UNIVERSIDADE CATÓLICA PORTUGUESA

"Lean Thinking Contribution to Domestic Food Waste"

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Católica Porto Business School
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by

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Resumo

No ambiente atual, marcado por uma crescente preocupação com a sustentabilidade e a eficiência, o ambiente doméstico enfrenta vários desafios relacionados com o desperdício alimentar. Para enfrentar este problema, é essencial que as famílias adotem estratégias claras para reduzir o desperdício, sendo as metodologias de gestão eficazes cruciais para isso. Estas abordagens não só ajudam a gerir as complexidades do desperdício alimentar, como também permitem uma melhor adaptação às mudanças e a maximização de oportunidades para práticas alimentares mais sustentáveis. Exemplos notáveis, como o uso de práticas eficientes de conservação de alimentos, destacam a crescente procura e aplicação de metodologias que promovem a redução do desperdício em vários contextos.

Este estudo visa analisar a aplicação do pensamento Lean como metodologia para a redução do desperdício alimentar em ambientes domésticos. O pensamento Lean, conhecido pela sua ênfase na eliminação de desperdício e na melhoria contínua, pode ser aplicado em conjunto com práticas de conservação de alimentos, oferecendo uma abordagem integrada para enfrentar o problema. Foram realizadas doze entrevistas com indivíduos de diferentes idades, profissões e estilos de vida.

Os resultados deste estudo mostram que a aplicação do pensamento Lean pode superar as limitações das práticas tradicionais de conservação de alimentos. Além disso, esta metodologia oferece vantagens promissoras para a redução do desperdício alimentar, beneficiando não só a sustentabilidade ambiental, mas também promovendo a eficiência e a inovação na gestão dos recursos alimentares ao nível doméstico.
Palavras-chave: Ferramentas Lean, desperdício alimentar, organização

Abstract

In today's environment, marked by increasing concerns about sustainability and efficiency, households face numerous challenges related to food waste. To address this issue, it is essential for homes to adopt clear strategies for reducing waste, and effective management methodologies are crucial for this. These approaches not only help manage the complexities of food waste but also enable better adaptation to changes and the maximization of opportunities for more sustainable food practices. Notable examples, such as the use of efficient food preservation practices, highlight the growing demand for and application of methodologies that promote waste reduction in various contexts.

This study aims to analyze the application of Lean thinking as a methodology for reducing food waste in domestic settings. Lean thinking, known for its emphasis on waste elimination and continuous improvement, can be applied in conjunction with food conservation practices, offering an integrated approach to tackling the issue.

Twelve interviews were conducted with individuals of varying ages, professions, and lifestyles.

The results of this study show that applying Lean thinking can overcome the limitations of traditional food conservation practices. Furthermore, this methodology offers promising advantages for reducing food waste, benefiting not only environmental sustainability but also promoting efficiency and innovation in the management of food resources at the household level.

Key words: Lean tools, food waste, organization

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Introduction

Food wastage in households has become a pressing concern, leading to notable impacts on the economy and the environment. The problem mainly arises from insufficient food handling practices, such as spontaneous shopping, lack of meal planning, and inefficient storage, resulting in high levels of waste in numerous households. Research indicates that a significant portion of food purchased by households is wasted, resulting in financial losses for families and negative effects on the environment from the wasted resources used in food production, transportation, and disposal. The increasing recognition of these problems has inspired investigations into practical, methodical approaches to control and minimize food wastage.

Lean Thinking, initially created for improving manufacturing efficiency, provides potential solutions for addressing these problems. Lean's emphasis on getting rid of waste and improving processes could be very successful when applied to household management. Strategies like 5S and FIFO, commonly used in businesses to increase efficiency, also have the potential to reduce food waste, promote conscious consumption, and endorse sustainable habits in homes.

The main inquiry of this research is: How can Lean Thinking tools be efficiently used to decrease food waste in households? The study seeks to comprehend the specific reasons behind household food waste and assess the practicality of Lean methodologies as a solution. This study aims to develop a structured method for families to enhance food utilization, reduce waste, and embrace sustainable practices by applying Lean tools.

This research employs a qualitative approach to understand household behaviors and difficulties related to food waste. Semi-structured interviews were carried out with both individuals and families to gain insight into their habits related to buying, planning, and storing food, as well as their knowledge of methods to reduce waste. Next, the interview data was examined in order to pinpoint typical trends and obstacles.

