Design for waste separation and reduction during big events

Master Thesis
Strategic product design
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Master Thesis

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Summary

Nowadays, the environmental issue is the common challenge that the world is facing. With the development of manufacturing and the prevalence of consumerism, resources are being consumed, which turn into tons of waste that can not be easily degraded.

Large public events such as business exhibitions and consumer trade fairs are cases that produce a significant amount of residual waste throughout all the stages, which not only bring a substantial negative impact on the environment but also expensive to process. The venue and the event organizers are looking for a change. However, it can not be achieved without the exhibitors' and visitors' collaboration, who bring in the material to the event and generate waste during their visit.

The study aims to reduce the negative environmental impact and the financial cost of processing the event's waste. To define the research scope and learn the current waste management situation at events, the venue Rai Amsterdam was selected as the main case study. The performance on waste management throughout the construction stages, during the event, and demolition was investigated. Based on the result, more severe problems regarding waste separation and the abuse of unrecyclable materials were found in the stage "During The Event, " causing a recyclable waste being collected and processed as general waste.

To find out the specific problems regarding waste management during the event, the project selects two representative events, The Household Fair and the Horecava, to study further.

The two target groups' pain points on waste management and their event journeys were mapped out by interviewing the exhibitors and visitors of these two events. According to the research result, the waste produced during the event was mot separated into recyclable and non-recyclable waste, but all collected together and processed as general waste.

Exhibitors decide most of the material input and the waste from their stand as the most vital waste management group.

They did not receive relevant support from the event on waste sorting to cope with difficulties in facilities, cost, and time. The lack of incentives also makes them less interested in taking initiatives in waste sorting. On the other hand, the two events also did not enable visitors to separate their waste due to the absence of classified waste bins. Additionally, the knowledge gap is identified as another barrier for exhibitors and visitors to conduct waste separation. The pain points and obstacles are categorized into the factors that lead to insufficient ability and motivation in performing waste separation behavior. Each aspect was tackled with specific solutions in the ideation and conceptualization phase. Exhibitors' ability to separate waste is increased by providing instructions, proper waste sorting facilities, and visitor flow to plan time better. Meanwhile, cost-reduction incentives will be set to increase the motivation for waste sorting, which is based on a lower processing cost of recyclable waste than that of the general waste.

The final design consists of the following insights to improve waste sorting result:

- Create a digital platform that integrates the services and support that exhibitors may need along the waste management process.

- Gather information on the recyclable waste stream data to enable straightforward waste sorting instruction.

- Use the information about visitors' flow to help exhibitors better manage their time on waste sorting.

- Establish incentives on waste sorting and visualize the achievement.

- Promote the eco-choice to exhibitors with extra brand exposure opportunities.

Content

Chapter 01
Introduction

1.1 Context of the project

Venues bring people together with beautiful events, while the process can generate vast amounts of waste.

In recent years, environmental issues have attracted more and more attention from various industries, bringing sustainability as a principle for companies to reflect on their corporate social responsibility. Event organizers also pursue the goal of pursuing social responsibility in terms of actively working on waste management together with their waste processing partner.

However, the amount of waste produced from events is still huge, with many recyclables being thrown away as general waste.

1.2 Waste management at Rai Amsterdam

This project first collaborated with Rai, who later decided to not involve anymore because of the Covid-19 situation. However, since Rai is the company that briefed the problems in event waste management first and as an essential international exhibition center venue in the Netherlands, Rai's waste management is still selected as the main case to study in this project.

1.2.1 Introduction to Rai Amsterdam

Rai Amsterdam, also known as Rai, is an international exhibition and conference organization with the experience of organizing and facilitating meetings that bring people together for nearly one century.

Rai Amsterdam facilitates about 500 events per year, which include International congresses, (trade) fairs, events, and more than a thousand smaller congresses, presentations, and meetings that attract about 1.6 million visitors.

As an event organizer, Rai also organizes approximately 25 consumer and trade fairs every year, including the two events studied in this project: Horecava and the Huishoudbeurs. (RAI, 2020)

Aim---Zero Waste

Rai has the ambition to stimulate sustainable growth and development of people, markets, and the environment through valuable encounters.

1.2.2 Current waste management at RAI's event

Current waste management process

Figure 1.1 illustrates the process of waste management at RAI, which involves waste collecting, separating, transferring, and recycling. (RAI 2018)

According to RAI, the venue adopts the "On-site waste separation strategy," which is to separate waste before transferring them to the recycling company. According to the relevant figures published in the RAI's Annual Report of 2018, the in-house separated waste maintained 62% during the years of 2017 and 2018 (RAI, 2018)

Based on figure 1.1, the following waste streams were separated on-site at Rai's events:

- Wood
- Carpet
- Paper
- Swill
- Metal
- Glass
- Residual waste

Although aiming for zero waste with 100% recycling, the percentage of residual waste processed into eco power and other products was only 38%.

Meanwhile, among the waste streams that are separated on-site, there is no plastic waste.

Current waste streams at events

Waste volume

x 1 tonnes

	2018	2017	2016	2015	2014
wood	1,464	1,074	929	722	684
carpet	342	284	257	275	239
paper	260	250	235	213	230
plastic	2	-??	-??	-??	-??
swill	146	151	119	133	109
organic	4	16	67	-??	-??
iron	31	40	30	21	10
glass	77	73	104	71	50
construction & demolition	849	744	573	377	131
other specialist waste	2	6	7	7	2
residual	1,977	1,583	1,701	1,785	1,706
Total	5,154	4,221	4,022	3,604	3,161

Table 1.1 Waste volume of RAI's events (Image from RAI,2018)

Table 1.1 lists the volume of different waste streams produced from RAI's events, from where construction materials such as wood and carpet were at the highest amount. (RAI 2018)

It is worth noticing that the volume of plastic waste was only 2 tonnes in 2018, even no information has been recorded for the other four years. While the amount of general waste was the largest every year on the table, which is the most expensive waste category to process. (RAI 2020)

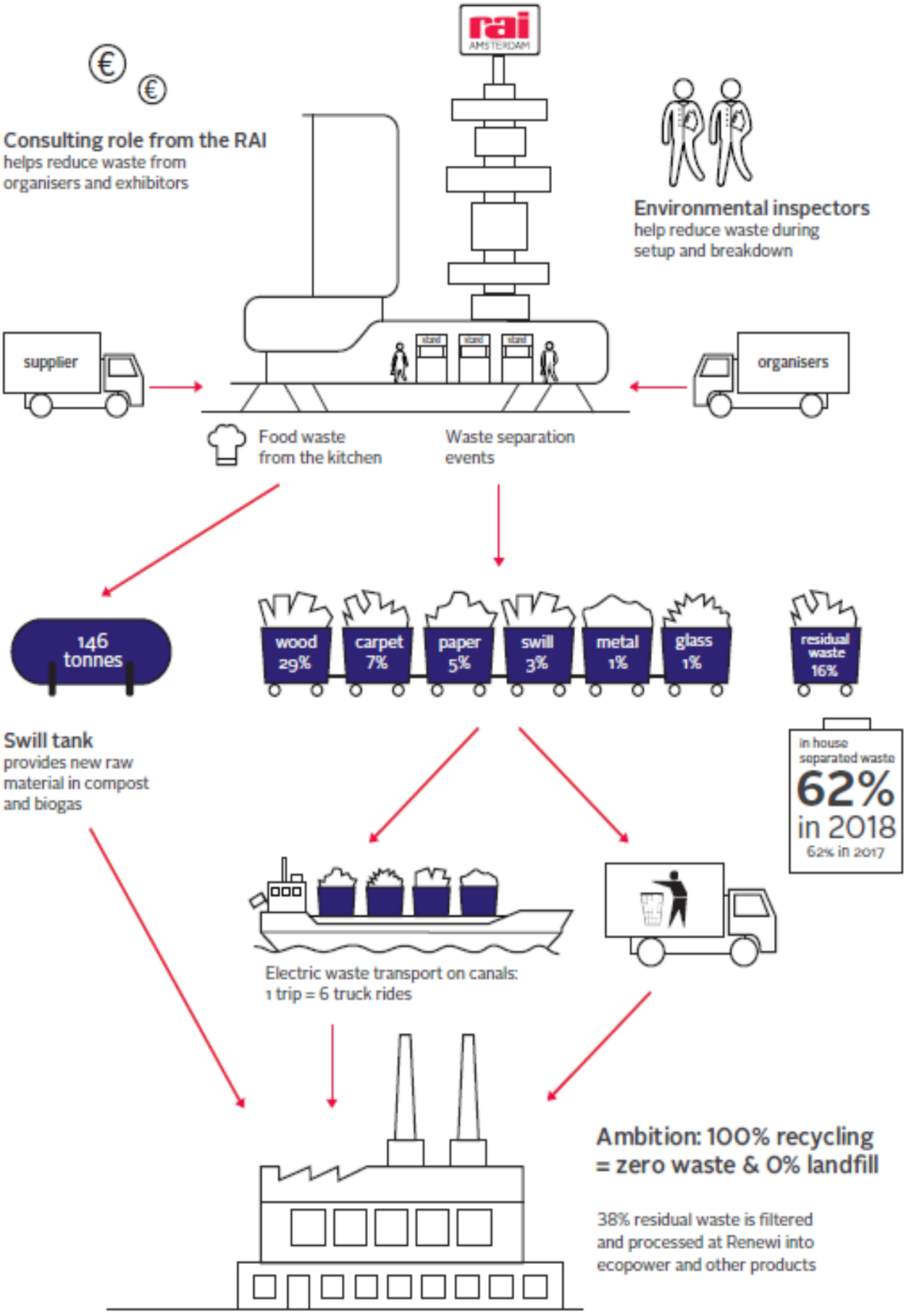


Figure 1.1 Waste management process of RAI (Image from RAI 2018)

Three stages of events

The overall event includes three chronological stages (Figure 1.2)

- Stand construction
- During the event
- Stand demolition

The waste streams from the stand construction and demolition are usually more predictable, for Rai has to access the material input. According to Rai, specific stand construction plans are provided for exhibitors in some events.

Simultaneously, exhibitors can also tailor their stand construction plan, which still needs to be evaluated and approved by Rai before the construction can start. (Rai 2020)

In most cases, the workers involved in stand construction and demolition are internal employees. Event organizers can manage the waste disposal behaviors of the workers through relevant policies and regulations.

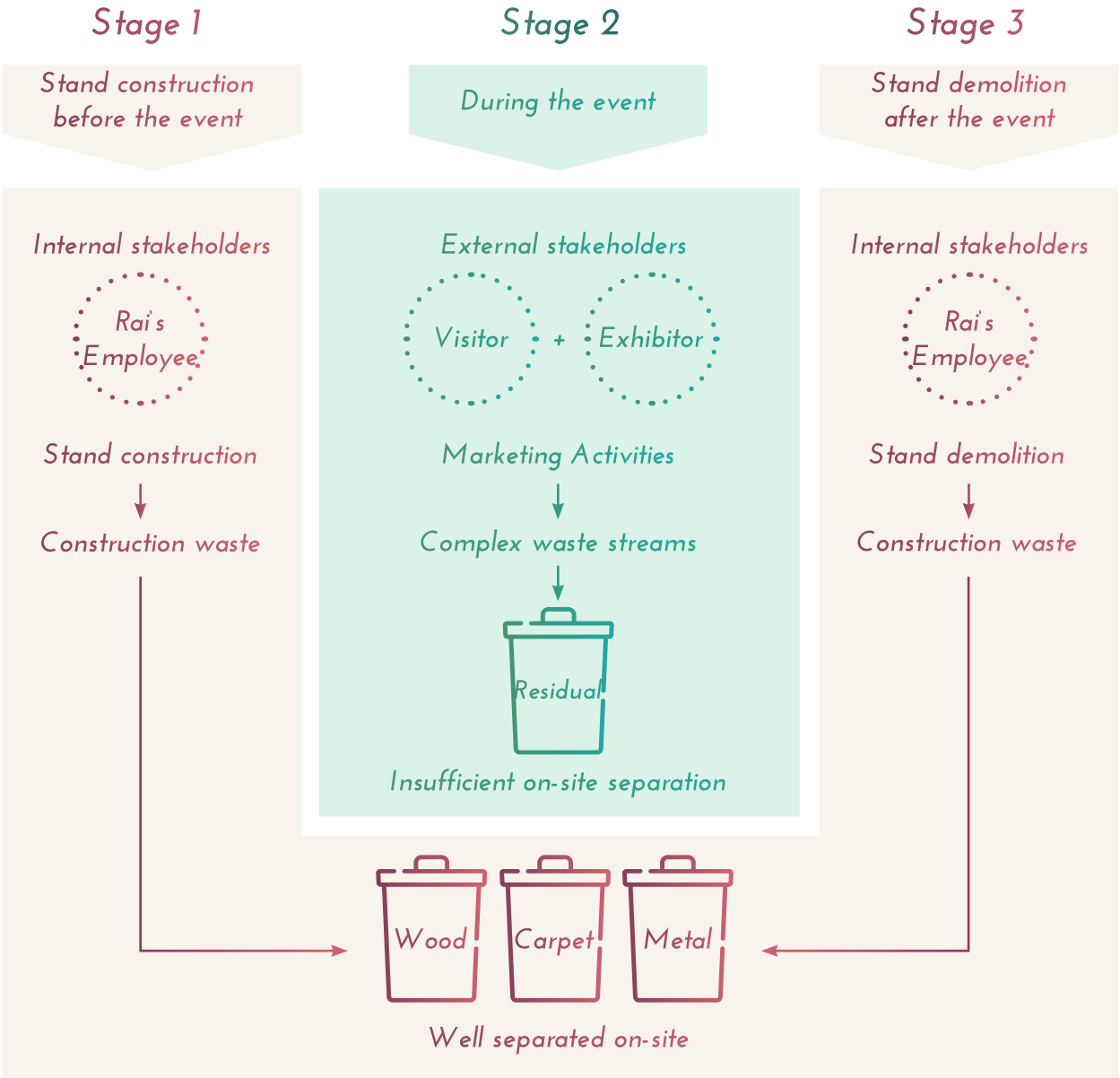


Figure 1.2 Three stages of the event

Findings

- Most of the waste streams from construction were well separated on-site and processed for further recycling
- Despite the large volume, the waste streams from the stages “Stand construction” and “Stand demolition” are more predictable in terms of the categories and the work.
- The on-site waste separation can be insufficient due to the amount of sorted plastic waste was too little.
- During the event, the material input from all the stands and visitors is diverse, resulting in more complex waste streams.
- The dynamic participants during the event increase the difficulty of managing waste disposal behaviors.

