Sustainable choices, fresh approaches: Redesigning meal kits using activity theory

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In: Design Across Borders – United in Creativity Book 4Mexico, Monterrey 2024, 2024, pp. 1013-.
Editors: Lorenzo Imbesi and Alessandra Perlatti

ISBN: 9789527549063
Publisher: Cumulus

UNIVERSIDAD DE MONTERREY &
TECNOLOGICO DE MONTERREY

16 — 18
OCTOBER, 2024

DESIGN ACROSS BORDERS
UNITED IN CREATIVITY
MONTERREY, MEXICO

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SUSTAINABLE CHOICES, FRESH APPROACHES: REDESIGNING MEAL KITS USING ACTIVITY THEORY

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ABSTRACT | "Cook and eat" meal kits from pre-packaged food delivery services provide exact portions of ingredients required for specific recipes, promoting sustainability by eliminating food waste in the cooking process. However, these services often overlook some of the current consumer behaviours associated with their use. This study aims to explore consumer behaviour regarding the use of meal kits in the Swedish context, with a particular focus on the sustainability of these behaviours. Applying activity theory as the theoretical framework, this study explores how consumers interact with meal kits during the ordering, cooking, storing and disposal and identifies potential areas for service and packaging improvement to promote sustainability. The methodology used includes a combination of qualitative survey (24 answers), in-depth interviews and observations with 4 households to gather data about consumer cooking practices and perceptions and self-reporting from 3 of the authors. Specifically, the study focuses on the operational layer of activity theory, analysing the routine actions and adjustments consumers make while interacting with meal kits, which directly and both consciously and unconsciously impact food waste and its sustainability. Considering the harmonies and tensions found between the consumer, the meal kit, including the recipe, the food, and the packaging, and the homemade meal, the findings show that while meal kits ease the cooking process and save time, they are perceived as having excessive packaging and do not completely eliminate food waste as promoted. Design suggestions include considering returnable packaging systems, offering ingredient replacement options, providing freezable and microwavable recipes, and including new cooking guidelines such as taste-testing steps. These changes can better align them with consumer needs, and potentially reduce the impact of consumer use, reducing food waste and increasing the sustainability perception of the system.

KEYWORDS | MEAL KITS, ACTIVITY THEORY, DESIGN FOR SUSTAINABLE BEHAVIOURS, FOOD WASTE, PACKAGING

1. Introduction

In recent years, meal kits have risen in popularity as a convenient and efficient way for individuals and families to prepare home-cooked meals without the hassle of grocery shopping. These pre-packaged food delivery services provide consumers with exact portions of ingredients required for specific recipes, thereby promoting sustainability by potentially eliminating food waste in the cooking process (Sharda et al., 2024). Companies such as HelloFresh, Marley Spoon, or Linas Matkasse follow this trend, offering diverse menus and easy-to-follow recipes that provide for a variety of dietary preferences and cooking skills (HelloFresh, n.d.; *Linas Matkasse*, n.d.; *Marley Spoon*, n.d.) Consumers can choose from many options that change from week to week, including vegetarian, traditional diet, and low-calorie meals, among others, suitable for both lunch and dinner. These meal kits also present different difficulty levels, allowing consumers to select recipes based on their cooking experience and the amount of time they have available. For example, the service HelloFresh offers "Rigatoni with Goat's Cheese" as an easy and vegetarian option or "Oven-Roasted BBQ Chicken" as a medium-difficulty option for a traditional diet (HelloFresh, n.d.).

We can identify four main categories of meal kits available today in the market, presenting them into four types: cook-and-eat, heat-and-eat, ready-to-eat, (Global Market Insights, 2023) and nutritional meal replacements. The "cook and eat" kits include raw ingredients and recipes for consumers to make meals from scratch. The "heat and eat" kits include pre-cooked ingredients that require only minor heating before consumption. "Ready to eat" kits provide fully prepared meals that can be consumed immediately. Lastly, meal replacements, which come in powdered or liquid form, offer a quick alternative to traditional meals, with a focus on nutritional content and meal replacement. This study focuses on "cook and eat" meal kits, which require the preparation of meals using raw ingredients provided in specific portions. Figure 1 presents the four types of meal kits just described.