Lean tools such as 5S and FIFO were suggested as specific solutions, and participants were educated on these ideas to assess their suitability and potential for use in homes.

This approach aims to create a useful structure for incorporating Lean Thinking into everyday food management practices, tackling the underlying reasons for food wastage with flexible, research-backed methods.

Chapter 1 – Domestic food waste

1.1 The problem of domestic food waste

Food waste presents a significant global challenge, with profound environmental, economic, and potentially social ramifications. Studies suggest that a substantial portion of produced food goes uneaten. Has been estimated that as much as 50% of all food that is produced never actually enters a human mouth. This amounts to a potential two billion tonnes of food waste per year.(Woolley et al., 2016) This wastage occurs throughout the entire value chain, with food loss (FL) transpiring at earlier stages of production and distribution, while food waste (FW) predominantly arises at the household level.

Food waste occurs at the household level at the end of the value chain, whereas Food loss occurs at former stages of the supply chain. (Deliberador, L. R., et al., 2023). It is evident that consumer behavior plays a pivotal role in driving food waste, necessitating transformative changes in our consumption patterns to mitigate this issue.

Indeed, tackling household practices to minimize food waste presents a formidable challenge. This aspect of waste reduction demands addressing deeply entrenched consumer behaviors and habits, which are often resistant to change. However, precisely because of the pervasive nature of household food waste, successfully mitigating it holds the promise of yielding significant

benefits, both environmentally and economically.It could be argued that preventing household food waste has more benefits than reducing food waste upstream of the supply chain. In addition to supporting sustainability objectives, reducing food waste has been regarded as highly important to ensure a sustainable food security. (Woolley et al., 2022)

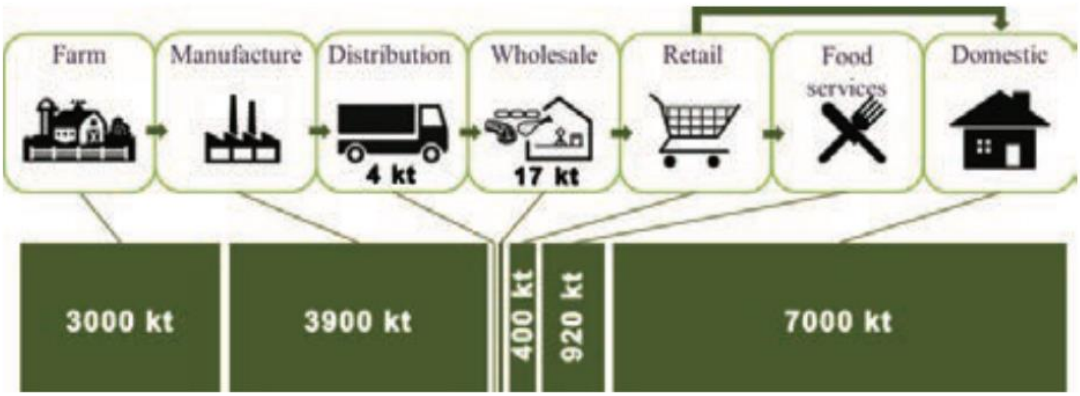

Figure 1 - UK food waste

1.2 Studies on domestic food waste

The amount of research on food waste has grown significantly over the last ten years. Studies focusing on consumer segmentation could help pinpoint groups that waste a lot of food and identify their unique traits. Recent research has

used surveys to categorize and understand consumers based on their roles in managing food, their habits, demographics, and how they respond to food promotions. Although there may be limitations in data collection methods, consumer segmentation provides a promising path for future studies to reduce food waste and guide intervention strategies.

Studying domestic waste poses significant challenges due to various factors. Self-reporting has emerged as a prevalent measurement strategy in empirical studies on food waste due to its practicality and cost-effectiveness. However, it also introduces a notable limitation through self-reporting bias. Therefore, it is imperative to explore alternative methodologies leveraging new technologies to enhance measurement accuracy and evaluate intervention strategies effectively. (Vittuari, M., et al., 2019)

Numerous sources propose experimental approaches, suggesting that experimental testing offers preliminary evidence of the effectiveness of various strategies. By generating data in a consistent and rigorous manner, such testing enhances transparency regarding methodology and execution, and importantly, establishes cause-effect relationships in a controlled environment. However, there is limited evidence from these sources regarding the longer-term effects of interventions. This constraint hampers the ability to draw conclusions on the longevity, sustainability, and replicability of interventions. Nonetheless, given that consumer food waste research is still in its early stages, the rapid proliferation of experiments is viewed positively, as it offers a diverse array of approaches that are ripe for replication