Based on the above research findings, the project will focus on ***Waste management during the event.***

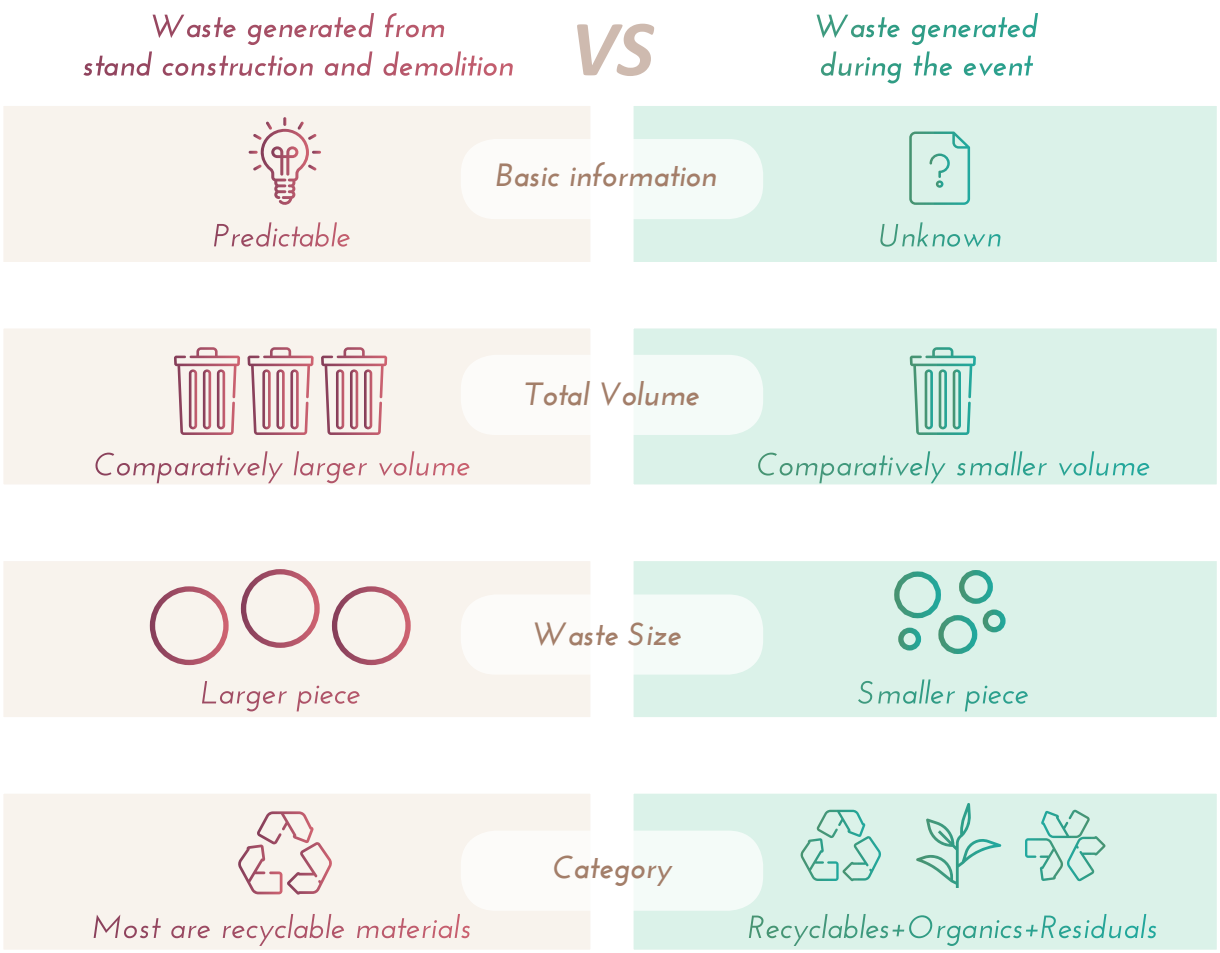


Figure 1.3 Characteristics of waste generated from the three stages

1.3 Problem definition

According to the current waste management situation at Rai Amsterdam, waste generated by exhibitors and visitors during the event is more challenging to collect and sort.

Seeing from table 1.1 and figure 1.1, the sorted waste is mostly construction waste, while for waste that commonly exists during the event, such as plastic, is barely sorted out. Thus, it is likely that most of the waste produced during the event, including recyclable waste, was collected as "residual waste."

Meanwhile, the residual waste is not environmentally-friendly and comparatively expensive to process. However, residual waste can be effectively reduced if the waste produced during the event can be better managed and separated.

In general, the problem found from Rai's waste management exists in the stage "During the event." Insufficient waste separation during the event results in a higher amount of residual waste, which does harm to the environment and increases the expense of waste management.

1.4 Assignment

Based on the problems, the project will dive deep to waste management's current status during the event. Interviews will be conducted to identify the issues as well as stakeholders' pain points on this topic.

The outcome of this project will be a product-service system that optimizes the waste management process in terms of reducing the amount of residual waste by sorting out the recyclable waste.

1.5 Challenges & Opportunity

1.5.1 Challenges of waste management

Waste management during the event can have challenges from the following two aspects:

Participants
The "participants" here refers to two groups: exhibitors and visitors.

Diverse & Dynamic

For visitors, the group consists of people worldwide, while this group's composition is continuously changing. Similarly, the exhibitors of an event can work in different industries and have different cultural backgrounds. Meanwhile, various events will attract various exhibitors to attend.

The diverse and dynamic increase the cost of communication regarding waste management and set a higher standard for the solution to be more intuitive with a short learning curve.

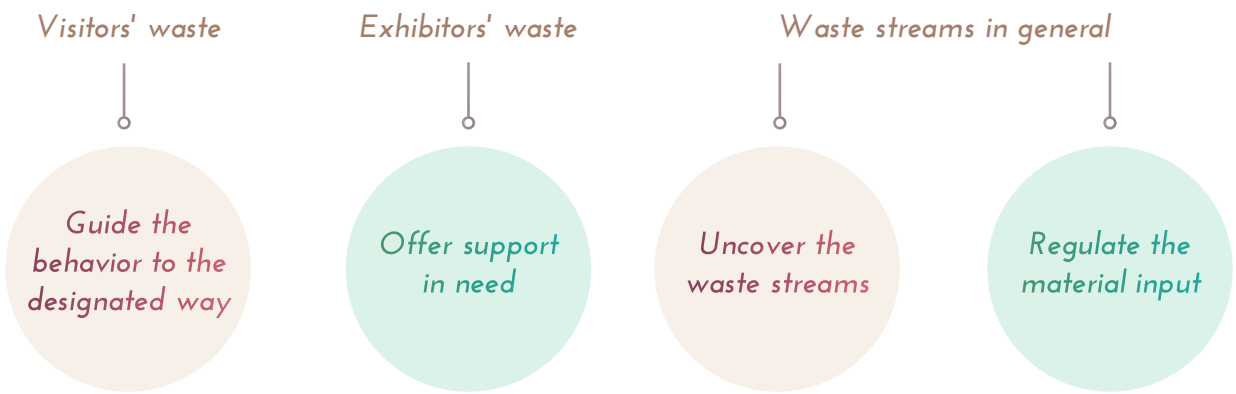
External party
Since the participants are all external parties, event organizers' right to decision-making can be more limited, such as the material input.

Waste streams
The waste streams refer to the waste generated by exhibitors at stands and by visitors at the event.

Unknown&Complex
During the event, the waste streams are mostly from the materials brought by event participants, which can be diverse and complex.

Currently, there is no action to collect information regarding the material input from exhibitors. Without channels to know the waste streams, it is hard for event organizers to set targeted plans for specific events in advance.

1.5.2 Areas of opportunities



Chapter 02

Literature review

2.1 Waste Management

2.1.1 Priority of activities

The first principle describes waste management activities' priority is the 3R's rule, which refers to "Reduce, Reuse and Recycle" measures for processing waste. Later with further research in this field, the 4th R "Recovery" was presented and later added to the group. Facing more serious waste challenges nowadays, the principle has been developed and extended to a whole level.

Waste management hierarchy

The waste management hierarchy demonstrates the priority of actions in waste management. (Figure2.1) Through a series of activities, it aims to minimize the waste generated eventually by extracting the resources as much as possible. Based on the Reduce, Reuse, and Recycle principle in the 3R's Rule, waste management hierarchy addresses a complete process by emphasizing the earlier stage of preventing waste and the later stage of energy recovery and treatment before final disposal.

From various resources of descriptions, variances can be found regarding the subdivision and naming of different levels, while the order of priority remains the same. (Hansen, W., Christopher, M., Verbuecheln, M. 2002, Haggar, S. E. 2007, EPA.2017, EPA. 2018). Top actions with higher preference can impact earlier phases of waste management, which are more likely to minimize materials entering the waste stream with a lower economic and environmental cost. (Hansen, W., Christopher, M., Verbuecheln, M. 2002) Prevention&Reduction is considered the ideal solution in the waste management hierarchy, followed by reuse and recycle, energy recovery, treatment, and final disposal.

The hierarchy portrays the logic flow of actions that business can refer to optimize their current waste management process. The priority of activities helps to drive more attention to the earlier phases, which provoke a broader audience to reflect on and change their way of consuming resources.

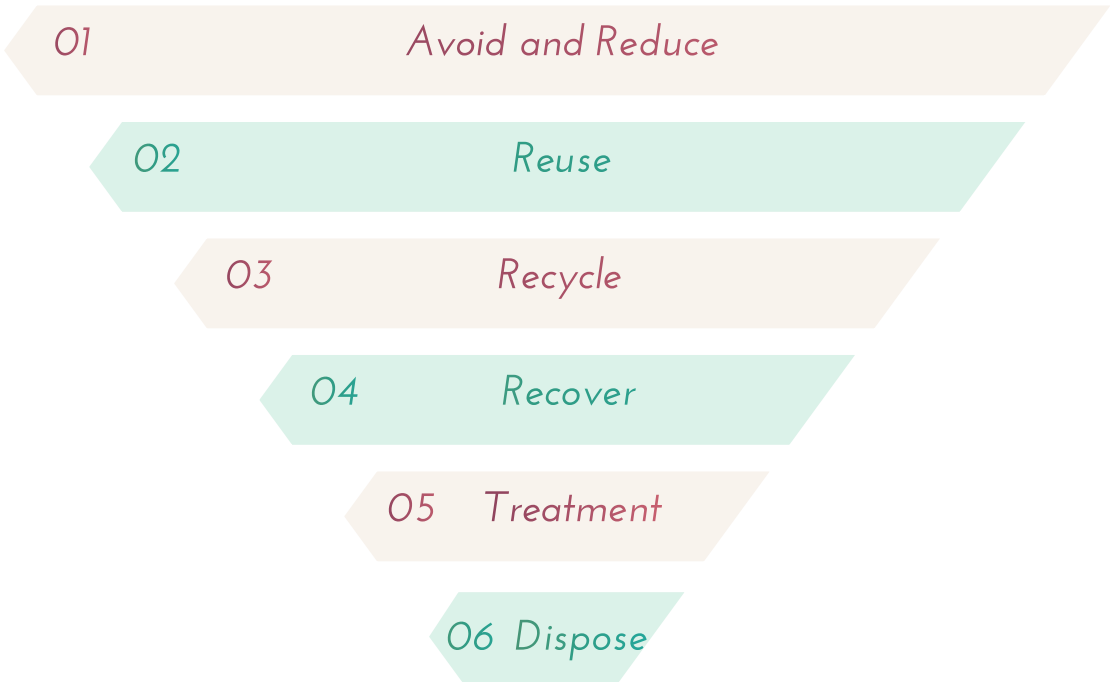


Figure2.1 Waste Management Hierarchy

Integrated solid waste management

With the development of urbanization and industrialization, the volume of waste also continues to increase. The management of solid waste has become a big challenge for businesses to conquer. Thus, an effective system that integrates A-Z activities in waste management, including waste minimization, recycling, transporting, and disposal, needs to be built. (Turner, R.K., Powell, J., 1991)

According to the definition of the United Nations Environmental Programme(UNEP), Integrated solid waste management(ISWM) refers to “a framework of reference for designing and implementing new waste management systems and for analyzing and optimizing existing systems.” (UNEP 1996) In this case, solid waste should be managed appropriately from a holistic perspective, where different stages are integrated into a seamless flow. Additionally, stakeholders need to form a collaboration in this process as a waste management community. (UNEP 2009)

Strategic planning in ISWM

Strategic planning is considered a holistic framework that leads the organization to achieve the current situation's predefined future goals. In ISWM, which is a complex project that needs to achieve a long-term objective together with different parties, strategic planning plays an essential role in defining directions, making decisions in allocating organizational resources. (UNEP, 2009) Tools such as SWOT analysis were applied as well to identify the internal and external vital factors. (USEPA, 2014) The detailed steps in the strategic planning of ISWM are illustrated in the figure below. (Diagram 2.1)The analysis can be conducted from both internal and external perspectives. There are relevant elements to focus on for the internal situation (organizational structure, staff profile, infrastructure availability, financial position). While the external situation generally refers to phases in waste management that are happening outside of the organization and relevant local policies and ongoing projects. (UNEP,2009)

To achieve the vision feasibly, it is essential to breakdown the ultimate goal into feasible objectives with concrete actions. Thus, in strategic planning, objectives on a smaller scale will be developed along the way, each with strategies regarding implementation. Under each strategy, a series of tactics will be set, which further instruct specific actions. (UNEP,2009) With this laddering structure, waste management parties can bring the abstract goals down to the ground to achieve feasible tasks step-by-step.

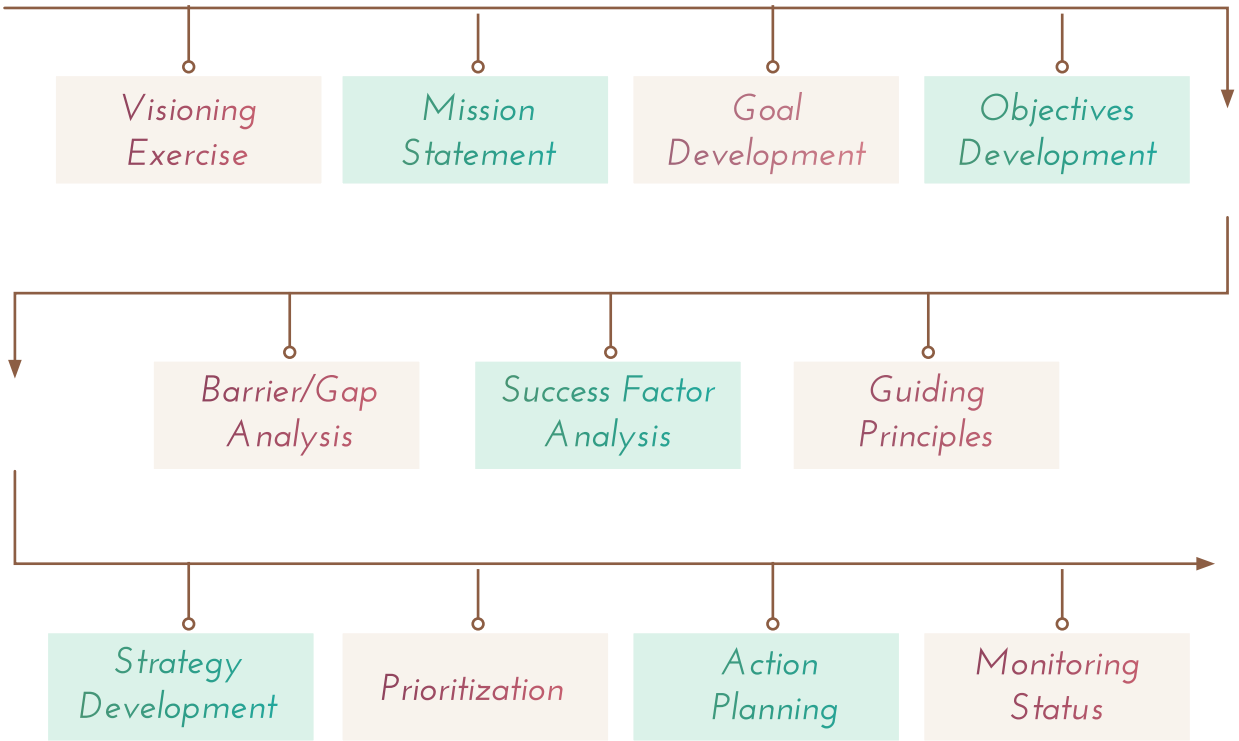


Diagram 2.1 Strategic Planning of Waste Management

2.1.2 Producer Responsibility

The definition of Producer Responsibility is “an environmental policy approach in which a producer’s responsibility, physical, and financial, for a product is extended to the post-consumer stage of a product’s life cycle.” (Riddick, K. 2003) It makes producers and importers co-responsible for managing the waste phase of their products.