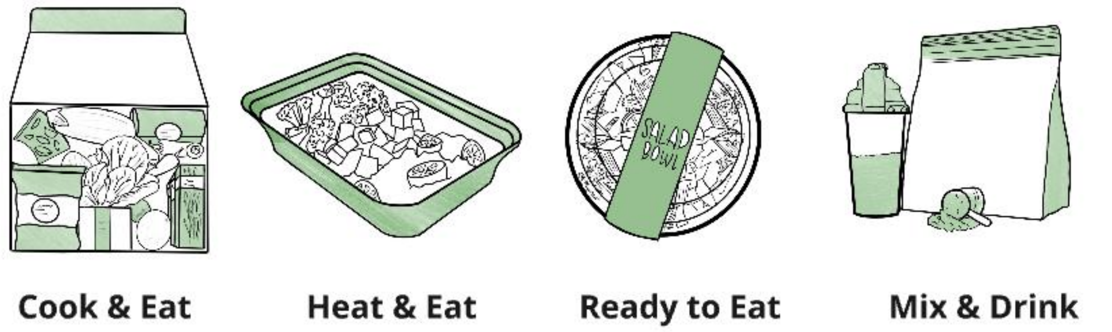

Figure 1 Type of meal kits

However, while "cook and eat" meal kits offer several advantages, including convenience and the reduction of food waste (Cho et al., 2020), they also introduce new sustainability challenges. For example, the significant amount of packaging required to keep ingredients fresh and separate can lead to increased waste if not properly managed. Additionally, the unflexible structure of pre-determined ingredients may not align with all consumers' eating habits or cooking styles, leading to food waste despite the intention of meal kits to minimise it. Thus, understanding the full impact of meal kits on sustainability requires a comprehensive analysis of consumer behaviours and perceptions associated with their use.

Activity theory, a framework originally developed by Soviet psychologists Vygotsky and Leont'ev, offers a valuable lens for examining these behaviours. Activity theory focuses on the interaction between individuals and their environment, emphasising the tools and community involved in any given activity (Leont'ev & Hall, 1978; Vygotsky, 1978). By applying this framework to the context of meal kits, we can gain insights into how consumers interact with these services during different stages such as ordering, cooking, storing, and disposal. This theoretical approach helps identify contradictions and harmonies within these interactions that may contribute to sustainable or unsustainable practices, guiding design strategies to develop functionality and user engagement towards sustainable outcomes (Chu et al., 2021).

Building on this, this study looks into consumer behaviour regarding "cook and eat" meal kits in Sweden, with a particular focus on sustainability. Using activity theory, we look into consumers' routine actions, both consciously and unconsciously, and their impact on food waste and sustainability, making use of a mixed-methods approach, including qualitative surveys, in-depth interviews, and observations, to identify areas for improvement in service and packaging. The goal is to provide new recommendations for meal kit services that will better align with sustainable consumption patterns.

2. Methodology

To uncover the unsustainable behaviours behind the “cook and eat” meal kits, the lens of activity theory is used. This framework allows us to understand the motives behind the use of meal kits, the goals that users aim to achieve, and the conditions and routines that influence their use. By employing a combination of surveys, observations, interviews, and self-reporting, we seek to capture insights into the different levels of activity theory as they relate to meal kit usage.

For this study, we used four different methods to gather comprehensive data. A qualitative survey was conducted among both users and non-users of meal kits. The objective was to understand the motives behind the decision to include meal kits in their grocery shopping routines. The survey gathered data from 12 users and 12 non-users on their perceptions of sustainability, food waste, and the user-friendliness of meal kits. The questions were designed to uncover conscious behaviours and preferences. Through the survey, participants were also asked if they would be willing to take part in cooking observations for the next phase of data collection.

Observations of the meal kit used were carried out with four households recruited from the survey. During these sessions, we monitored the participants' actions from planning to cooking and storing or eating the food. This method provided insights into the operational layer of activity theory, focusing on routine procedures and the conditions under which these actions are performed. Following the observations, in-depth interviews were conducted with the participants right after the use of the meal kit, to look deeper into their goals and conscious decisions regarding the use of meal kits. These interviews helped to capture the participants' immediate reflections on the cooking process and their overall perceptions of the service.