1.3 Approaches to reduce domestic food waste

Meal planning and preparation involve organizing meals in advance to prevent overbuying and minimize food waste. Effective storage and preservation techniques, such as freezing and vacuum sealing, can prolong the shelf life of perishable items. Portion control encourages serving appropriate amounts to reduce leftovers and waste. Understanding date labels is crucial to avoid unnecessary discarding of edible food. Creative cooking and leftover utilization promote repurposing ingredients to minimize waste. Composting at home diverts food scraps from landfills and enriches soil for gardening.Community initiatives and education raise awareness about food waste reduction and provide support to households. Implementing these approaches can significantly reduce domestic food waste and contribute to a more sustainable system.

The Recipe Suggestion tool employs Particle Swarm Optimization to recommend recipes that best fit user preferences while minimizing waste. Although the system has not been implemented in real-world scenarios due to various technological, legislative, commercial, and social obstacles, it is proposed as a potential solution to reduce household food waste.

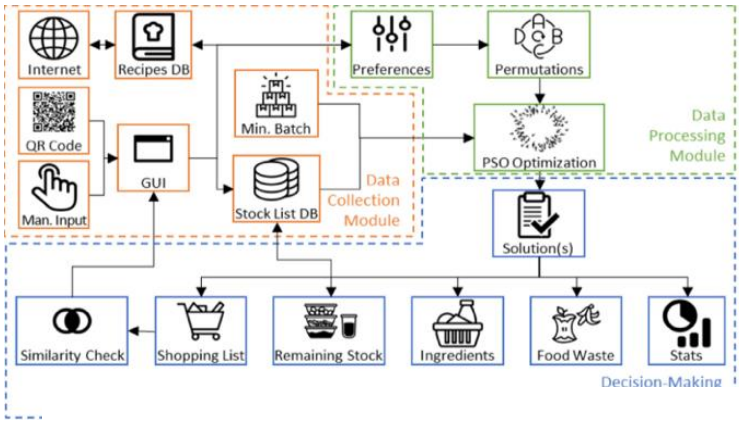

Figure 2 - The Recipe suggestion tool framework

Chapter 2 – Lean thinking

2.1 What is lean thinking?

Lean thinking is a methodical way to identify and remove waste, aimed at optimizing processes to generate greater value with fewer resources. Derived from the Toyota Production System created in Japan after World War II, the goal is to improve manufacturing processes despite limited resources.

This approach provides numerous advantages for companies. Cost reduction is made possible by lean thinking through improving efficiency and reducing waste. Furthermore, its focus on preventing defects and constantly improving enhances the

quality of products and services. As a result, organizations that implement lean principles are able to go above and beyond customer expectations, ultimately improving satisfaction levels. Moreover, lean practices cultivate a workplace that empowers and motivates employees, leading to increased morale.

Essentially, lean thinking offers companies a comprehensive structure to improve operations, enhance value delivery, and promote ongoing growth.

Figure 3 - Lean Thinking benefits

2.2 Lean thinking tools

Value Stream Mapping in its traditional structure was proposed by Rother and Shook (1999) with the goal of "seeing" the production flow more clearly, including material flows, energy, people, information, and more, typically measured in efficiency indicators to identify and reduce losses. (Silva, E. S., Agostinho, F., Almeida, C. M. V. B., Liu, G., & Giannetti, B. F., 2024).This detailed mapping serves to illuminate bottlenecks, expose non-value-adding activities (commonly referred to as waste), and pinpoint opportunities for improvement. Armed with this comprehensive picture, teams can strategically focus their efforts on optimizing the flow of value, ensuring a streamlined journey for the product or service towards the end consumer.

The 5S lean tool, an acronym for Sort, Set in order, Shine, Standardize, and Sustain, is a systematic approach to organization and efficiency. While these steps may sometimes have different names, they ultimately serve the same purpose.

Implemented correctly, 5S helps reduce non-value adding time, enhance productivity, and improve quality. This technique has found application in designing efficient facilities and has been integrated with other lean tools to reduce changeover time. (Omogbai and Salonitis, 2017)

The 5S methodology can be summarized as follows:

1. Sort: Organize items for easy storage and retrieval, eliminating unnecessary clutter.

2. Set: Clearly designate and label storage locations to minimize searching and ensure items are kept in their designated places.