Extended producer responsibility(EPR)

Based on the definition from Organization for Economic Co-operation and Development(OECD), the definition of Extended Producer Responsibility is "an extension of responsibilities of producers to the post-consumer stage of a products' life cycles." (OECD,1996) The policy is often applied by the government to transfer the cost of municipal waste management from local authorities to producers. (OECD,1996) In this case, producers are encouraged to reduce their products' environmental impact by rethinking their choices in the production process, packing, and marketing strategies. (OECD,1998)

Polluter-Pays Principle(PPP)

Cooperate with the EPR policy, another strategy that aims to make parties responsible for their waste is the Polluter-Pays Principle in terms of economic cost. It means that "the polluters should bear the cost of measures to reduce pollution according to the extent of either the damage done to society or the exceeding of an acceptable level (standard) of pollution." (OECD,1992). Followed the PPP principle, the concept of internalization of the environmental cost was addressed. It suggests that products' market prices should reflect environmental costs during the production, such as natural resource utilization and waste generation. (OECD, 1995)

2.2 Event greening strategies

2.2.1 Sustainable event management

A sustainable event can balance environmental, social, and economic responsibilities. Organizing sustainable events reduces environmental impact and brings other benefits such as financial advantages and positive company reputation. (UNEP 2012) In this case, Sustainable Event Management is the process of integrating environmental, social, and economic responsibility issues into event planning. (ISO 20121 2012, UNEP 2012)

The management principles for sustainable events raised by UNEP addressed the importance of forming a core management team, planning for actions, allocating resources, communicating, and monitoring. (UNEP 2012)

Stakeholders' engagement

During the Preparing stage of sustainable event management, crucial factors, including project scope, responsibilities, and commitment, should be defined first within the top management team. (BSI 2012)

After the preparation, stakeholders should be engaged in the project for inspiring changes and create a legacy that will last long. (BSI 2012, UNEP 2012) For this process, a checklist for stakeholders' engagement can be followed. (Diagram 2.2) (UNEP 2012)

First, map out all relevant stakeholders, from both internal and external parties. Then, categorize them based on the difference of their roles, relevant significance, current involvement, and interest of participation. (BSI 2012, UNEP 2012)

After that, it is essential to communicate the sustainability goals set in the preparation stage with stakeholders in an intuitive way that can be easily understood.(BSI 2012, ,UNEP 2012) In this case, it gives stakeholders time to adapt and better respond to the sustainability strategy needs. (UNEP 2012) Meanwhile, engaging the stakeholders to specify and prioritize issues, among which the most significant ones get solved first. It ensures that the identification of issues is involved with consideration from various perspectives. (BSI 2012)

Next, establish a formal collaboration that links 'the current sustainability initiatives of stakeholders, develop common goals, and use pooled resources. Finally, plan awareness-raising and capacity-building activities, organizing meetings or training for relevant parties, and capturing more attention from the general public. (UNEP 2012)

Sustainable transition of suppliers

One essential element of a sustainable event is to have suppliers who are also sustainable. According to UNEP, to establish policy and initiatives on sustainability are essential for suppliers to become sustainable. The event organizer should check whether the suppliers have specific environmental credentials during the selection process. (UNEP 2012) With similar qualities provided, local suppliers are considered a more sustainable choice due to less travel.(Resource-efficient Scotland, 2015)

Additionally, keep monitoring the targets that can be checked later, ensuring that sustainable related activities will be managed efficiently and urge suppliers to follow the venue's sustainability requirements. (Resource efficient Scotland, 2015)

However, it can be challenging to find all the needed suppliers who comply with environmental responsibility. In this case, it is necessary to adopt measures to reduce suppliers' negative environmental and social impacts. For example, incentives or support on staff training can be applied to motivate such transition further. (UNEP 2012)

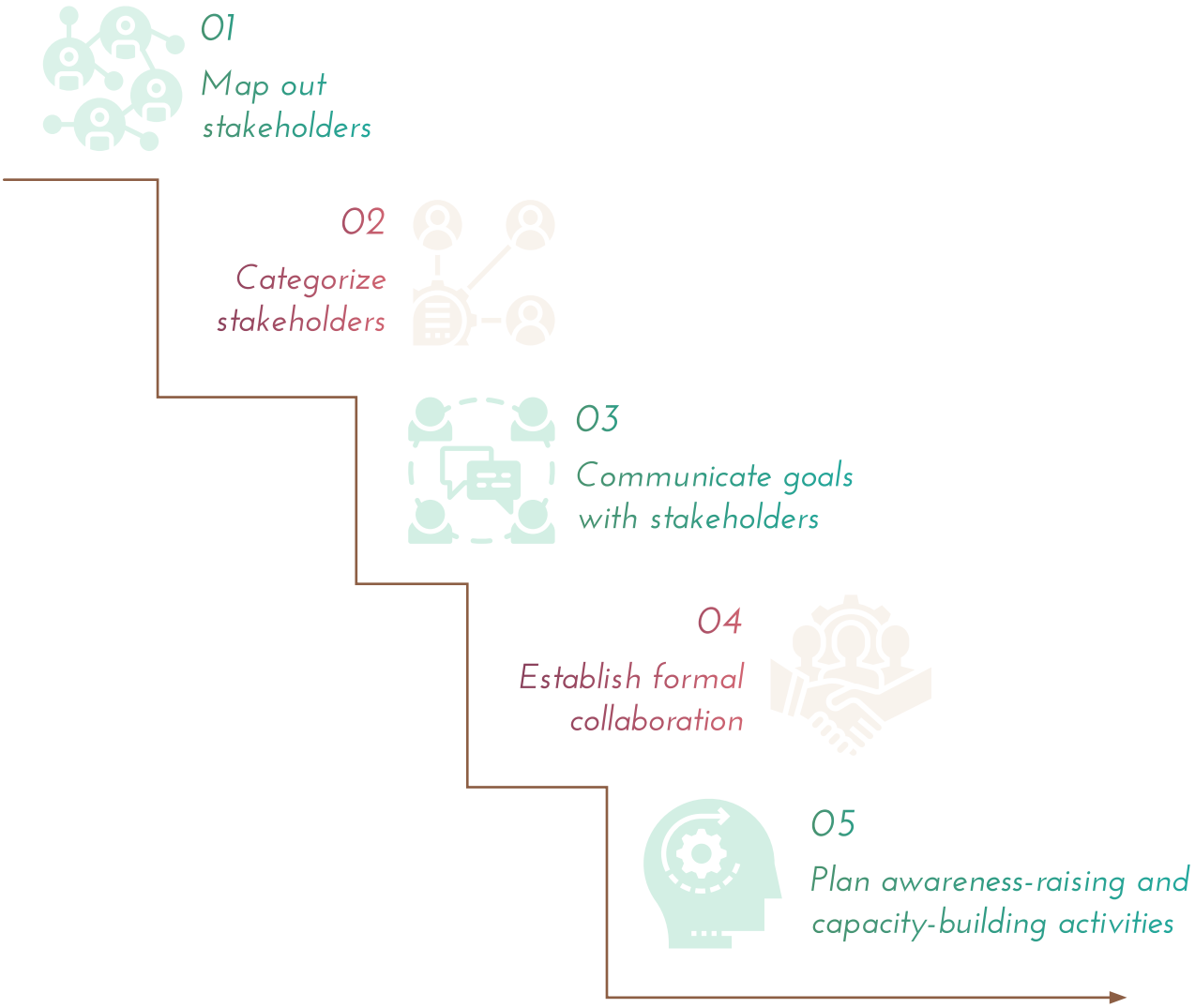


Diagram2.2 Checklist for stakeholder's engagement

2.3 Behaviour change

2.3.1 Indispensable factors

It is essential to understand and manage the factors that control people's behavior to change behavior. According to Fogg's behavior model(FBM), there are three types of indispensable factors that together drive behavior change, which is motivation, ability, and triggers. (BJ Fogg, 2009). In any context, only when the three conditions all present at the same time will the behavior be performed. As demonstrated in the FBM model, the level of motivation and ability are positively correlated with the chance to perform a particular behavior. (Figure 2.2)

Trigger

The forms of the trigger can be varied, while they can be categorized into three types based on different implementing occasions, including spark, facilitator, and signal. (BJ Fogg, 2009) The principle to choose triggers that suits different situations is whether the person has a sufficient level of motivation and ability to carry out specific behavior. In other words, certain types of triggers can further motivate or simplify behavior while playing their original role.

Motivation

To increase the motivation towards specific behavior, Fogg presented three groups of motivators that consist of different emotional bonds to build up motivation. (BJ Fogg, 2009) Each of these groups contains two words evoking the opposite feeling, such as pleasure and pain. Different motivators should be selected based on the specific context. However, the objective of driving people's intention to perform the behavior remains the same.

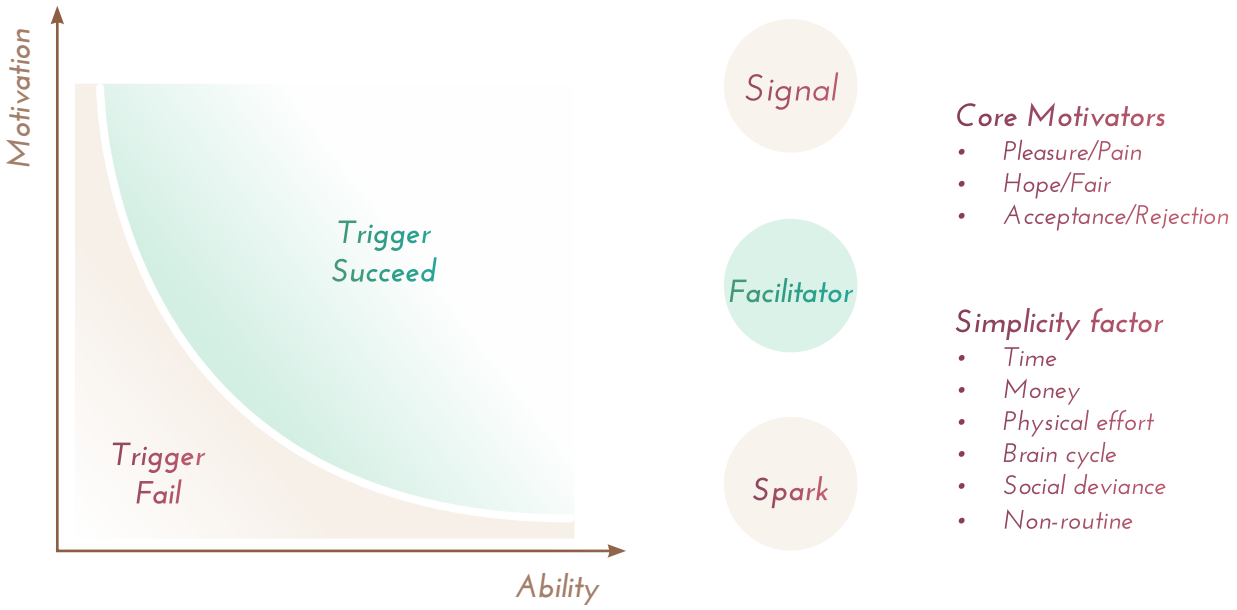


Figure 2.2 Fogg Behavior Model

Ability

When it comes to ability enhancing, it is natural that people will relate to approaches such as learning or training. However, the required effort and time turn into the biggest obstacle in practice, especially in today's world, where convenience and speed are highly valued. In this regard, lower the threshold through simplifying the behavior becomes the win-win strategy. (BJ Fogg, 2009)

Simplicity can be achieved through various aspects, while whether a particular method works or not depends a lot on the specific context. According to the FBM model, solutions including shortening the time in need, lower the financial cost, reduce the required physical effort or brain cycles, stay within the social norm, and share more similarities with the routine behaviors. (BJ Fogg, 2009)

2.3.2 Sustainable design-led interventions

Design-led interventions are strategies that explore different ways to influence people's behaviors and decrease the negative environmental impact generated from user activities. (Tang, 2010; Tang and Bhamra, 2008)

From eco-information to clever design, a gradual shift can be found in the dominance of decisions-making from the user side to the product/designer side. (Diagram 2.3) This gradient acts as a scale for designers to develop solutions that cater to various cases in reality.

Among these intervention ideas, diversity, as well as relations, can be discovered. For example, eco-information and eco-choice rely on consumers' self-reflection, from where the consumers are expected to reduce their negative environmental impact. The difference is that Eco-choice also offers consumers options to act in a sustainable way, which may not exist in Eco-information. While for people who are lack of awareness about their unsustainable behaviors, the idea of providing real-time feedback is introduced in Eco-feedback to give further notice. What is more, the policy of rewarding and penalties is involved in Eco-spur to enhance motivation. (Bhamra, T., Lilley, D., Tang, T., 2011)

Compared to the first four strategies, which still leave consumers the right to make decisions, Eco-steer, and Eco-technical intervention are more strict towards this freedom. More constraints are embedded in the product system to limit the choice of consumers, which is possible to encounter resistance from users due to a lack of user-friendliness.

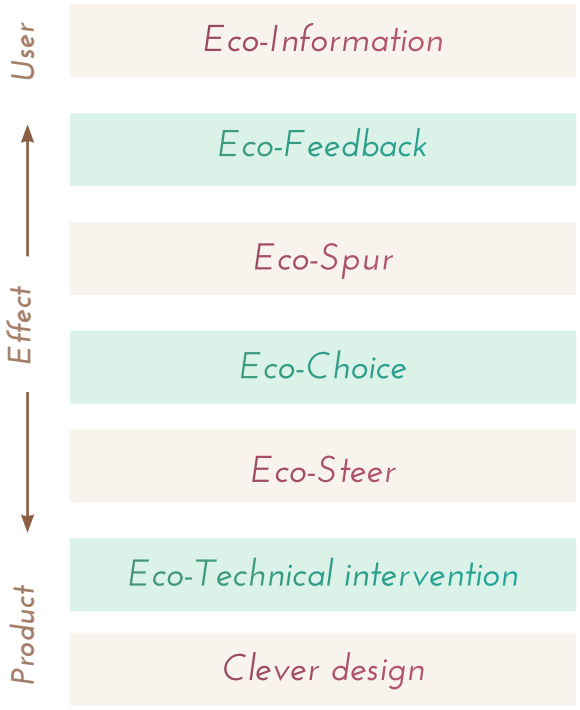


Diagram 2.3 Design-led intervention

2.4 Insights from the literature review

Waste management can also adopt the mindset of strategic planning to break down the ultimate goal into several horizons with feasible objectives and concrete actions. With the development of technique and the rising environmental awareness of people, the strategic plan of waste management may aim at a higher level of the waste management hierarchy. (e.g., Recycle--Reduce--Avoid)

With the “Polluter-Pays Principle,” exhibitors need to pay for the waste they generated. This policy makes exhibitors more sensitive about the amount of waste they produced and may trigger the motivation of reducing the waste to save cost.

Event organizers play a crucial role in urging event suppliers' sustainable transition via releasing policy and offering support.

Waste management requires a close collaboration of stakeholders, including event organizers, exhibitors, and recycling partner companies. It is necessary to start this collaboration before the event to bring every stakeholder on the same page by briefing the process, action, relevant responsibilities.

For waste management, exhibitors and visitors need to have sufficient ability and motivation to deal with the waste they generate and receive the trigger at the proper time.

According to simplicity factors, the keywords to increase the ability of waste management can be:

- Enhance efficiency.
- Reduce the cost/Generate new revenue.
- Reduce the brain cycle/Create intuitive behavior.

Motivation is generated from the emotional bond between the behavior and the person. It is necessary to bring pleasure via incentive or a sense of pain via punishment to motivate exhibitors and visitors.

The sustainable design-led interventions that are close to the user side are more desirable to use since users have more freedom to make their own decisions.

The interventions close to the product side are effective in preventing non-sustainable action for users to perform a designated behavior while may not desirable for users.

Chapter 03

Field research

3.1 Case study-Horecava & Household fair

To understand waste management's current situation during the event and identify problems, the project chooses one business event and one consumer event organized by RAI Amsterdam: The Horecava and The Household Fair.

Introduction to Horecava

Horecava is the largest catering trade fair in the Netherlands, held for more than 60 years. (RAI, 2020)

The event Horecava offers participants a platform to find a broad and complete overview of products, services, and trends from the catering industry.