The authors also engaged in self-reporting by using the meal kits themselves. This approach provided firsthand experience and insights into the different stages of meal kit usage, from ordering to cooking. Self-reporting helped to identify any potential biases or unique insights that might not be captured through observation alone.

The data collected from surveys, observations, and interviews were analysed qualitatively (Hashim & Jones, 2014). An affinity diagram was used to compile and categorise the data, highlighting common themes, tensions, and harmonies. This process facilitated understanding the participant's experiences and the identification of areas for potential improvement in meal kit services. The study was conducted within a Swedish context, involving consumers with varying diets (traditional diet, vegetarian, and with allergies) and household compositions, predominantly single or two-person households. The group of consumers who agree on participating aligns with the current common household types most likely to use meal kits (Schoenbauer, 2019), as these services are particularly popular among single individuals and small households due to their convenience (Choi et al., 2023). Additionally, the diverse dietary preferences of participants reflect current diet trends (Global Market Insights, 2023), ensuring a more realistic spectrum of preferences.

3. Activity Theory Framework

For this study, activity theory is applied as a theoretical framework to better analyse the behaviours associated with meal kit services. Activity theory provides an approach to understanding human behaviour by breaking it down into a hierarchical structure of activity, action, and operation. The methods selected for this study align with these levels, enabling a detailed examination of the motivations, goals, and conditions that shape consumer interactions with meal kits.

Activity theory involves subjects, objects, and artefacts, together with the rules, community and division of labour, for this study we will be analysing the relation between the three first elements. The subject refers to the individual or group who performed an action. In this context, the subjects are the consumers using meal kits. The object is the goal or purpose that the subject aims to achieve, such as preparing a meal with minimal food waste. The artefact or tool is the means through which the activity is performed, which in this case includes the meal kits themselves, along with any associated packaging, instructions and online app or website. (Kaptelinin, 2024)

To analyse the different layers of activity theory and find the improvements within “cook and eat” meal kit alternatives, we focus on uncovering the tensions or contradictions. Tensions and contradictions are conflicts within the activity system that can hinder the achievement of the object (Engeström, 2015). They are relevant for identifying opportunities for improvement.

For this study, we reveal secondary and tertiary contradictions, focusing particularly on the secondary type. The four types of contradictions (Engeström, 2015) are:

1. Primary Contradictions: These occur within each component of the activity system, such as within the subject or the artefact.
2. Secondary Contradictions: These arise between components of the activity system, such as between the subject and the artefact or between the object and the community.
3. Tertiary Contradictions: These occur when a culturally more advanced form of the activity is introduced into the current activity system.
4. Quaternary Contradictions: These emerge between the central activity and its neighbouring activities.

Additionally, the study examines the harmonies within the system, which are the aspects users perceive as positive and that function well within the service. Understanding these harmonies helps in retaining effective elements while addressing the tensions.

This study also focuses on the improvement of the artefact within this system. Through the lens of activity theory, the cognitive evaluation and the potential for behaviour change in neighbouring activities are also discussed, as a result of using these services.

By applying activity theory to consumer behaviour with “cook and eat” meal kits, we aim to understand how consumers interact with the service at different stages. The activity level helps us identify the overarching motivations, such as convenience and sustainability. The action level allows us to explore specific goals, like following a recipe or reducing food waste. The operation level focuses on the habitual practices and conditions under which these actions are performed, such as cooking techniques and storage methods.

We collect data through surveys, observations, interviews, and self-reporting to gain insight about consumers' conscious and unconscious routines, allowing us to identify and classify specific tensions and harmonies within the meal kit service. This classification helps us to redesign and reduce secondary contradictions, such as resolving tensions between sustainability goals and packaging or maintaining harmonies like the convenience of pre-portioned ingredients, better aligning the service with user needs and environmental objectives.