3. Shine: Maintain cleanliness and neatness in the workplace to enhance efficiency and safety.

4. Standardize: Document work methods and integrate 5S practices into the organizational culture to ensure consistency and sustainability.

5. Sustain: Regularly review the implementation of 5S to identify areas for improvement.

Kanban emerges as a visual production management system designed to ensure smooth and uninterrupted workflow. This methodology leverages visual signals, often manifested as cards, to meticulously manage work in progress (WIP) and maintain a consistent flow throughout the production process. By strategically limiting WIP, Kanban exposes bottlenecks and proactively prevents overproduction, a significant source of waste within the lean paradigm. (Abdul Rahman, N. A., Mohd Sharif, S., & Mohamed Isa, M.,2013).

Kaizen events embody the essence of continuous improvement, the cornerstone of lean thinking. These focused and time-bound workshops assemble teams specifically dedicated to brainstorming, meticulously analyzing, and ultimately implementing improvements on designated processes. This structured approach fosters problem-solving and innovation, cultivating a culture of ownership among employees who are actively engaged in optimizing operational excellence. (Maarof, M. G., & Mahmud, F.,2015).

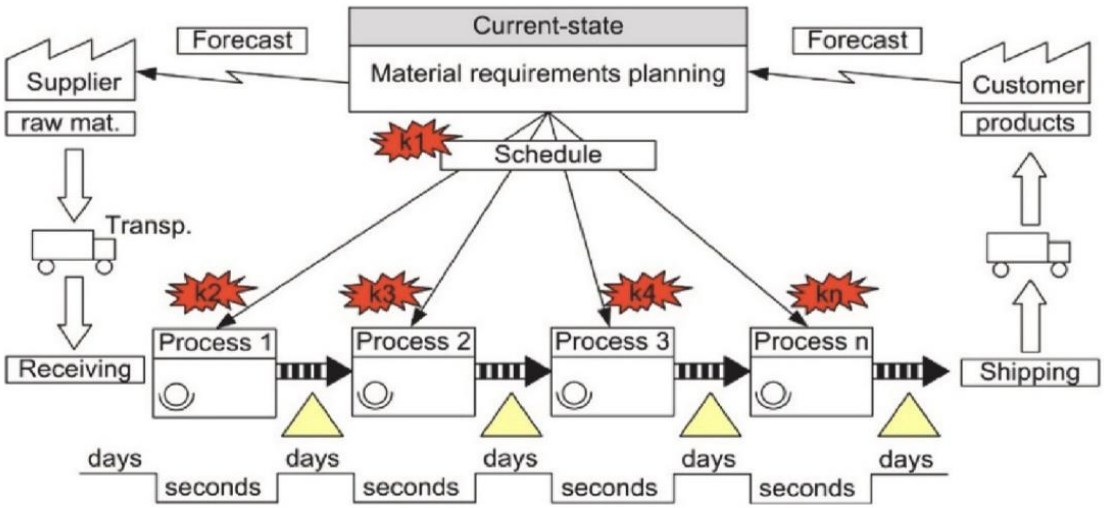

Figure 4 - VSM framework

Chapter 3 – Applying Lean thinking on domestic Food Waste

After delving into the complexities surrounding food waste, including its challenges, consequences, and potential solutions, the study faces the pivotal task of adapting lean tools for domestic use. While the exploration of lean methodologies has shed light on their potential application, extending these principles to household settings poses a significant hurdle, especially concerning food waste management.

To address this challenge, the study will adopt a qualitative approach. Through in-depth interviews, it aims to not only propose suitable lean tools tailored for domestic food use but also evaluate any observed changes in domestic food waste practices.

Furthermore, central to this research is the formulation of improvement strategies informed by the outcomes of rigorous data analysis.

By delving into these aspects, the study seeks to offer insights into the feasibility of implementing lean practices within households to mitigate food waste effectively. Through this holistic approach, it endeavors to contribute practical recommendations for optimizing food usage and reducing waste at the domestic level.

Objectives

The primary aim of this study is to conduct a comprehensive analysis of the current approach adopted by ordinary individuals on their households regarding food waste and the application of lean thinking. This entails a detailed investigation into how individuals structure their daily processes to address food waste in their households and how they evaluate their own performance within this context. Furthermore, it seeks to understand the broader impacts of this approach on their lives, including aspects such as dietary habits, efficiency in food management, and environmental awareness.