Introduction to Household Fair

The Huishoudbeurs is an annual event that has been held every year since 1955 in Rai Amsterdam. At the consumer fair that traditionally aims at homemakers, products and services are presented in fashion and cosmetics, health, cooking, living and equipment, and leisure.

During the Household fair, visitors can take advantage of the many bargains and participate in creative workshops and fashion shows. (RAI,2020)

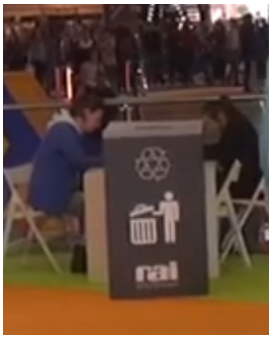
3.1.1 Event scenario observation

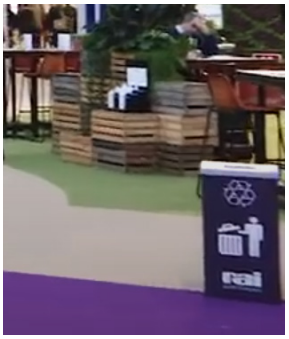
Due to the Covid-19 situation, no on-site observation was conducted in this research. However, an online observation was conducted via the two events' videos to gain an overview of the context. Insights found from the video clips are illustrated and explained below.

Most of the visitors at Horecava are bringing their shopping trolley to the event.

Plastic bags are widely used in sales activities.

Sampling activities are common





The waste bins at the event did not separate different waste streams

3.1.2 Event participants interview

To understand how exhibitors and visitors manage their waste during the Horecava and Household fair, four visitors and four exhibitors from these two events were interviewed.

Waste streams during the events

- *Disposable utensils.*

In the interviews, exhibitors from both events acknowledged that they used disposable utensils to provide free samples of food and drinks to visitors. The use of disposables brings the event participants efficiency and convenience, while it also vastly increases the amount of general waste.

- *Sample packages, Cardboard, Plastic bags*

Package waste is another main waste stream from sampling activity, which can be made of diverse materials, such as plastics, paper, and foil metal.

Besides, the cartons that exhibitors used to bring their goods to the venue also ended up in cardboard waste after the event.

Additionally, visitors and exhibitors of the Household fair also expressed a widespread use of plastic bags across the event. For instance, some products were fully-packed with packages, while exhibitors who sold products on the fair would still use other plastic bags to wrap the products.

- *Marketing printings*

Exhibitors mentioned that they handed out advertising printings such as flyers and brochures during the event, while they would only target visitors who showed interest.

Exhibitor A: "We ask them do you want a flyer, yes or no. We ask everybody if they want to, they get it. Otherwise, no."

Facilities for waste collection

- *Facilities for exhibitors to collect waste- Waste bags*

Exhibitors have to collect the waste and keep their stands waste-free at the end of the exhibition day. For collecting the waste during the event, most exhibitors need to purchase particular waste facilities from the event to use the waste-collecting &processing service.

However, exhibitors have complaints about the size of the waste bins provided by the event, such as it is too big to fit into the stand. Thus, most of the exhibitors only use waste bags to collect their waste, making the waste-collecting process even more annoying due to the bags easily collapse on the ground.

- *Facilities for visitors on waste disposal- General waste bins*

Inside the venue, visitors can dispose of their waste in the general waste bins placed in the hallway. These waste bins were prepared explicitly for visitors, for which exhibitors were forbidden to dump the waste from their stands.

Exhibitor B: "You are not allowed to put anything of your garbage in the waste bins prepared for customers or visitors."

Obstacles of visitors on waste sorting

- *Lack of proper facilities for waste separation*

Based on the interviews, none of the visitors separated their waste during the event. The barrier they all mentioned was no classified waste bins provided at the two events. According to visitors, all the waste was thrown in the general waste bins.

Visitor D:"I haven't really seen anything to sort waste. Maybe that it was somewhere, but the trashcans at a stand where just to throw everything in."

Visitors from interviews expressed that they are willing to separate their waste during the event if they provide them with classified waste bins. Thus, the venue or event organizers must provide proper facilities on waste separation to visitors at first.

Visitor A:" I held onto my waste if I couldn't throw it away and separated the flyer at home with the paper waste."

Visitor B:" If they have appropriate trash bins there, it doesn't matter for me to separate...as long as there is trash bin that you can separate, then I will do it."

- *The knowledge gap in waste separation*

Additionally, the knowledge gap in waste sorting can be another challenge for visitors to separate the waste correctly. Visitors from one exhibition can be diverse, while some of them do not have sufficient knowledge of waste sorting. Thus, it is crucial to add a clear message to visitors regarding where to throw what kind of waste.

Waste collection of exhibitors

- *Improper behaviors of exhibitors on waste disposal*

According to Rai's relevant waste removal policies, exhibitors are responsible for removing the waste they generated throughout the whole event. (RAI 2020) However, improper behaviors on waste disposal still exist among exhibitors.

Exhibitor A: "I saw many companies who were at the RAI. They just dumped their garbage when nobody was looking. For instance, some exhibitors threw the garbage in the bins prepared to the visitors, and someone also just dumped the garbage behind the stands."

- *Insufficient waste separation at stands*

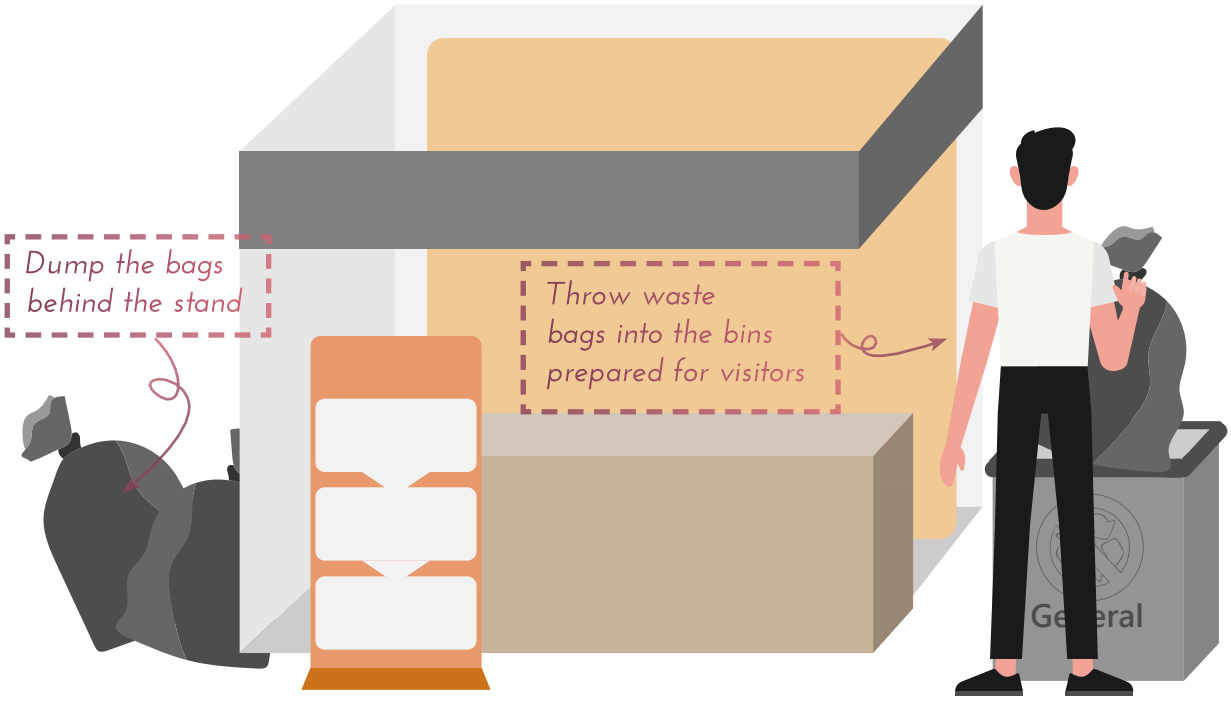
As for waste separation of exhibitors, only one out of four exhibitors from the events Household Fair and the Horecava separated waste at the stand. Several containers were provided by RAI to sort food waste, glass, plastics, and metal.

Exhibitor D: "We separated glass, plastic, and cans, then they picked it up for us...waste bags for food waste, big wagons for plastics, bins for glass and metal waste."

The rest of the exhibitors acknowledged that they did not focus a lot on waste separation during the event. One exhibitor mentioned they only handled the big cartons separately, while still mixed up the rest of the waste.

Most of the exhibitors collected all their waste in one or two waste bags every day, without separating the waste streams by source.

Exhibitor A: "We did not do any waste separation at the time of disposal...only the carbon was separated from other waste, the rest are all together."



- *Removal process of waste generated from stands*

During the Horecava, exhibitors need to bring their waste bags to a waste collecting site to throw their waste bags in the big containers. However, no waste separation was conducted during this process.

Exhibitor B:"During the Horecava, at the back of the hall, there are several super big containers where you can put your garbage in. But there were no separation for the containers."

However, exhibitors from The Household Fair only need to place their waste bags next to the stand at the end of each exhibition day, which would then be collected by the staff. (RAI 2020)

Exhibitor C:"At the end of the day, we just put the bag in front of our stand, and the cleaning from RAI picked it up and for the recycling."

Based on the research above, the current situation of waste separation and approaches to waste removal is illustrated in diagram 3.1. The left part demonstrates the management process of the waste generated by visitors, starting with all the possible waste streams. Similarly, the right part refers to the management process of waste produced by exhibitors at stands. It is found that different waste streams were not separated along the way of processing, including both the disposal and the collection.

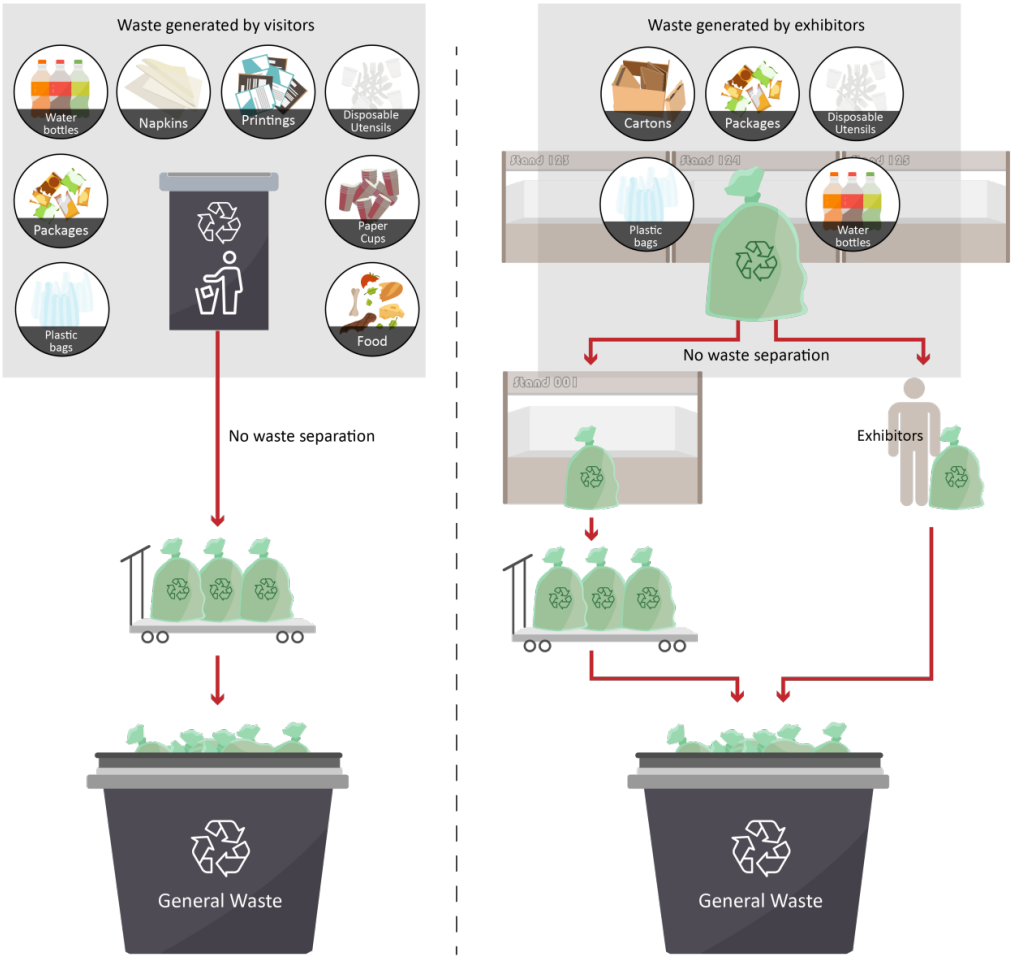


Diagram3.1 Current waste processing

Pain points of exhibitors on waste separation

- *Limited of time for waste sorting*

The first obstacle of exhibitors on waste sorting was the lack of time, as exhibitors expressed that they are busy with event work. It is unlikely for exhibitors to take the initiative on waste sorting if the event itself did not address or provide any support for exhibitors on waste sorting.

> *Exhibitor A:" I think the separation costs much time...Exhibitors are just so overwhelming. And you also have to think about, in which bins do I have to throw this away."*

- *Lack of proper facilities for waste separation*

Like visitors' expectations, exhibitors also mentioned it is essential for organizers to provide proper facilities on waste separation. Otherwise, it is difficult for them to take the initiative.

> *Exhibitor A: "If the organizers provide us the good facilities to do that, such as garbage bins with several sections, I will do that for sure."*

- *Demotivated by the inconsistency in waste separation process*

One exhibitor from The Horecava had separated waste from her stand once. However, she found out no classified bins provided at the time of final disposal. The lack of facilities vastly decreased her motivation for waste separation. From here, it can be seen that the process of waste separation is inconsistent. The event needs to take action on waste sorting first before expecting exhibitors to do so.

> *Exhibitor B:"You see that everyone just mixed up everything.You can separate your garbage, but at the end, the point where everything were collected, it's still the same."*

- *Lack of motivation on waste separation*

Meanwhile, exhibitors felt less motivated on waste separation due to various limitations and obstacles from the event context.

> *Exhibitor A: "I don't think that exhibitors really have the energy or motivation on this during the event...so reduction and separation is not the priority at that time"*

3.2 Waste management of other events

In addition to the case study of RAI's events, three interviews were conducted with organizers from other events, including the venue Messe Dusseldorf (MD), Sustainable Living fair(SLF), and Dutch Design Week(DDW), to get a broader view about the current situation of waste management at other events.

3.2.1 Waste management strategies

- *Briefing exhibitors the information on waste management*

In the interviews, organizers from Messe Dusseldorf applied the strategy of briefing exhibitors about relevant services and waste management policies before the start of stand build-up. The briefing makes sure every exhibitor is clear about how to process their waste properly while also address the importance of waste management across the event.

> *The organizer of MD: "All exhibitors from all over the world are briefed about our waste services and waste philosophy by our global Representatives and Daughter companies as well as our specific show information, offered waste disposal services and technical guidelines."*

- *Close collaboration with recycling companies*

Messe Dusseldorf is working with several 3rd-party recycling companies on waste management. Two of them are responsible for waste generated from the venue, while the other processes the waste for further use.

> *The organizer of MD: "We have some important partners who are a great help for us regarding the overall waste disposal. AWISTA, take care of all waste in the fairground outside the exhibition halls. ISS takes care of all waste inside the buildings. REMONDIS, they are doing further use of various waste."*

- *Utilize the exhibition to increase awareness*

During Dutch Design Week, specific construction projects were displayed to show the process of materials reuse. Through the exhibition, the organizer showcased the influence of recycling with practical cases, which helps to raise awareness among participants on reuse and recycling. This suggests the advantage that the event has on inspiring and educating people.