4. Findings and Analysis

4.1 Findings from the Methods

Survey Results

The survey conducted among both users and non-users of “cook and eat” meal kits aimed to understand the motives behind the decision to include meal kits in their grocery shopping routines, their perceptions of sustainability and food waste, and the user-friendliness of meal kits. Most respondents highlighted the convenience of using meal kits, noting time savings and the ease of having pre-measured ingredients as significant advantages, aligning with the results of other studies (Moir, 2021; Shin et al., 2024). Users generally felt that meal kits helped reduce food waste because they provided exact portions needed for recipes. Additionally, meal kits were appreciated for introducing new recipes and adding variety to users' diets. Some users felt that meal kits encouraged healthier eating habits by providing balanced meals with fresh ingredients, and they enjoyed the simplified meal planning process as they did not have to think about what to cook each day.

However, there were significant tensions identified. A major concern among users was the excessive packaging associated with meal kits, which contradicted their sustainability goals. When asked if the meal kits were considered a more sustainable option, one of the users pointed out in the survey:

“Hard to say. It is good that I don’t waste food but bad that everything is packed in individual packaging and the door delivery (increased transportation needs).”

Some respondents found meal kits to be expensive compared to traditional grocery shopping. Users also noted a lack of flexibility in meal kits, as they could not easily substitute or skip ingredients without creating waste. Additionally, some users felt that the meal options became repetitive over time, reducing their interest in the service and the only option of delivering is not perceived as a sustainable option in the service.

Observations and Interviews

Observations were carried out with four households using meal kits, monitoring participants' actions from planning to cooking and storing the food. Following the observations, in-depth interviews were conducted to delve deeper into their goals and conscious decisions regarding the use of meal kits. Participants generally found the meal kits easy to use, with clear instructions that made the cooking process straightforward. Some participants perceived the service to ease the planning process. The quality of the ingredients was often highlighted, with users feeling that they were getting fresh and high-quality products. Users appreciated the time efficiency of meal kits, noting that they could prepare meals more quickly than if they had to measure and prepare all ingredients themselves.

Despite these positive aspects, several tensions were identified. Some participants found that the instructions could be unclear particularly when indicating different quantities in the recipe, leading to mistakes or inefficiencies during cooking. Additionally, participants felt that they were completely trusting the recipe without any taste recommendations along the steps, making it hard to judge if the flavour was as expected. There were mixed feelings about portion sizes; some found them too large, leading to leftovers, while others found them insufficient. Issues were perceived with the storage of ingredients and their freshness, particularly if the kits were not used immediately upon delivery. Occasionally, users found that certain ingredients did not meet their quality expectations or wondered about the source of the products. Even with pre-measured ingredients, some users ended up with waste from components they did not use fully or did not prefer. Lastly, it was perceived that some recipes were more complex than anticipated, requiring more time and effort than expected.

Self-Reporting

The authors also engaged in self-reporting by using "cook and eat" meal kits themselves. This approach provided firsthand experience and insights into the different stages of meal kit usage, from ordering to cooking. The self-reporting confirmed that the meal kits provided a comprehensive service that covered all aspects of meal preparation, from ingredient delivery to cooking instructions. The meals prepared were generally satisfying in terms of taste and variety, matching the expectations from the meal kit service. Authors noted that using meal kits introduced them to new ingredients and cooking techniques they had not previously used.

However, some tensions were identified. There were logistical issues with delivery times and conditions, which could affect the freshness and quality of the ingredients. Managing and disposing of the packaging materials was seen as overpacked, and the need for them was questioned. Additionally, there were occasional mismatches between the expected and actual contents of the kits, such as missing ingredients or incorrect quantities. When not selecting your order for the next week, the order will be selected automatically, leading to recipes that might not match the user's diet or food not planned to get delivered.

4.2 Analyses of the findings through Activity theory

Contradictions in the traditional grocery shopping

Traditional grocery shopping involves several tensions that motivate consumers to seek alternatives like meal kits. To prepare a fresh homemade meal, individuals require *cooking skills*, which many may lack, leading to repetitive meal choices and *limited culinary variety*. According to Hill and Maddock (2018), the lack of *time* and cooking skills can lead consumers to opt for convenience foods, which often discourage cooking from scratch and can result in a society lacking in food preparation skills (Hill & Maddock, 2018). Additionally, purchasing ingredients in larger quantities often results in food waste, as consumers struggle to use up all the items before they spoil. Another significant tension is the desire to try new recipes and ingredients without ending up with *leftover ingredients* that they don't know how to use in future meals. Meal kits can provide a structured approach to cooking, reducing the cognitive load associated with meal planning and preparation (Hill & Maddock, 2018). These tensions push consumers towards meal kits, which offer pre-measured ingredients and easy-to-follow recipes, potentially reducing food waste and making the cooking process more accessible, offering a meal plan, creative cooking experience, help in the cooking process, and quick and easy solutions, main attitudes among meal kit buyers according to Numerator Psychographics data (Schoenbauer, 2019).