Subsequently, the study aims to ascertain individuals' willingness to embrace new methodologies, such as lean thinking, to tackle food waste in their homes. This necessitates a careful analysis of potential barriers that may hinder the adoption of new approaches. It may explore whether this reluctance to change stems from internal factors, such as entrenched habits or lack of knowledge about more efficient practices like lean thinking.

Lastly, the study endeavors to assess the feasibility and complementarity of applying lean thinking in relation to the current approach individuals employ to address food waste at home. This involves conducting a detailed comparison of the characteristics, principles, and practices of lean thinking with individuals' existing habits. The objective is to identify areas of synergy and integration opportunities that could enhance the effectiveness of food waste reduction.

Methodology

The present dissertation constitutes a case study employing a qualitative methodology, conducted with individuals in a real-world setting, focusing on the integration of lean thinking principles and strategies for addressing domestic food waste.

Therefore, this section will begin by introducing the individuals involved in the study. Subsequently, we will briefly outline their roles and the procedures adopted, including the development of interview scripts, data collection (interviews), and the methods for analyzing the collected data:

The study involved twelve participants, each with distinct, age, career and lifestyle characteristics. The research chose participants from various professional fields and ways of life in order to pinpoint shared themes and potential areas for enhancing efforts to decrease food waste at home. This varied selection also intended to emphasize the influence of income levels, family structures, and living environments on waste patterns within households. Acknowledging that the place and age of

individuals can greatly influence how they buy and store food, these factors were also closely considered in the selection process. Therefore, the interviewees cover a broad range of views and behaviors, providing a detailed understanding of the impact of different socio-economic and demographic factors on food waste. This variety enables a more in-depth examination, encompassing common issues and individual situations that lead to food waste at home. The research chose participants from various professional fields and ways of life in order to pinpoint shared themes and potential areas for enhancing efforts to decrease food waste at home. This varied selection also intended to emphasize the influence of income levels, family structures, and living environments on waste patterns within households. Acknowledging that the place and age of individuals can greatly influence how they buy and store food, these factors were also closely considered in the selection process. Therefore, the interviewees cover a broad range of views and behaviors, providing a detailed understanding of the impact of different socio-economic and demographic factors on food waste. This variety enables a more in-depth examination, encompassing common issues and individual situations that lead to food waste at home.

Name	Age	Occupation	Living Situation	Interview Date	Duration
Interviewed 1	23	Medicine Student	Shared Apartment	June 21, 2024	30 minutes
Interviewed 2	87	Retired	Private Residence	May 6, 2024	40 minutes
Interviewed 3	50	Banking Professional	Family Residence	August 8, 2024	35 minutes
Interviewed 4	42	Nurse	Family Residence	September 9, 2024	20 minutes
Interviewed 5	24	Intern	Studio Residence	September 9, 2024	40 minutes
Interviewed 6	29	Designer	Shared apartment	September 12, 2024	30 minutes
Interviewed 7	34	Engineer	Family Residence	September 13, 2024	35 minutes
Interviewed 8	28	Nurse	Shared Apartment	September 15, 2024	25 minutes
Interviewed 9	35	Engineer	Studio Residence	September 15, 2024	30 minutes
Interviewed 10	28	Designer	Shared Apartment	September 17, 2024	22 minutes
Interviewed 11	42	Engineer	Family Residence	September 20, 2024	30 minutes
Interviewed 12	42	Entrepreneur	Family Residence	September 20, 2024	20 minutes

Table 1 - Name, Age, Occupation, Living situation, interview date, and duration

Procedures

Yin (2014) provides a comprehensive overview of case studies and qualitative research methods. In addition to discussing document analysis, Yin also introduces the concept of *inside research*, another research methodology. This dissertation considered these methods and their potential challenges.

To identify opportunities for applying Lean Thinking principles to reduce food waste, a comprehensive analysis of participants' lifestyles, purchasing patterns, and food disposal practices was conducted. This analysis involved examining a range of documents, including shopping lists, meal plans, and food waste logs. By mapping existing processes and identifying bottlenecks and waste points, this research provided a foundation for proposing Lean-based improvements. The integration of these findings with data from interviews and observations enabled the development of a targeted action plan to reduce.

This study is framed within a qualitative survey, a research methodology focused on gathering non-numerical data to explore participants' perceptions, motivations, and experiences in-depth. The qualitative approach allows for a richer and more detailed understanding of human behavior, particularly in complex topics such as household food waste.