> *The organizer of DDW: "It was a building that we created with all materials afterward went back to the parties that they came from…With that project, we try to make some good examples of how things can be and to inspire people to work and think differently."*

3.2.2 Challenges on waste management

- *Visitors are lack of the motivation/interest in waste sorting*

The diversity of visitors can result in various attitudes towards waste separation. Some visitors inevitably have less interest and motivation in sorting their waste. In the case of Messe Dusseldorf, despite there are plenty of classified waste bins provided across the venue, improper waste disposal behaviors still exist.

The organizer of MD: "I would describe the 'waste disciplines' of our international visitors as a big challenge…Our visitors come from all parts in the world, all cultures, religions, and nations of this planet are visiting us, but not everybody has the knowledge or the interest to think about the waste they are leaving in our fairground."

For the above situation, the problem of waste separation can also result from visitors disregarding the waste disciplines. Additionally, due to a vast diversity of the visitors' backgrounds, some can have less experience of waste sorting from their daily life and thus are less likely to do so during the event.

- *Exhibitors are lack of motivation& awareness on waste separation*

In terms of waste management, many exhibitors are less motivated to deal with the process of waste separation and recycling if they paid a considerable fee to attend the event. According to the organizer of SLF, these exhibitors consider the venue or organizers should shoulder the responsibility. The same problem was addressed by the organizer of Dutch Design Week. Among many exhibitors and relevant parties involved, some lack the awareness of waste reducing and sorting.

The organizer of SLF: "The exhibitors, since they pay much money, so when they come, they just wanna get rid of their garbage… when the fair is much more expensive to attend, exhibitors will think the event organizers should take care of the waste problems."

3.3 Summary of interview insights

3.3.1 Deficiencies in the preconditions of waste sorting behavior

Insufficient ability & motivation

The interview content was coded and categorized into clusters, which can be found in Appendix B. Based on the interviews, it is found that most of the visitors and exhibitors were not separating their waste at the events. According to Fogg's behavior model, it is necessary to have sufficient ability and motivation to form a behavior. Thus, the pain points discovered can be the reason for deficiencies in ability and motivation.

- *Insufficient Ability (Exhibitor)*

 Time	Exhibitors were busy at event, which they found it difficult to arrange their time for waste sorting.
 Cost	Exhibitors are complained about the high cost they pay for waste management.
 Facilities	Exhibitors were not provided with suitable waste sorting facilities.
 Knowledge	Exhibitors were not given clear instructions regarding the overall process and their responsibilities on waste sorting.

- *Insufficient Motivation (Exhibitor)*

 Incentive/ Punishment	Exhibitors did not get any reward or punishment from the event regarding (not) sorting waste.

- *Insufficient Ability (Visitor)*

 Facilities	Inside the exhibition hall, only general waste bins were provided.
 Knowledge	Unclear about "where to throw what"

- *Insufficient Motivation (Visitor)*

 Incentive/ Punishment	Visitors did not get any reward or punishment from the event regarding waste sorting behaviors.

Conclusion:

From the interviews with exhibitors and visitors from Rai's events, it can be seen that the two events did not attach enough importance to waste sorting.

For waste sorting at stands:

1. No requirements or policies were released to inform exhibitors what to do on waste sorting.
2. Not enough support was provided from the event to help exhibitors sorting their waste.
3. No reward or punishment was given to motivate exhibitors to sort their waste.

For waste sorting at events:

1. No classified waste bins were provided to visitors inside the exhibition hall.
2. No instructions were given to help visitors correctly sort their waste.
3. No reward or punishment was given to motivate exhibitors to sort their waste.

To increase the ability and motivation, the following action can be done by the event:

Specify relevant Policies and inform stakeholders	*Provide sufficient support for facilities*	*Set reward or punishment to motivate proper behavior*

Trigger

In the Household fair and Horecava, event organizers applied the inspectors' mechanism to remind and supervise the exhibition's waste management process. According to the exhibitors' description in the interview, these inspectors will patrol the venue to stop or punish some incorrect garbage disposal or dumping. However, the inspectors only care if the standing waste is cleaned, while they do not care about if the waste streams are separated.

For visitors' waste disposal, currently, there is no trigger for reminding visitors to sort their waste.

3.3.2 Opportunities for waste reduction

From the interviews, problems were found in the use of plastic bags and disposable utensils. According to the waste management hierarchy, avoiding and reducing waste is a more preferred solution than recycling the waste after it was generated.

- *Promote the biodegradable disposable utensils*

As for the disposable utensils, the ones used at the event are usually made of non-biodegradable materials. The recycling companies can not recycle most disposable utensils due to the small size and possible food contamination. (Recyclenow, 2020) Simultaneously, the demand for disposable utensils at the event is still great, which can not be completely replaced with reusable utensils due to the requirements for convenience, efficiency, and hygiene.

At the current stage, one feasible way to reduce the negative environmental effect caused by the use of non-recyclable disposables is to promote the use of bio-degradable alternatives.

- *Limit the use of plastic bags*

Unlike the unavoidable use of disposables, the plastic bags in the Household fair are not a rigid demand in many cases. The main reason is that most visitors are carrying their shopping trolleys to the event, which can be used to load the items they purchase. In this regard, it is possible to reduce the number of plastic bags used at the Household fair without sacrificing visitors' demand.

For doing that, the event's relevant policies should be released to limit the use of plastic bags.

Conclusion:

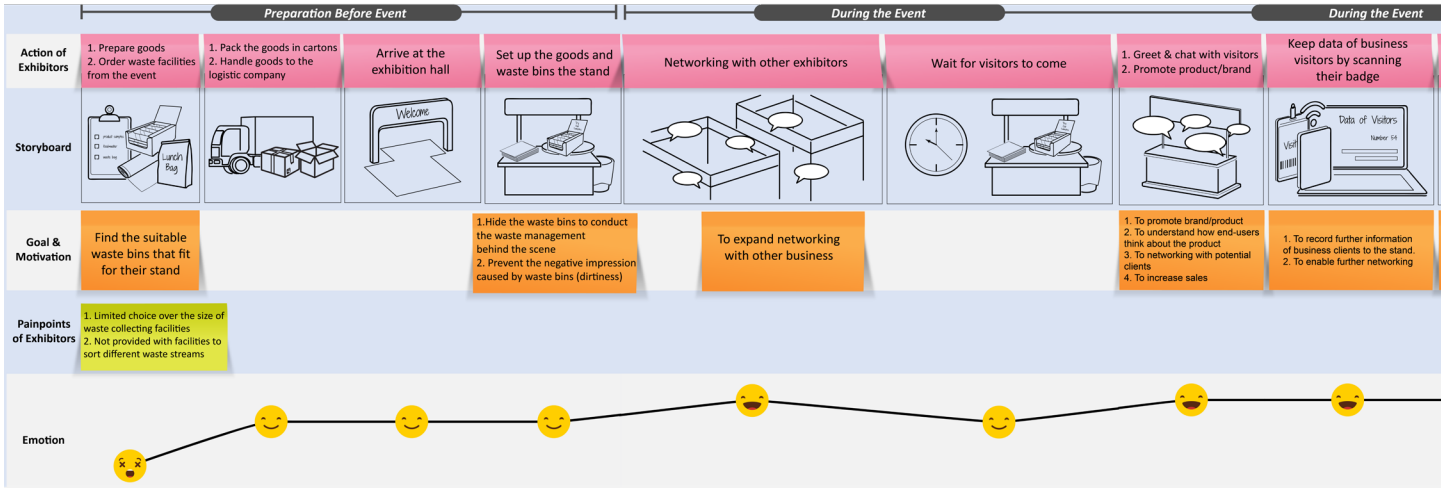
In the content above, the focus of reducing the use of plastic bags and disposable utensils are different. More solid interventions should be put to limit the use of plastic bags, through regulations or financial punishment. While the rigid demand for disposables makes it hard to limit the use directly, it can reduce its non-recyclable proportion by recommending using the bio-degradable ones.

3.4 Event journey of exhibitors and visitors

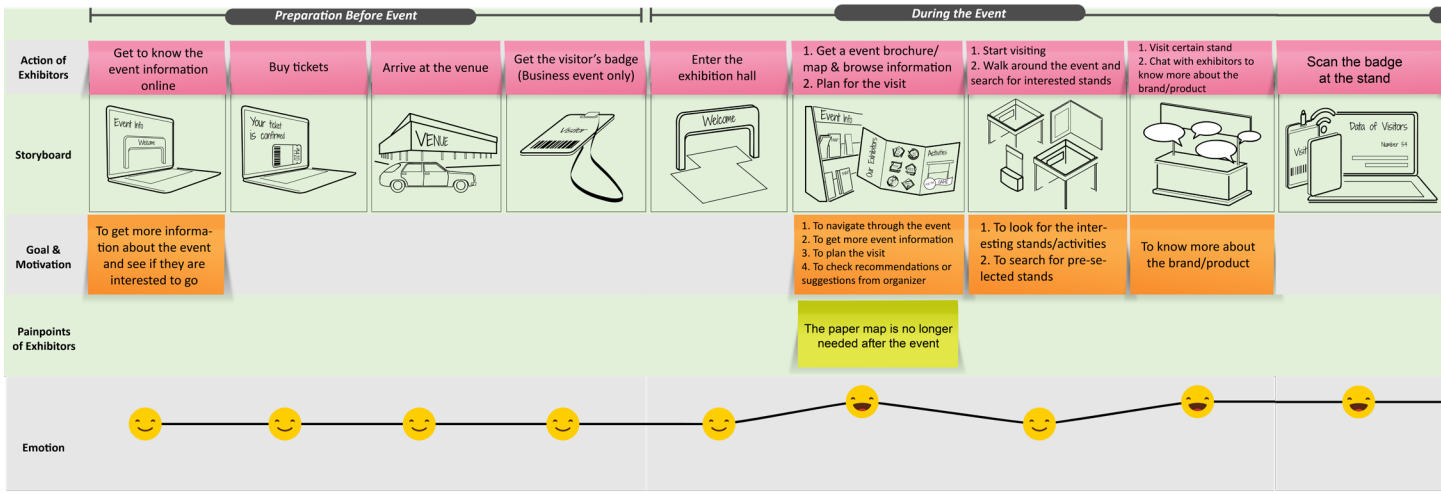
To better illustrate the findings and see how the interactions between exhibitors and visitors influence waste management, two journeys are mapped out to display how exhibitors and visitors go through in one exhibition day. The visitors and exhibitors' journeys demonstrate the activities, motivations, and emotional changes of the two groups.

3.4.1 Insights about waste streams

Exhibitors' Journey



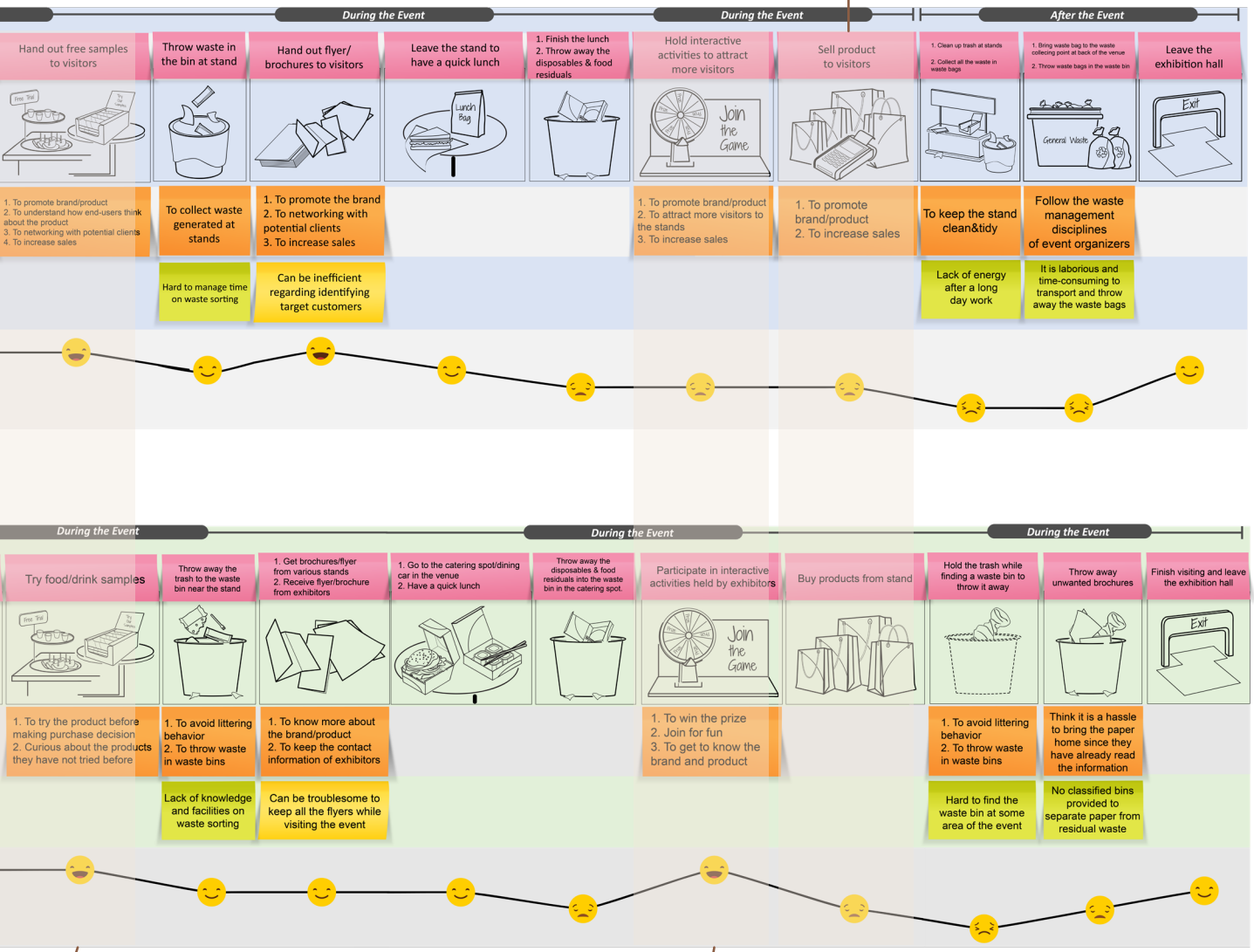
Visitors' Journey



Handing out free samples increases the complexity of the visitor's waste streams. Only a few food stands will prepare extra waste bins for visitors. Most of the packaging waste is ended up in the general waste bins in the hallway.