Considering the interaction between the subject, the goal which in this case might be to have a fresh homemade meal, and the instrument, in this case, the system of traditional grocery shopping, is represented in Figure 2 the tensions that can lead the subject to try a new grocery system.

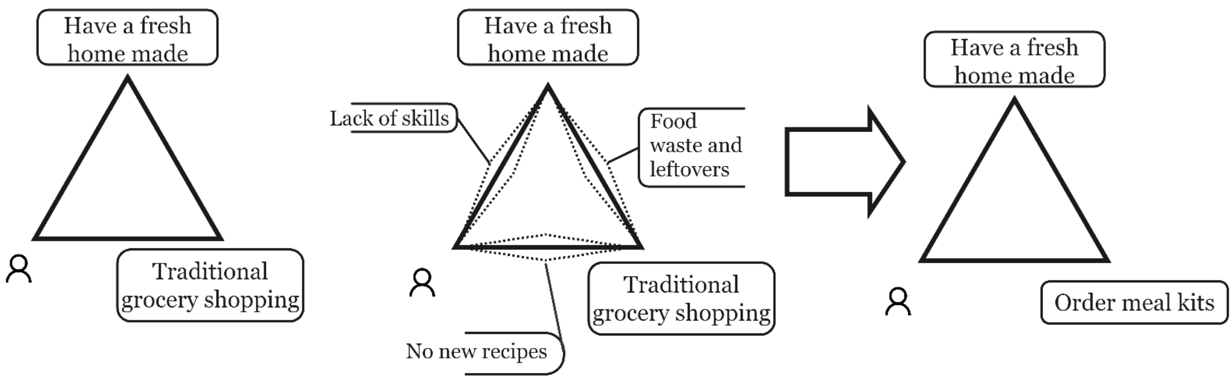

Figure 2 Tensions within traditional grocery shopping

Tertiary contradictions between systems

While meal kits offer a solution to these tensions within traditional grocery shopping by providing pre-measured ingredients and easy-to-follow recipes, they introduce their own set of contradictions. Traditional grocery shopping is generally cheaper, whereas meal kits, despite being more convenient, come at a higher cost. This creates a tertiary contradiction where consumers must balance the cost-effectiveness of traditional grocery shopping with the convenience offered by meal kits. *This tension can lead to a combination of routines from both systems, promoting new behaviours.* These tertiary contradictions are represented in Figure 3.