A semi-structured interview approach was employed to collect data for this case study. The interviews were guided by a semi-structured protocol and were subsequently analyzed thematically to identify emerging patterns and themes. These findings were then discussed in light of the research objectives and their potential implications for future organizational studies.

This approach is particularly useful in understanding how different circumstances, such as resource availability, distance to markets, or lack of time, influence food management practices among the interviewed households.

The use of interviews in research offers several advantages, as noted by Brewerton and Millward (2001), Mason (2002),and Yin (2011). In this particular study, these benefits were particularly evident.

Conducting interviews provided a unique opportunity to establish trust with participants, thereby facilitating the collection of rich and detailed data about their experiences with food waste. The flexibility of this method allowed for the exploration of sensitive and complex issues, such as ingrained habits and difficulties in changing behaviors. This close engagement with participants was instrumental in understanding the barriers and enablers of applying lean thinking in domestic settings, enabling the development of more effective interventions.

The interview guide was designed with common questions in mind, aiming to gather data relevant to the study's objectives. However, due to variations in age, personal, and professional circumstances among participants, the guide was adapted to some extent while maintaining the core focus of the research.

Chapter 4 - Results and discussion

Although the interview data could have been categorized and presented in tabular form, a narrative approach was chosen.This method was considered more appropriate for clearly and concisely connecting the findings to the broader discussion. Aligned with Yin (2014) recommendations, a detailed narrative was constructed to capture the essence of participants' perspectives, experiences, and opinions

Consequently, we opted for a combined presentation of results and discussion, using excerts from the interviews as illustrative examples. This approach, supported by Yin (2011), allows for a more seamless integration of data and analysis, providing the reader with a deeper understanding of participants' perspectives and the study's key findings.

Main problems

Inadequate meal planning and careless grocery list preparation are two of the main factors contributing to food waste, as evidenced from the interviews. **Interviewed 1** mentions that one of the challenges she faces is going grocery shopping without having planned her meals for the week, leading to inefficient or suboptimal purchases. “I think the main reason is a lack of planning. Often, my housemate and I buy food on impulse or because we think we’re going to cook something specific, but then plans change and that food doesn’t get used. We’re also not very organized with expiration dates, and by the time we notice, the food has already expired.”

When there is no proper plan for what will be consumed throughout the week, there is a risk of buying unnecessary ingredients or purchasing them in excessive quantities, which can result in products expiring before they are used. Furthermore, the lack of clear planning may lead to improvised meals, where some of the purchased food ends up not being utilized.

This mismatch between what is bought and what is actually consumed generates food waste and financial losses, negatively affecting both the household budget and the environment. Therefore, careful meal planning and a well-thought-out shopping list are essential to ensuring conscious and sustainable consumption.

Disorganization in the pantry and food stock is a prevalent issue that significantly contributes to food waste. When food items are not stored properly, older products can be pushed to the back of shelves and forgotten, resulting in their expiration and eventual disposal. This inefficiency is compounded by the fact that a lack of clear visibility of available items often leads to the purchase of duplicate products or items that are not immediately needed. Consequently, this results in an excessive and unmanageable stockpile of food. The resulting disorder not only leads to food waste but also causes financial loss and unnecessary consumption of resources. As **Interviewed 3** said " Sometimes, I buy extra things to have some variety. When I get home, I put everything away in the fridge and pantry, but over time, the older items end up being forgotten. "

Excessive food stock poses a significant challenge to the efficient and sustainable management of food resources. When there is a disproportionate accumulation of products, the likelihood of items being forgotten and unused in time increases. Foods stored in large quantities can easily be obscured by newer items, leading to a higher risk of expiration before consumption. This phenomenon results in waste, as still-usable foods are discarded prematurely. Additionally, disorganization and excess

stock complicate the management and access to available food, as noted by **Interviewed 2**, who sometimes purchases more food than needed, leading to waste. “I think the biggest problem is the amount we buy. Sometimes, we don't need that much, but out of habit, we buy more. And since it's just the two of us, we can't eat everything before it goes bad.” This lack of control and the need to manage large quantities of items not only increase food waste but also raise operational costs and diminish the effectiveness of resource management.