*Most of the **plastic bags** were brought back home by visitors, **few will end up in waste bins** and directly become event waste.*

*The plastic bags provided at the event are more out of **marketing purposes** than the functional ones as visitors will carry the bags around the event, which can be a "mobile advertisement" for businesses to promote themselves.*



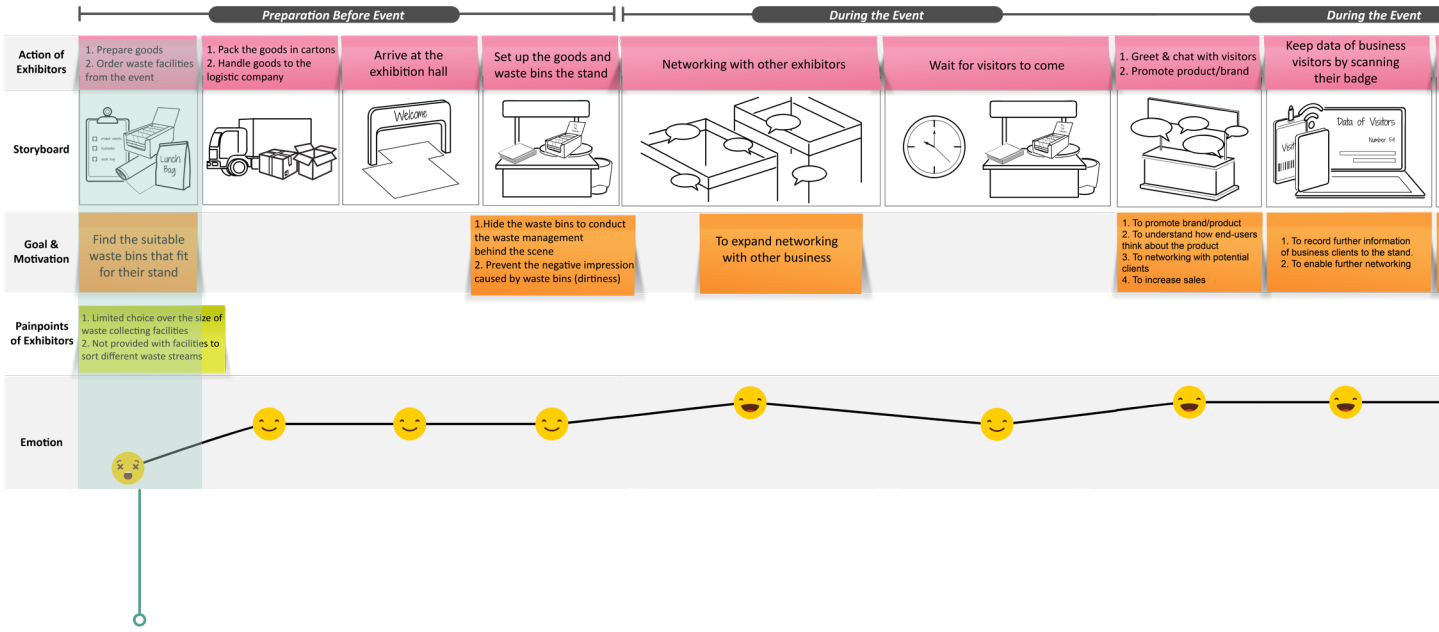
***Pop-up activities** in the exhibition can cause large crowds to gather and are inevitably to generate waste. Event organizers should check if the area holding the activities is equipped with waste facilities in need.*

3.4.2 Insights from exhibitor's event journey

The exhibitors' journey consists of three stages chronologically: preparation before the event, during the event, and after the event. The main activities involved in these stages are Event goods preparation, order waste facilities, and logistics before the event, marketing promotions during the event, and waste collecting and transporting after the event.

Goal of attending the event & Motivation on waste management:

The goal of exhibitors to attend an event is for business and marketing purposes, by getting in touch with their end-users and expanding the networks with business clients. Waste management is not a topic they care that much and would like to spend much time doing due to the regulations and policies. For exhibitors, waste management activities should not interfere with their event work, which is always the top priority.



The pain point of exhibitors:

Can not find facilities that fit into the limited stand space.

The choice of waste collecting facilities is limited. Exhibitors sometimes can not find waste bins with suitable size (usually too large). There is not enough space at their stands to place multiple bins for waste separation.

Exhibitors

Need to pay for the waste they produce

The intension of attending the event

- Marketing purpose

Attitudes towards waste management

- Be able to fulfill the obligations.

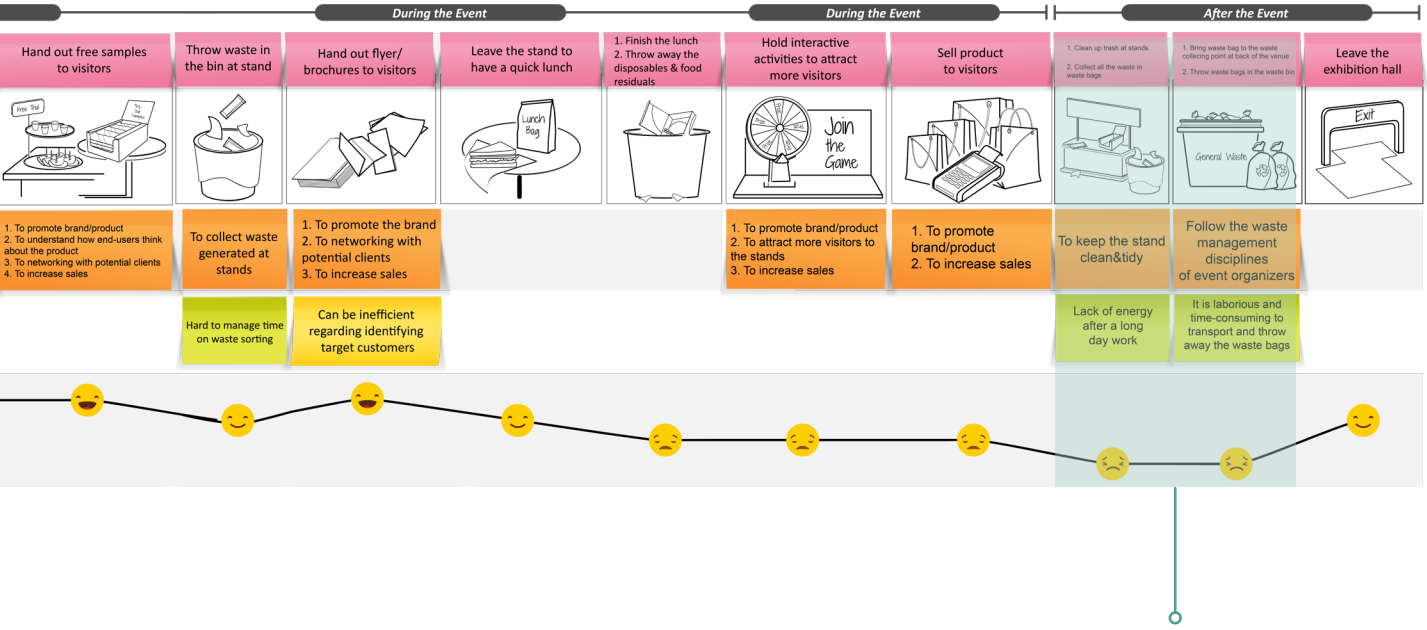
(Collect & Remove waste at their stand)

- Lacking the motivation of pursuing a goal with a higher level

(waste sorting & recycling)

Preference for waste sorting

- Cost-effectively
- Efficient



Wish of exhibitors:

Shorten the time spend on waste management after the event.

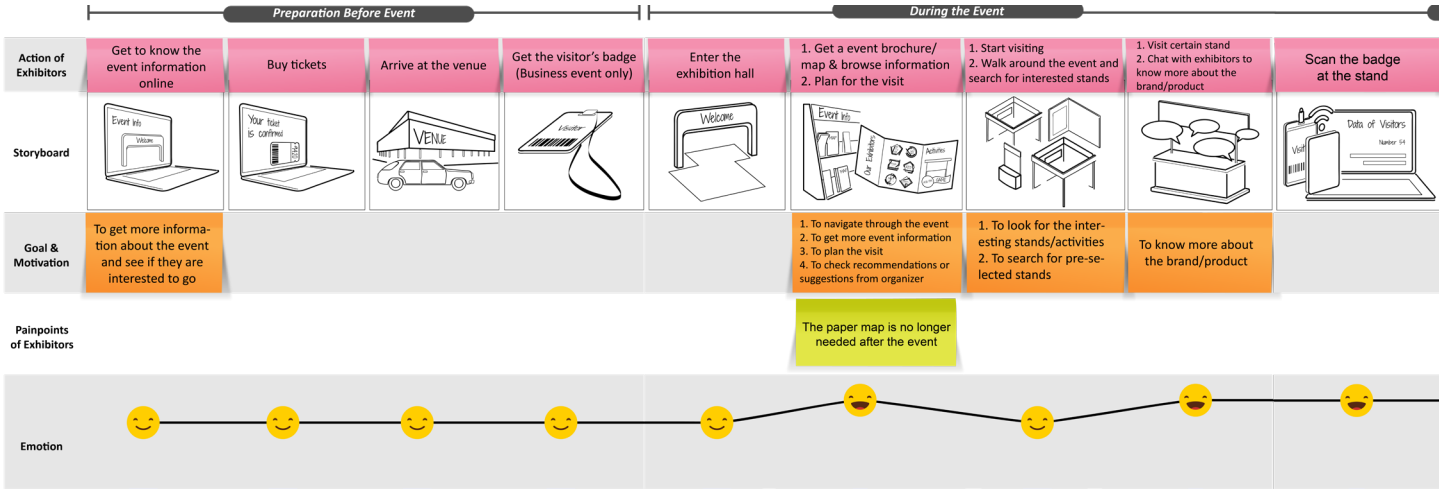
Exhibitors feel tired at the end of the day. What they want is to finish work as soon as possible.

3.4.3 Insights from visitor's event journey

Unlike the exhibitors' journey, the visitors' journey only has illustrated the first two stages since they are relevant to the research topic. The main activities here are deciding on visiting before the event, interacting with exhibitors, receiving marketing materials, trying free samples, and shopping during the event.

The goal of attending the event & Motivation for waste management:

Visitors do not need to pay for the waste they generated at the event. As a result, visitors do not care about how much waste they produced and how they will be processed. Most visitors will properly dispose of their waste if the facilities in need of waste sorting are provided at the event.

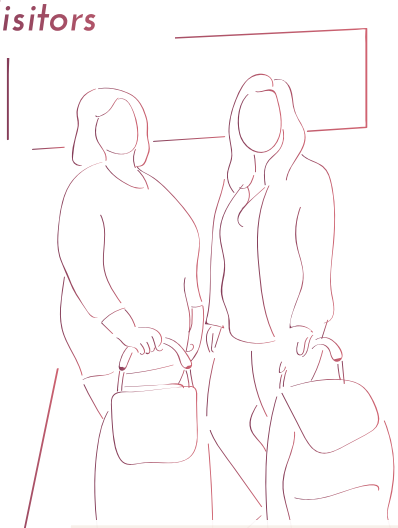


The wish of visitors:

To have instructions about waste sorting.

Some visitors do not have sufficient knowledge of waste sorting. It would be helpful to provide clear and intuitive instructions on waste sorting to help them

Visitors



Do not need to pay for the waste they produce

The intension of attending the event

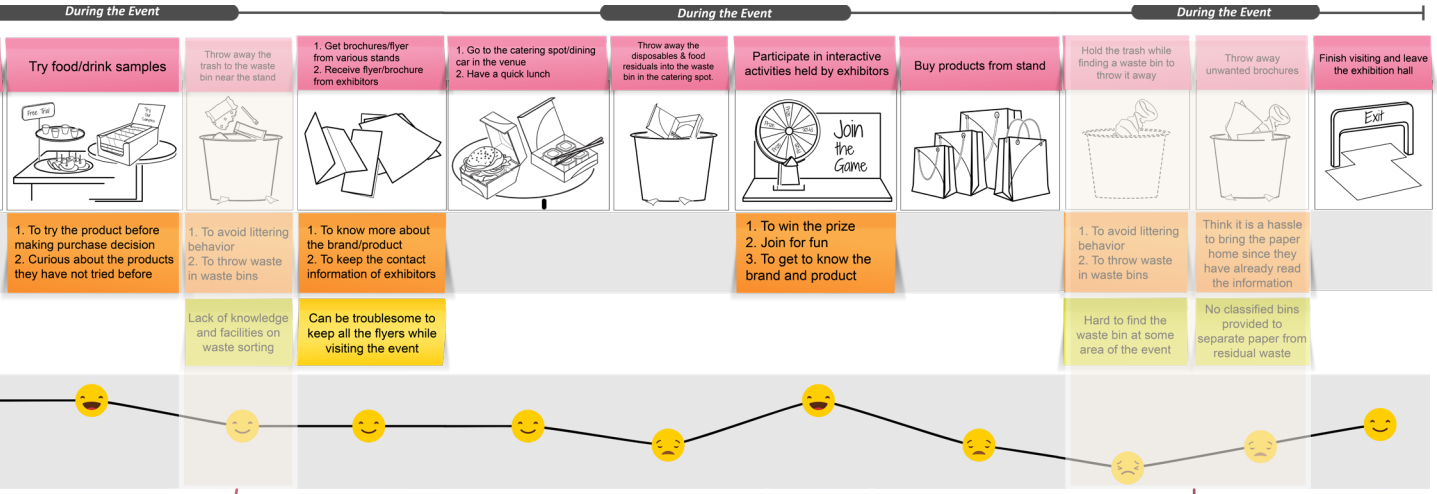
- *Expand business networks, learn cutting-edge industry development, have fun, and enjoy the activities.*

Attitudes towards waste management

- *Be able to fulfill the obligations (waste sorting) when the facilities are ready, otherwise less likely to take initiatives.*

Preference for waste sorting

- *Easy*
- *Effortless*



The pain point of visitors:

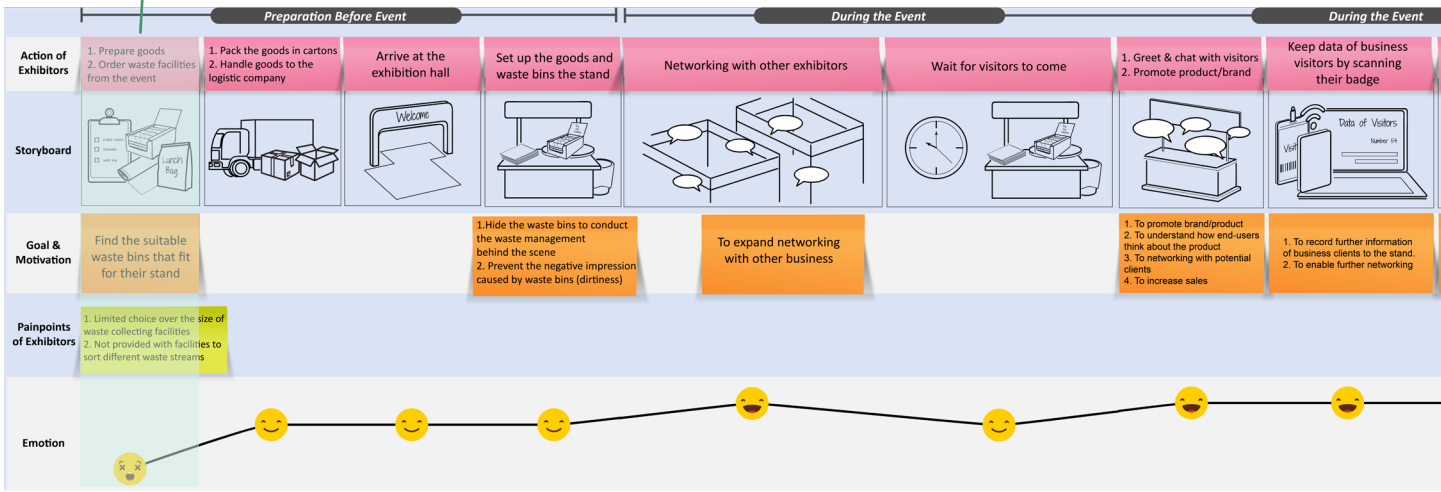
Hard to find waste bins sometimes at the event.

Sometimes, visitors find it hard to find waste bins at events when they want to throw away their waste. It can be inconvenient for them to hold trash in hand while visiting the event.