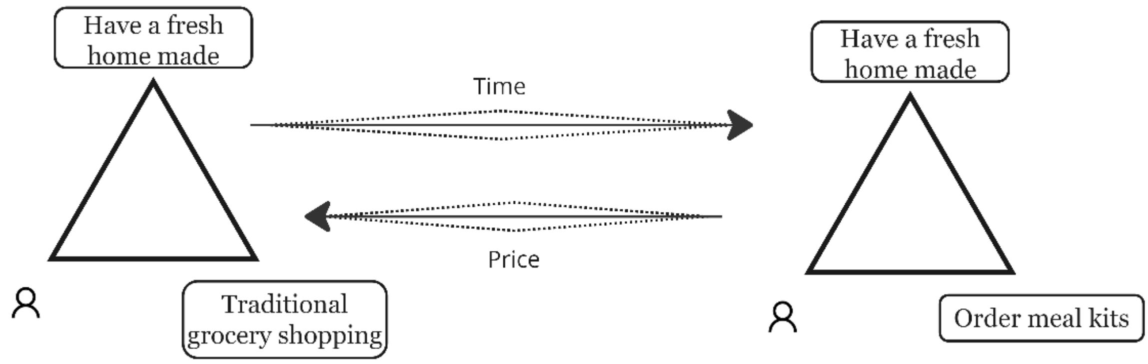

Figure 3 Tensions between traditional grocery shopping and meal kits

Considering the internalisation and externalisation principles of activity theory, consumers can internalise new knowledge about ingredients and recipes by incorporating meal kits. They then apply this knowledge when grocery shopping, potentially buying only the quantities needed and reducing waste. The variety of recipes tried through meal kits also could enable consumers to remember and retry these recipes, using ingredients more efficiently. Research indicates that meal kits can promote healthy dietary behaviours by improving cooking skills and confidence (Fraser et al., 2024), which can be translated into long-term use to more efficient and less wasteful traditional grocery shopping practices.

Additionally, after an internalisation process through the use of meal kits, consumers might no longer require them if we consider the tensions of cooking skills, recipe variety and food waste. By buying products in the exact quantities needed, learning through the use of the meal kits and avoiding food waste and unnecessary extra food, they might transition and depend on other types of systems, such as packaging-free systems. Therefore, meal kits could be used as a transition, helping consumers internalise quantities, products, and new recipes while allowing more flexibility in cooking. This could lead to more efficient grocery shopping and the potential use of packaging-free grocery systems, where consumers can reuse or return packaging and buy food products in bulk quantities, adjusting themselves the amount of ingredients they need in their households. However, the combination of the use of both ways of grocery shopping is outside the scope of this study and it has not been studied with the participants.

Tensions and harmonies within meal kits

The operational layer in activity theory focuses on the routine actions and conditions under which these actions are performed. In the context of meal kits, this layer includes the practical aspects of cooking skills, trying new recipes, and avoiding food waste and leftovers. Each of these objectives involves interacting with specific artefacts: meal kit recipes, meal kit food, and meal kit packaging.

Figure 3 illustrates the operational layer in activity theory for meal kits, showing the transition from traditional cooking to potential improvements. Initially, traditional grocery shopping and home cooking are associated with issues such as a lack of skills, the absence of new recipes, and food waste. The introduction of meal kits presented in the new approaches aims to address these issues by providing fresh home-cooked meals, improving cooking skills, introducing new recipes, and reducing food waste through pre-measured ingredients, bringing their own sets of harmonies and tensions.

