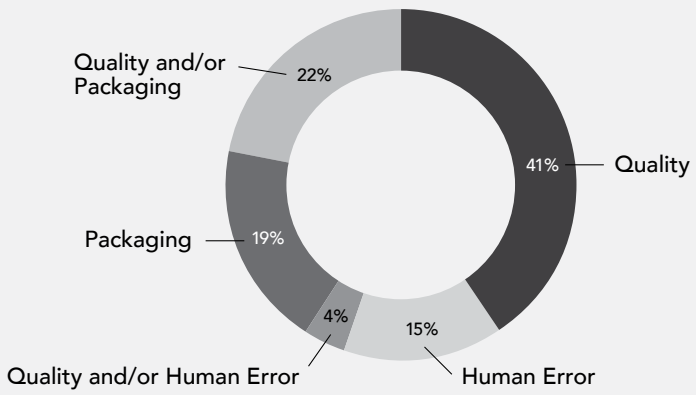
Table 1 above contains the identified reasons for food wastage which are differentiated by legends assigned to each category. The percentage of each count against the total number of rejected items is also included in the table. The reasons observed for rejecting these ingredients are shown in the last column of Table 1 after the explanations of the legends for reference. The four main factors contributing to food waste include quality, packaging, human error, a combination of either quality or human error or packaging and human error. The last two categories were included to cover all possibilities as there could be instances where the reasons for rejection could not be identified.

The data on the tables above were converted into Figures 4 and 5 below. Figure 41 shows that the most rejected items are garlic, potatoes, and cauliflowers because of their quality. But it is important to note that the quality of the ingredients might be affected by the seasons. Thus, the items rejected due to quality may vary depending on their availability or the time of the year.

Figure 4: Rejected Products and Corresponding Amount

On the other hand, Figure 5 below shows the main factors affecting food wastage on the production lines at the meal-kit company observed. The largest number of rejections were due to below-par quality of the products and ingredients. The meal-kit company maintains a standard of quality for their meal kits therefore anything that does not pass the quality inspection will be rejected. This is a combination of quality and human error at 21% and packaging and human error at 19%. This means that the products were not included in the meal-kits either because of a combination of substandard quality and the meal-kit production warehouse employees' packing mistakes or issues with packaging and the errors by the packing employees. Lastly, the other reasons identified are focused solely on packaging followed by human error.

Figure 5: Reasons for Food Wastage in a Meal-Kit Warehouse



There are four causes of food waste identified at the meal-kit production warehouse observed. The first is substandard quality of ingredients, for instance, vegetables and fruits that are damaged, rotten, mouldy, wilted, cracked or infected by bugs or cans that are rusty or dented. The second is problems with packaging such as misprinted and incorrectly printed labels, nutritional information and best before or use-by dates. There were also instances where the packages were not sealed properly resulting in spilled ingredients leading to rejections. The third factor identified was human error, that is the meal-kit company employees committing packing mistakes that lead to product rejections and wastage. This also includes ingredients falling on the floor which are thrown straight away into the enviro-waste bins. Human error could also be aggravated by faulty software programmes and broken equipment which makes packing more laborious and challenging for the employees.

Sources of Food Waste

Data was also collected regarding the amount of food donated by meal-kit companies like KiwiHarvest, a charitable organisation that collects perishable goods and distributes them to those in need. Food donations include products and ingredients that have been ordered for the week but have not been used in the meal-kit production facility, in short, these are excess orders. Table 2 below shows a comparison of the amount of food waste from the meal-kit productuction area, adding up to about 100 crates (bins that are used to carry the ingredients around in the meal-kit production warehouse) per week as compared to the bulk of waste resulting from excess supply, which is a staggering total of 752 crates per week of various ingredients. The majority of food waste comes from excess supply and only a fraction comes from the meal-kit production facility. The issue of over-ordering could be a result of poor enventory management.

Table 2: Sources of Food Waste in a Meal-Kit Warehouse

FOOD WASTE	CRATES PER WEEK	PERCENTAGE
Food waste from production warehouse	97.2	11%
Food waste due to over supply	752	89%
Total	849.2	100%

Note. Table generated by Mendoza. Own work.

Figure 6 below shows the data on Table 2 converted into a pie chart to illustrate the identified sources of food waste.

Figure 6: All Sources of Food Waste

The main reasons for food wastage at the company observed are the poor quality of the ingredients being packed in the production areas and the over-ordering and oversupply of items which accounted for most of the food waste. Although this is put to good use and donated to help those in need, it is still important to address the issue of their inventory management as it is costing them revenue. In addition, the problems regarding the quality of ingredients must also be resolved to be able to reduce food waste and improve food waste management practices at the meal-kit company.

CONCLUSION

There are four leading causes of food waste identified within the meal-kit production facility observed and these include substandard quality of food ingredients, problems with packaging and product labels or information, mistakes by meal-kit

production facility employees and lastly, poor inventory management resulting in over stocking of ingredients or that are left unused, donated to the employees and charity.

The meal-kit industry is on the right track with its sustainability initiatives vis-à-vis the SDGs of the United Nations. However, there is a gap in their food waste management practices that need to be addressed to successfully achieve their sustainability goals. The meal-kit industry should focus on improving its food waste management strategies by addressing the problems with low-quality ingredients from suppliers and finding ways to improve its poor inventory management.

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