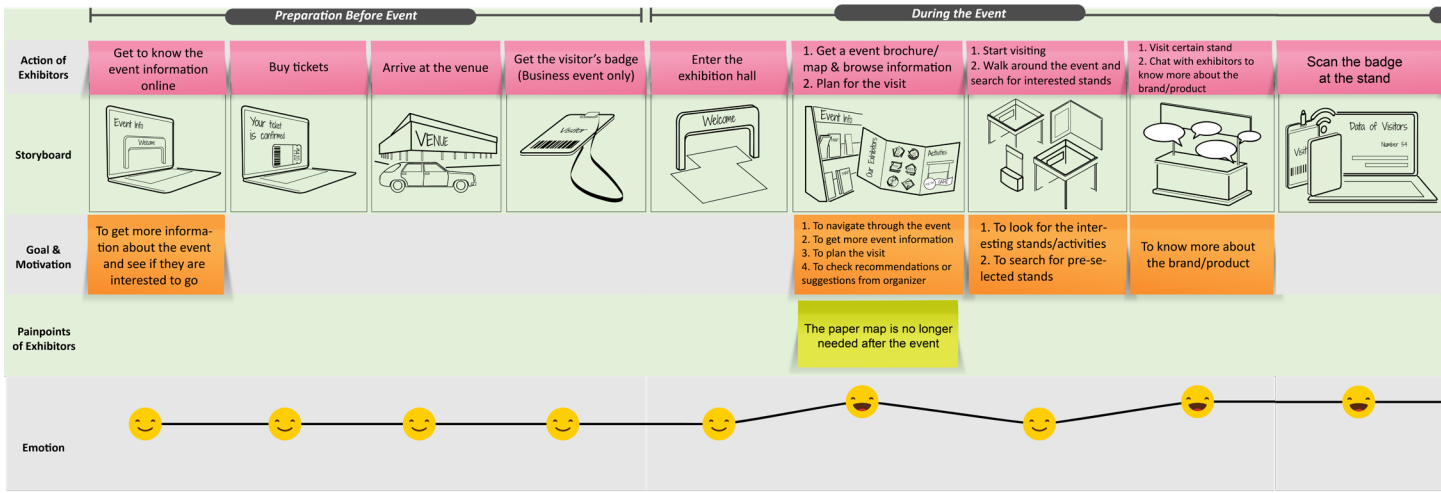
3.4.4 Opportunities for design intervention

Help exhibitors better match waste sorting facilities with their stand environment.

Exhibitors' Journey



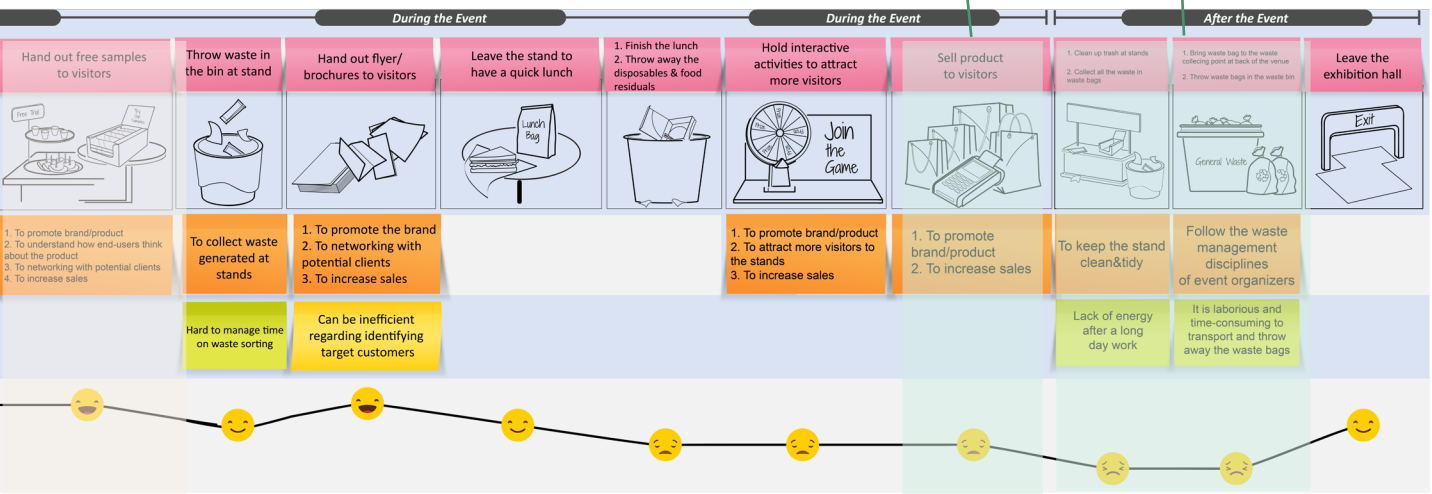
Visitors' Journey

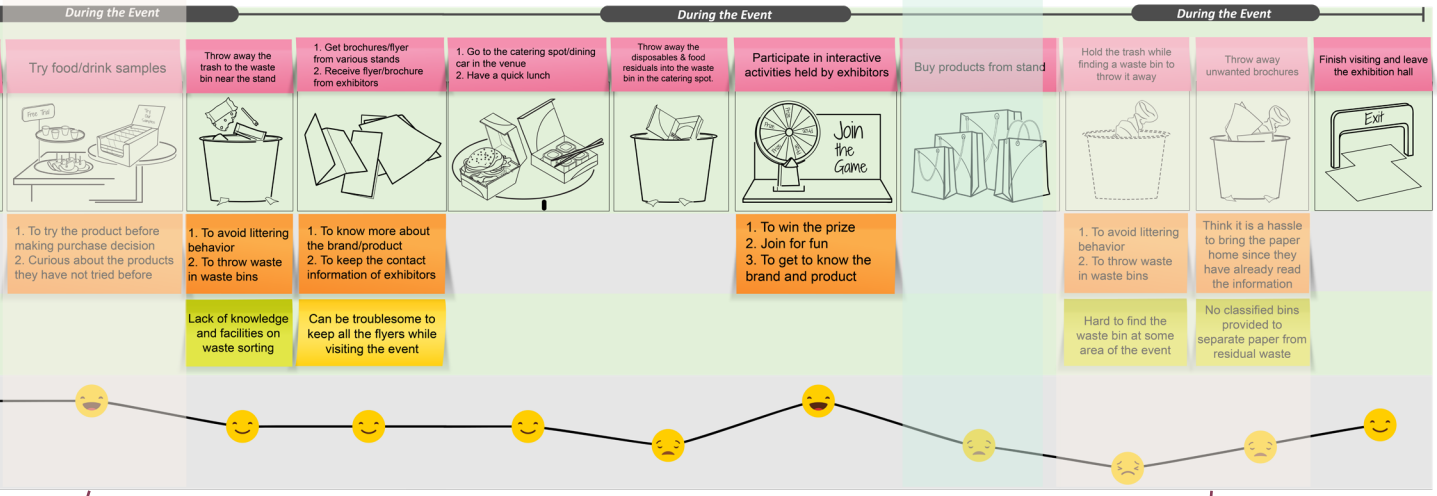


The focus of managing visitor's waste is the packaging waste from free sample distributing

Reduce the workload of exhibitors on waste management after the event

Limit the use of plastic bags.





Making waste sorting intuitive for visitors

Chapter 04

Design Brief

4.1 Problem Definition

4.1.1 Main problems---Insufficient waste sorting

Most of the waste generated during the event was unsorted, which poses a negative environmental impact while increasing the cost of collection and processing the waste.

Root problem 1---Exhibitors' waste sorting

Exhibitors ***did not gain sufficient support*** from the event regarding collecting and sorting waste at stands, to tackle the pain points on time, motivation, cost, and relevant facilities.

Root problem 2---Visitors' waste sorting

Visitors are not enabled to separate different waste streams due to ***a lack of classified facilities*** in some events. Additionally, there are often few messages provided at the event to remind visitors to throw away their waste correctly.

4.1.2 Side problems---Overuse of non-recyclable materials

Non-recyclable materials such as plastic bags, disposable utensils are overused during the event. Among them, the demand for plastic bags proved to be non-rigid.

4.2 Design Brief

4.2.1 Design focus

According to the problem definition, the design will focus on the following aspects:

1. Increasingly sorted out the recyclable waste from the general waste.
2. Support exhibitors on waste sorting at stands by tackling relevant pain points.
3. Guide visitors to correctly and intuitively on waste sorting.

4.2.2 Goal of the design solution

The goal of the design solution is to:

- Reduce the negative environmental impact.
- Reduce the financial cost of processing the waste generated during the event.

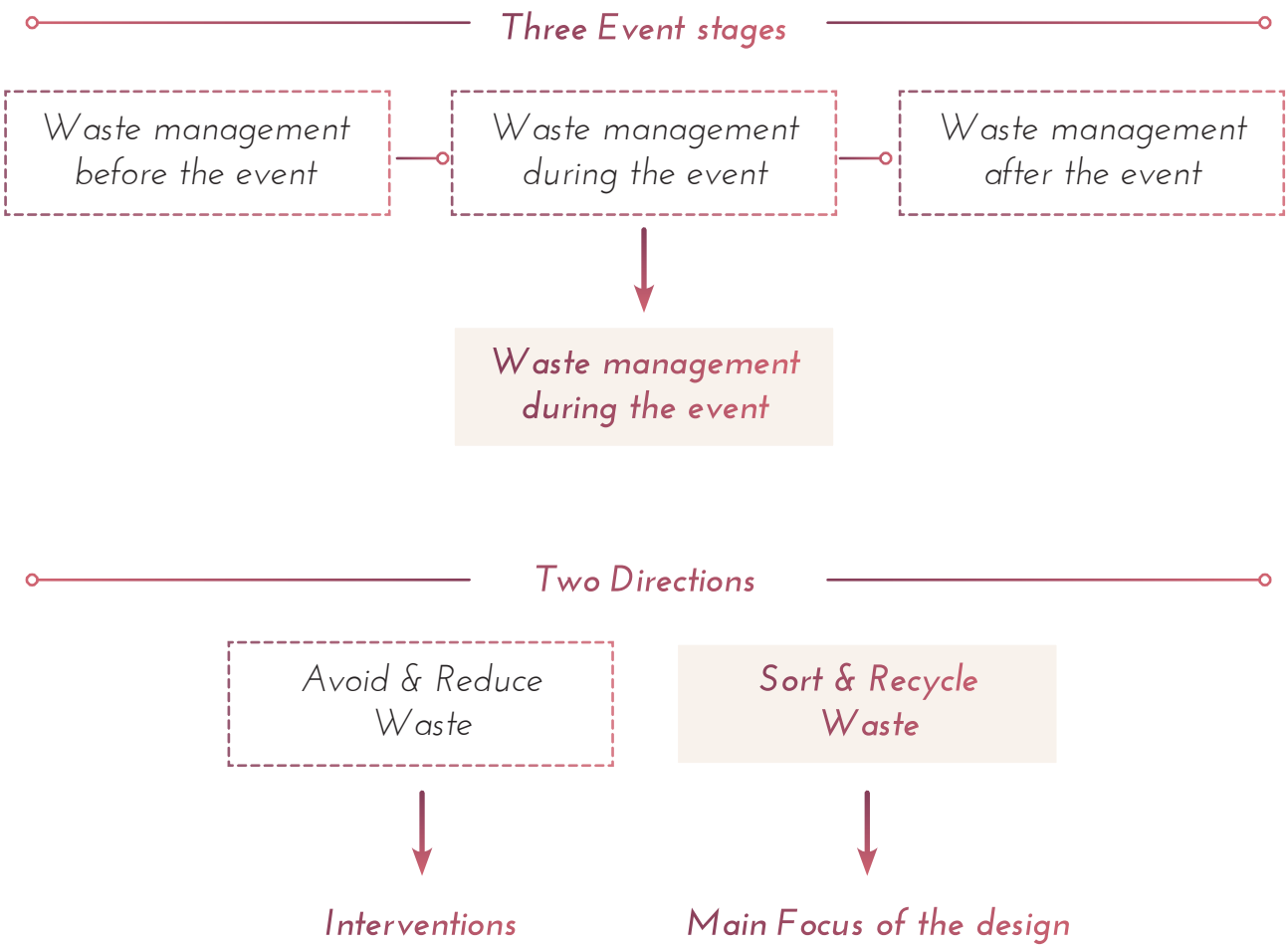
Objectives:

- To sort out the recyclables efficiently and effectively.
- To increase the motivation of exhibitors on waste sorting.
- To provide the necessary support to exhibitors on waste sorting.
- To guide visitors sorting out recyclable waste intuitively.
- To reduce the plastic bags used during the event.

4.2.3 Design vision

To create services that turn the exhibition waste management a straightforward, efficient, and cost-effective process of environmental value creation.

4.2.4 Development of design focus



4.3 List of requirement

Feasibility:

The design helps to increase the ability, motivation of event participants on waste collecting and sorting.

The design provides notification as triggers of the waste sorting behavior.

The design ensures event participants have the necessary facilities of waste collecting and sorting.

The design enables exhibitors to choose facilities that fit for their stand environment.

Desirability:

The design use rewards to motivate designated behaviors instead of extra cost.
The design does not interfere with the visit.
The design does not interfere with the stand activity of exhibitors.
The design does not involve activities that require extra staff from the exhibitors' side.

Efficiency:

The design shortens the time in need of waste management after the event.
The design enables exhibitors to plan and manage their time on waste sorting.
The design does not increase the time that visitors need to throw away their waste.
The design is efficient for event organizers to operate.

Viability:

The design does not generate extra cost to exhibitors on sorting their waste.
The design helps event organizers to save cost on waste management and processing.

Quality of waste sorting:

The design helps to ensure the quality of the sorted out recyclables.

Flexibility:

The design provides products that can adapt to different occasions.

Chapter 05

Ideation & Conceptulization

5.1 Ideation

5.1.1 Brainstorming session

The ideation phase started with an online brainstorming session with four design students. The participants were first briefed with the context of the project, together with the research insights about the current problems and pain points and the journeys to emphasize the situations of exhibitors and visitors. Then, ideas were generated around the following central topics, each with several follow-up "How-to" questions related to the problems found in the research to trigger the creativity. The ideas generated under each topic can be found in Appendix C.

Topic 1: Waste collection

How to collect waste more efficiently?
How to help visitors to find waste bins during the visit?
How to better/more effectively sort out the recyclables?

Topic 2: Waste disposal/ separation of exhibitors

How to shorten the time in need of waste separation, especially after the event?
How to further motivate exhibitors on waste management?

Topic 3: Waste disposal/separation of visitors

How to define the categories of waste separation?
How to fill the knowledge gaps that visitors have on waste separation?
How to eliminate littering behavior?
How to further engage visitors in waste management?

Select ideas from the brainstorming session

Among the ideas generated from brainstorming, the following two ideas were selected to develop further.

- ***Idea: Develop a digital platform for waste management at stands***

To support exhibitors on waste management during the event, a digital platform can be developed to enable exhibitors to check relevant information about managing their waste at stands. (e.g. procedures/charging structure/facility purchase)The platform can be used throughout all the stages of an event, which integrates services and support for waste management.

This idea is selected due to its potential for integrating different services throughout the waste management process.

- ***Idea: Gather waste stream data before the event from exhibitors.***

Data of waste streams can be collected from exhibitors and suppliers before the event to make the target of waste sorting activity more specific.

Based on the comparison made between waste generated from stand construction and demolition and the waste generated during the event (Figure 1.2), event organizers have much less information about the specific waste streams during the event than those generated from stand construction demolition.

During the brainstorming discussion, it was agreed that the lack of understanding about the waste streams could be an obstacle for event organizers to define a targeted and effective waste management plan. From the feasibility perspective, the waste from the event should be predictable, since most of the waste is from the stands' material input, including the samples and other product they brought to the event. In this case, event organizers can get the potential waste streams information before the event via communicating with exhibitors.

In general, this idea is selected to be developed further because it helps organizers make informative decisions on planning waste management.

5.1.2 Value proposition canvas

Gain Creator

Exhibitor

- Introduce the process of waste management with short videos/ pictures before the event.
- Provide waste bins with different sizes.
- Send notifications to the exhibitors when their stand environment needs some cleaning.
- Stand cleaning service provided by the event.
- Help exhibitors to plan the time during the event on waste management.

Product/Service

- App for exhibitors, to inform them the relevant information, provide them all the services in need, and enable them to view the cost of waste management.
- Signs at the event to guide visitors correctly sort their waste.

Visitor

- Facilitate waste bins at the event.

Pain reliever

Exhibitor

- Provide the function of facility recommendation based on the specific stand condition and needs of the exhibitor.
- Use visitor flow data to help exhibitors on time planning by informing them when they will be less busy.
- Provide a plan to hide the bins at stands.
- Cut down the To dos of exhibitors on waste management after the event.
- Provide financial incentives if the recyclables are sorted out.