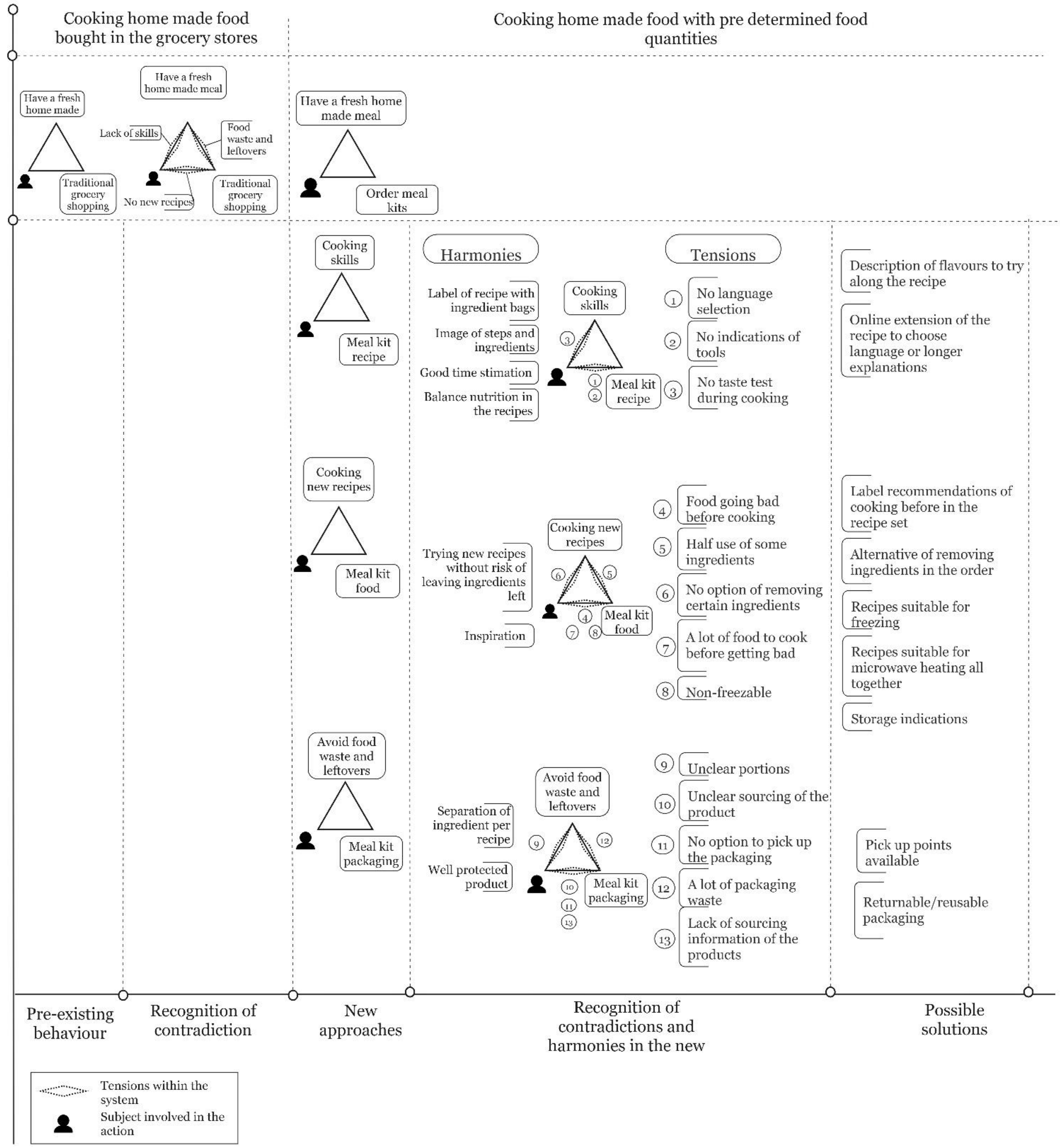

Figure 4 Layer analyses of the meal kit use

Cooking Skills

The artefact of meal kit recipes is important when developing cooking skills in this service. Users benefit from clear labelling of recipes with corresponding ingredient bags, which helps them easily identify what they need for each step. Additionally, the use of images for steps and ingredients provides visual guidance, making the cooking process more intuitive. Good time estimation within the recipes allows users to manage their time effectively while cooking, and balanced nutrition ensures that they are preparing healthy meals. However, there are several tensions present. The lack of language selection options limits accessibility for non-native speakers, and the absence of indications for necessary tools can confuse preparation. Furthermore, the lack of indications to conduct taste tests during cooking might lead to meals not meeting taste expectations.

Cooking New Recipes

When it comes to cooking new recipes, meal kit food serves as the key artefact. Meal kits inspire by offering new recipes that users might not have tried otherwise, encouraging culinary exploration and reducing waste by using exact quantities needed. This harmonises with the users' desire to try new dishes without the risk of leftover ingredients. However, there are significant tensions. Ingredients might go bad before they are used, leading to food waste. Additionally, some ingredients are only partially used, leaving users with half portions that are difficult to incorporate into other meals. The limited options for substituting or removing ingredients that users will not use in their recipe due to food restrictions or preferences are perceived as restrictive, and non-freezable recipes limit the ability to store leftovers for future use or to cook every recipe at the same time to avoid fresh food to get bad.

Avoiding Food Waste and Leftovers Ingredients

The artefact of meal kit packaging is relevant to the goal of avoiding food waste and managing leftovers. Separation of ingredients per recipe helps in organising and using ingredients efficiently, while well-protected products ensure that ingredients remain fresh until they are used. Despite these harmonies, excessive packaging is perceived during the observations as excessive waste. Portions can sometimes be unclear, leading to either insufficient or excess food. The sourcing of products can be unclear, raising concerns about sustainability and quality. Additionally, the lack of options for picking up is presented as inconvenient for some of the participants.

4.3 Proposed Solutions

To address these tensions, several potential solutions can be considered. Improving cooking skills through meal kit recipes, including language selection options and clear indications of necessary tools can enhance accessibility and ease of use. Providing taste-testing guidelines during cooking can help ensure that meals meet users' taste expectations.