Interviewed 3 mentions that one of the main causes of this waste is the lack of time to properly plan weekly meals. “I believe the main cause is the lack of time. With my job and my daughters’ routines, I don’t always manage to plan meals for the week in advance. Additionally, sometimes I buy food on sale or in larger quantities, thinking I’ll have time to use it, but the daily rush often prevents that from happening.”
The hustle and bustle of daily life lead to impulsive shopping decisions, such as buying products on sale or in larger quantities, with the intention of saving money or ensuring variety at home. However, this practice often results in the accumulation of food that isn’t used within its expiration date, eventually going to waste.

Moreover, the lack of a solid meal plan means that food bought without a specific purpose gets forgotten in the fridge or pantry, while quicker and more convenient options are chosen for dinner after a long day at work. This disconnect between what is purchased and what is actually consumed significantly contributes to food waste.

Important to notice that the increasing presence of small local markets is playing a crucial role in reducing household food waste. **Interviewed 6** said that one of the biggest problems was living far way from de supermarket “The main problem is that the nearest markets are quite far from our home. Since we don’t have time to go shopping frequently, we end up buying more than necessary to avoid having to return

soon. If there were a market closer, I think I would shop more regularly and only when needed. “

Located closer to residential areas, these markets offer convenience and accessibility, eliminating the need for long trips to larger supermarkets. This proximity allows consumers to shop more frequently and in smaller quantities, purchasing only what is necessary for the immediate future. In contrast, trips to large supermarkets often lead to bulk purchases to avoid frequent returns, which can result in overbuying and, ultimately, food waste.

With local markets readily available, households can adopt a more controlled and mindful shopping routine. This shift helps to reduce the common behavior of “stockpiling” food, which frequently results in items being forgotten in the refrigerator or pantry until they expire. Moreover, the ability to purchase fresh produce more regularly ensures that the food consumed is of higher quality, further decreasing the likelihood of spoilage and waste.

Additionally, the presence of small local markets encourages support for the local economy and promotes a more sustainable lifestyle. Consumers are able to adjust their food purchases to match their immediate needs, rather than buying excess “just in case.” This practice fosters more efficient food management, helping to minimize waste while encouraging a more conscious approach to consumption.

Other issue that is noticed in the interviews is that the visual organization of the pantry and refrigerator, using methods like color coding, expiration date sorting, or food category grouping, can be an effective tool in reducing household food waste. As **Interviewed 9** sai and marked as very important “I’m also going to reorganize the refrigerator to have a clear view of what needs to be consumed first.” By arranging food items in a clear and orderly manner, it becomes easier to identify what is available and what needs to be consumed first, particularly products with upcoming

expiration dates. Color labels or tags can also provide a quick and efficient overview of stock, preventing food from accumulating or being forgotten. This type of visual organization not only facilitates access to items but also encourages more mindful consumption, helping to avoid unnecessary purchases and the waste of food that might otherwise spoil.

Suggestions of improvements based on the survey

Following interviews and analysis, the main goal of the study was to create recommendations for decreasing household food waste using lean practices. In the upcoming sections, the research will pinpoint the most frequent issues seen in the interviews and demonstrate examples of lean techniques.

Three main reasons for this issue include insufficient meal planning and shopping lists, ineffective home food storage management, and limited knowledge of food preservation.

A primary issue that leads to food waste is the failure to plan meals properly and prepare a shopping list. Not planning meals for the week ahead often leads to buying excess food, usually on a whim or without a specific intention. This surplus purchasing often leads to food being left unused and eventually going bad. Not having a well-organized shopping list makes it more likely to buy items that are already in the house, adding to waste.

Another important problem involves the inefficient handling and storage of food resources within the household. Food is commonly stored in a chaotic way, leading to older items being overlooked in the rear of the fridge or cupboard. This lack of organization results in perishable items not being used before their expiration date and ending up being thrown away. Moreover, insufficient understanding of the correct methods for storing various types of food can speed up the process of spoilage.

In conclusion, insufficient understanding of food preservation and how to extend the shelf life of products is another key factor contributing to waste. A lot of individuals do not know how to prolong the shelf life of food or how to come up with innovative ways to repurpose leftovers in different dishes. This lack of knowledge results in unnecessary disposal of food, contributing to widespread food waste in households.

Examples of applying lean tools on domestic food waste problems

Problem: Inadequate Meal Planning and Shopping Lists
Lean Tool: 5S (Sort, Set in Order, Shine, Standardize, Sustain)

The 5S methodology can be applied to organize and standardize the meal planning process and the creation of shopping lists. By implementing 5S, households can systematize the preparation of detailed shopping lists based on planned meals for the week. This approach helps to eliminate impulsive purchases and ensures that only necessary food items are bought.