For cooking new recipes with meal kit food, offering ingredient substitution options and recipes that can be frozen for later use can increase flexibility and reduce waste. Ensuring ingredients are fresh and appropriately portioned in all cases can also help minimise food waste. Showing indications of which recipe to cook first depending on the food's current condition could allow consumers to prioritise meal recipes which can get bad sooner and indications on storing for both after and before cooking would ensure better food handling.

To avoid food waste and manage leftovers with meal kit packaging, using returnable packaging can reduce the amount of packaging waste. This implementation could be used as an internalisation process for consumers to later on apply these routines to new habits making use of other types of packaging-free systems. According to recent research, shifting away from plastic packaging is challenging and requires significant changes within the value chain, but experts suggest that returnable packaging presents a feasible alternative to meal kit services (Sharda et al., 2024). Clear labelling of portion sizes and transparent sourcing information can help users make more informed decisions. Additionally, implementing a system for packaging pickup and using just one type of packaging material to facilitate recycling can further promote sustainable routines. Indications of storage before and after cooking could also ensure that food has lasted longer if needed.

By addressing these tensions and implementing these solutions, meal kit services can better align with consumer needs and sustainability goals, providing a more balanced and effective solution to the combination of grocery shopping and cooking challenges.

5. Discussion and conclusions

Meal kit services offer an alternative that allows for a reduction in food waste at different phases of the cooking process. By providing pre-measured ingredients and easy-to-follow recipes, they help users manage portions more effectively and reduce the likelihood of unused food going to waste. (Shin et al., 2024) However, while these services address some of the tensions found in traditional grocery shopping, they also introduce new tensions, particularly within the operational layer of meal kit usage.

The proposed solutions to address the tensions in the operational layer, such as language selection, tool indications, and taste testing guidelines, aim to improve user experience and the overall effectiveness of meal kits. Similarly, offering ingredient substitution options and recipes suitable for freezing can provide users with greater flexibility and reduce food waste. Implementing returnable packaging, easing recyclability, providing clear labelling of portion sizes and sourcing information are also other steps towards making meal kits more sustainable.

However, these modifications could potentially introduce *quaternary contradictions* within the production and logistics phase before the food reaches consumers. For instance, the implementation of returnable packaging may disrupt existing supply chains, bringing in more variety of packaging to the logistics. To understand the practicality of these proposed changes, it is necessary to analyse their impact on the current logistics systems. This involves evaluating how these solutions might affect existing harmonies and identifying any new tensions that may arise in the order preparation. Some other changes which might create this contradiction are the personalisation of meals, such as removing elements, the assessment of which recipe should be cooked first when food is not labelled with expiration dates or the implementation of returnable packaging.

To ensure the possibility of implementing these solutions, it is important to find a balance between maintaining current operational harmonies and removing the presented tensions. This might involve redesigning supply chains to accommodate more personalised recipes and developing new logistics strategies to handle the return of packaging or the assessment of the food.

Another important area to explore is the realistic context of combining meal kit usage with traditional grocery shopping. This hybrid approach can offer a more sustainable and cost-effective solution, balancing the strengths of both systems. Understanding how these two modes of grocery shopping interact can provide insights into new behavioural patterns and identify potential areas for improvement. For instance, consumers might use meal kits to learn about portion control and new recipes, and then apply this knowledge to traditional grocery shopping, further reducing food waste and enhancing meal planning efficiency.

By exploring the combination of meal kits and traditional grocery shopping, it is possible to identify synergies that can lead to more sustainable consumption practices. This involves examining how users adapt their routines when integrating both systems and assessing the long-term impact on their shopping and cooking behaviours, anticipating new possible services into the picture as packaging-free grocery alternatives. Following recent categorisation, if packaging-free alternatives are considered in “cook and eat” meal kits, these could fall into the category of business-owned packaging, picked up at home by the company, bringing new sustainability questions to the current packaging-free classification (Jiménez Romanillos et al., 2024), but easing consumers to transition to other types of packaging-free options, such as refill or repurpose choices. This move could also encourage consumers to a broader adoption of packaging-free alternatives in other areas of consumption, and promote new practices.

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