Key results:

1. **Reduction in Impulsive Purchases**: By organizing and standardizing meal planning and shopping lists, households can significantly reduce impulsive purchases, leading to more mindful buying decisions.
2. **Minimized Food Waste**: A more structured approach ensures that only the necessary items are bought, reducing the likelihood of food expiring before being consumed.
3. **Improved Efficiency in Meal Preparation**: With a clear plan and organized shopping list, meal preparation becomes more efficient, saving time and reducing the stress of last-minute decisions.

Problem: Ineffective Management and Storage of Food Stock at Home
Lean Tool: FIFO (First In, First Out)

The application of FIFO in food storage ensures that older products are used first, preventing them from being forgotten and eventually spoiling. By organizing the pantry and refrigerator so that older items are placed at the front, households can consume food within its shelf life, thereby significantly reducing waste.

Key results:

1. **Reduction in Food Spoilage**: Implementing FIFO ensures that older food items are used first, minimizing spoilage and reducing the amount of food wasted.

2. **Better Inventory Control**: FIFO provides a clear system for managing food stock, allowing households to keep track of what needs to be consumed soon, leading to more efficient use of resources.

3. **Cost Savings**: By reducing the amount of food that is thrown away, households can save money by maximizing the use of the food they have purchased.

Problem: Lack of Knowledge on Food Preservation

Lean Tool: Kaizen (Continuous Improvement)

Kaizen promotes continuous improvement through small adjustments and ongoing learning. In the domestic context, this can include continuous education on food preservation techniques, such as freezing, proper storage, and creative use of leftovers. Kaizen encourages experimentation and the implementation of better practices in food preservation, leading to a continuous reduction in waste.

Key results:

1. **Improved Food Storage Practices**: Regularly updated knowledge and techniques for storing food properly, such as optimal temperatures for refrigeration and freezing, resulting in reduced spoilage and extended shelf life.

2. **Reduced Food Waste**: Implementing effective methods for repurposing leftovers and avoiding over-purchasing through ongoing education and experimentation, leading to lower waste generation and cost savings.

3. **Enhanced Preservation Techniques**: Continuous experimentation with new preservation methods and tools, such as vacuum sealing and dehydration, leading to more efficient and effective food preservation strategies.

Chapter 5 - Conclusion

This research provides a detailed examination of food wastage in households, exploring the potential benefits of implementing Lean techniques to minimize waste effectively. This study uses a qualitative method to discover the main reasons for food wastage in homes such as poor meal preparation, ineffective food storage and inventory management, and limited awareness.

Interviews showed that numerous households encounter similar issues: lack of time for meal planning, difficulty reaching markets because of distance, and a tendency to buy too much, influenced by poor planning or special offers. All of these factors together lead to elevated levels of food wastage. Nevertheless, the research indicates that Lean methodologies, such as 5S, FIFO (First In, First Out), and Kaizen, show great potential in this situation. The structured arrangement of 5S, focusing on sorting and organizing, combined with the FIFO technique of prioritizing older items, and the Kaizen approach to continual improvement, provide accessible solutions suitable for domestic purposes. Through advocating for organized storage, effective turnover of inventory, and a continuous focus on improvement, households can greatly minimize waste.

Implementing Lean methods results in various advantages beyond just cutting down on waste. It contributes to reducing the environmental impact linked to food production and waste disposal. Economically, it assists households in maximizing resources, enabling them to reduce expenses related to buying unnecessary food. In terms of social aspects, these behaviors promote conscientious and sustainable

consumption patterns, prompting families to be deliberate in their food selections and to think about the environmental consequences of waste. This research provides a detailed examination of food wastage in households, exploring the potential benefits of implementing Lean techniques to minimize waste effectively. This study uses a qualitative method to discover the main reasons for food wastage in homes such as poor meal preparation, ineffective food storage and inventory management, and limited awareness.

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Ultimately, this study concludes that Lean Thinking practices, traditionally used in industrial settings, can be effectively adapted for household use as a strategic response to food waste. The findings contribute valuable insights into managing food resources at home, suggesting that structured and intentional approaches in food handling can lead to significant improvements. Additionally, this research paves the way for future studies to further explore how Lean and other management principles can be applied to promote sustainable behaviors, optimize household efficiency, and ultimately foster a more responsible approach to food consumption and waste management.

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