Visitor

- Adjust the distribution of waste bins, ensure people in different areas can easily reach one.
- Set messages or signs of giving visitors straightforward instructions about how to sort waste correctly

To ideate the solutions that tackle specific pain points, the method value proposition canvas was used. The jobs, gains, and pains of exhibitors and visitors on waste management during the event were listed in the chart on page 55. Based on the gains and pains, ideas of "gain creators" and "pain relievers" were generated on page 54. These ideas can be later developed and integrated into the overall service concept.

Gains

Exhibitor

- Clearly understand the process, their responsibilities, and action on waste management.
- Get suitable waste-collecting facilities from the event.
- Maintain the stands clean and tidy.
- Finish work and leave the event earlier.

Visitor

- Get rid of their waste.

Pain

Exhibitors

- Order the waste facilities that failed to fit into their stand.
- Find it challenging to plan the time for waste management during the event.
- Waste bins are getting dirty and could harm the image of the stand.
- Feel tired to clean up and transport waste after the event.
- The cost of waste management is too high.

Visitors

- Hard to find waste bins sometimes at the event.
- Not sure if they sort the waste correctly.
- Not provided with classified bins at some events.

Customer jobs

Exhibitor

- Get to know the waste management policies.
- Order waste facilities from the event via the exhibitor portal.
- Facilitate waste bins at stands.
- Manage waste during the event.
- Clean up the waste after the event.
- Transport the waste bags to the collecting site. (In Horecava)
- Pay for the waste management fee.

Visitors

- Find waste bins at the event.
- Sort the waste into the corresponding bins.

5.2 Concept development

The concept development elaborates on the ideas from ideation. Besides, it also discusses and evaluates each solution together with the alternatives. The selected solutions are combined and integrated into the service blueprint in 6.3.

Figure 5.1 illustrates the overview of the decision tree of exhibitors and organizers. Each decision will be further introduced and evaluated with the criteria from the list of requirements.

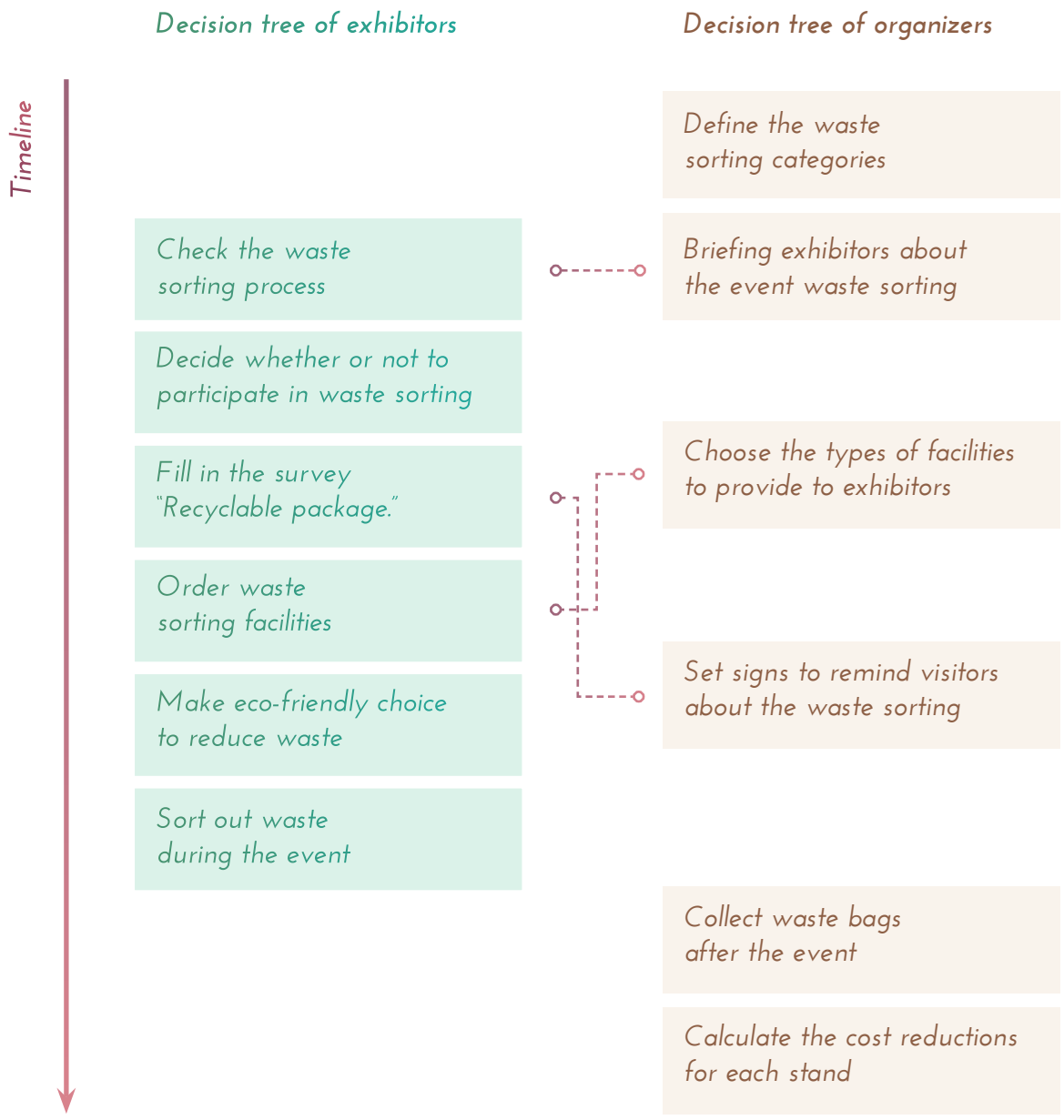


Figure5.1 Decision tree of exhibitors and organizers

5.2.1 Decisions & Activities of the exhibitor

• Participate in waste sorting

Exhibitors will first read the briefing content made by organizers about the specific information about waste sorting during the event. After briefing exhibitors the relevant information of waste sorting activity, exhibitors will need to decide whether or not to participate in waste sorting activity during the event.

Here, two different modes of waste sorting participation are evaluated: voluntary waste sorting and compulsory waste sorting. The event organizers will make a choice.

Solution A: Voluntary waste sorting
Exhibitors are free to choose whether to sort out waste during the event without any extra consequences.

Solution B: Compulsory waste sorting
All the exhibitors are expected to sort out their waste by the event. However, exhibitors who are unwilling to do so can pay an extra fee for not separating their waste but still joining the event.

Evaluation:

Criteria from List of Requirement:

- The design helps to increase the ability, motivation of event participants on waste collecting and sorting.
- The design helps to ensure the quality of the sorted out recyclables.
- The design helps event organizers to save cost on waste management and processing.

Desirability
Compared with the compulsory mode, voluntary mode gives exhibitors more freedom to choose based on their situation and preference without affording extra financial cost. In terms of desirability, the voluntary mode is considered better than the compulsory mode.

Quantity & Quality of sorted out recyclables
Compared to the compulsory mode, fewer recyclables are being collected under voluntary mode due to a lower participation rate.

However, the voluntary mode is more likely to collect recyclables with higher quality. Under the voluntary mode, exhibitors who choose waste sorting are motivated to complete the task and are more likely to act proactively and treat waste sorting seriously. On the contrary, the compulsory mode may involve exhibitors who are not motivated enough in waste sorting but making a choice due to the unwillingness of paying the extra fee. Thus, the lack of motivation can negatively influence the quality of sorted out recyclables.

Cost & Revenue of organizers
Under the two modes, exhibitors are the ones to cover the cost of waste management. In principle, no financial expenses will generate from the organizers' side. However, the unqualified recyclables may generate cost that organizers need to shoulder if no original stand can be found.

On the other hand, the organizers will have extra revenue under the compulsory mode, from exhibitors who choose not to separate their waste but pay the fee instead.

Conclusion

Based on the evaluation above, the two modes both have their pros and cons. However, since most of the exhibitors are still on the way of forming the waste sorting behavior, voluntary mode selects the exhibitors with higher motivation to join the activity, making it easier for organizers to test the overall concept.

Thus, the voluntary mode is more suitable for the first horizon when the waste sorting activity still needs to be tailored and adjusted in a real event context.

• Check the waste sorting process

Original idea:

- Develop a digital platform for waste management at stands
- Introduce the process of waste management with short videos or pictures before the event.

Exhibitors will be introduced to the waste sorting process before the event. Besides, they can also check the process of waste sorting anytime during the event via the digital platform. (Figure 5.2)

Evaluation:

Criteria from List of Requirement:

- The design helps to increase the ability, motivation of event participants on waste collecting and sorting.

Since exhibitors are not separating their waste during the event, the waste sorting activity is probably a new and non-routine behavior that exhibitors seldomly do in the event context.

However, many exhibitors do have the experience of domestic waste sorting, which the procedures and rules they can follow while dealing with event waste.

According to Fogg's behavior model, non-routine behaviors will add up the difficulty in performing the action. In this case, it is still necessary to provide channels to help exhibitors get familiar with the process and review the information conveniently anytime in need.

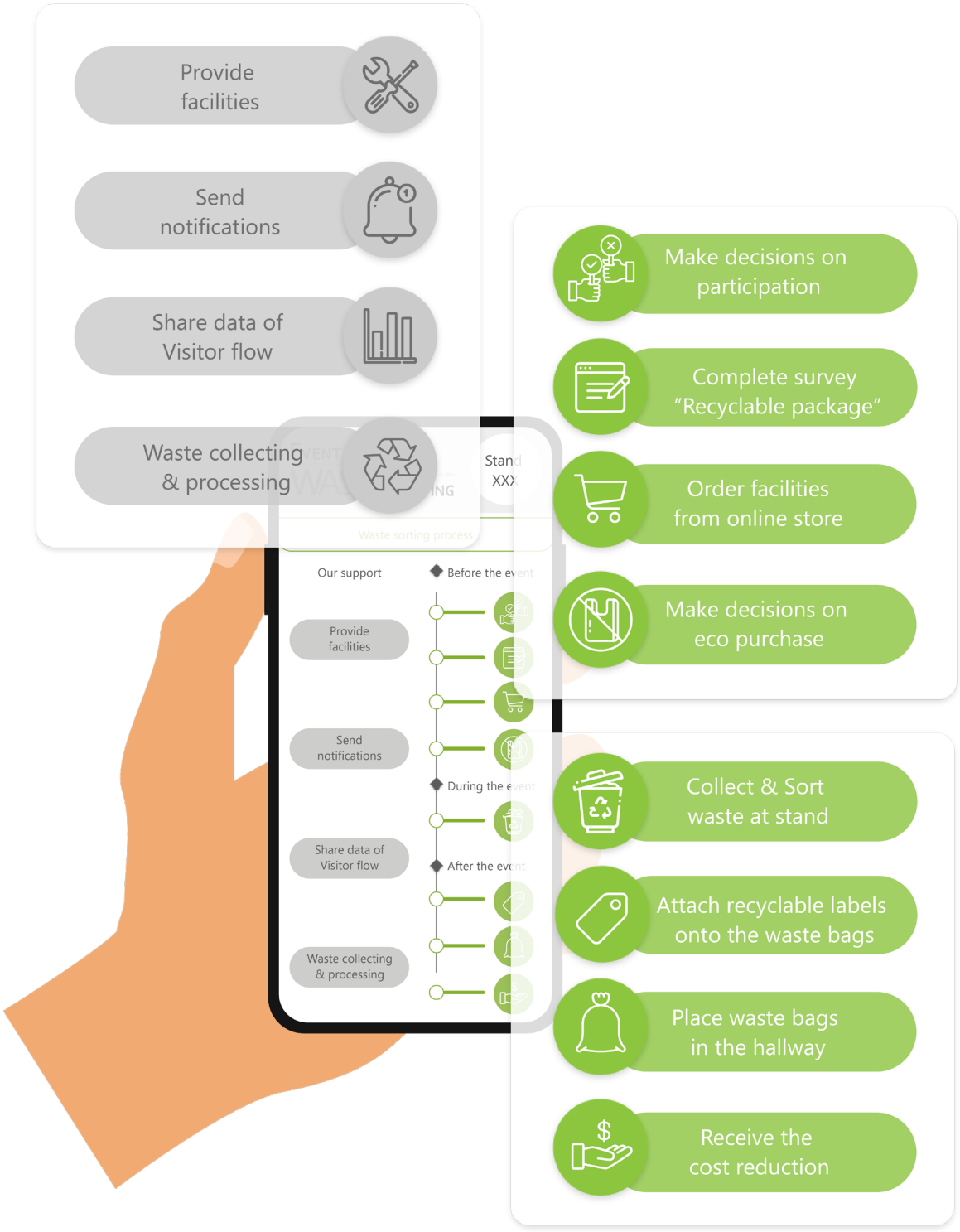


Figure5.2. Activities & Support for waste sorting

- *Fill in the survey "Recyclable package"*

For the activities “free sample distributing,” event organizers can get more specific information about the recyclable waste streams via their connections with relevant exhibitors. The data can facilitate the waste bins with a particular category, and as hints on waste sorting. Event organizers can send a survey to exhibitors regarding the “package” they use for free samples and food/drink, to gather the specific recyclables.

Figure5.3 Survey"Recyclable package" for exhibitors

• Order waste sorting facilities

The facility purchase can be completed via the waste sorting platform. Exhibitors will be able to choose the above facilities with different volumes based on their needs.

Original idea:

- Develop a digital platform for waste management at stands.

Original idea:

- Provide waste bins for different waste streams.
- Provide the function of facility recommendation based on the specific stand condition and needs of the exhibitor.

Figure5.4 Purchase waste facilities online

- *Make eco-friendly choice to reduce waste*

Before the event, exhibitors will be provided a channel to buy bio-degradable disposables with a discount. Exhibitors can make their decisions about whether or not to purchase bio-disposables from the event.

Although many plastic bags are not directly ended up as visitors' waste at the event, it still negatively influences the environment.

To make the event more sustainable, exhibitors will be asked to join the eco-bag campaign to refuse the use of plastic bags at the stand.

Signing an agreement before the event, exhibitors who participate in the campaign agree not to use plastic bags at the event. These exhibitors will have their brand names printed on the event shopping bags to promote brand sustainability.

Figure5.5 Interface-Purchase bio-disposables & Join Eco-bag campaign

• Sort out waste during the event

Original idea:

- Use visitor flow data to help exhibitors on time planning by informing them when they will be less busy.
- Help exhibitors to plan the time during the event on waste management.

The backstage system will monitor and analyze the data of the visitor flow during the exhibition day. This data will be translated to a certain "busy level" that reflects how busy exhibitors may be at a particular time of the exhibition day based on the number of visitors at the event. According to the "busy level", exhibitors can estimate how much time they would have on waste sorting and adjust their sorting strategies if necessary.

A curve that shows the estimated variation of "busy level" throughout the day will be shared with exhibitors before the event. Exhibitors can refer to the information when planning their waste management at stands. The curve will be generated based on relevant data such as the history of previous exhibition day and will be adjusted timely according to the real-time visitor flow.

According to the visitor flow, the event's busyness can be divided into 2 or 3 levels. For instance, Normal vs. Busy, or Normal, Busy, and Extreme Busy), The standard can be defined by event organizers based on a specific event's specific scale and situation.

Evaluation

Criteria from List of Requirement:

- The design enables exhibitors to adjust the waste sorting strategy based on their time capacity.
- The design shortens the time in need of waste management after the event.
- The design does not interfere with the stand activity of exhibitors.
- The design provides notification as triggers of waste sorting behavior.

The design informs exhibitors at critical moments to better prepare themselves for busy hours and utilize non-busy hours to manage their waste. In this way, it also shortens the time exhibitors need for waste management after the event.

The notification is provided, while the channel and form of the notification will be further verified with exhibitors in Chapter 7, regarding whether it is useful and desirable for them to receive the notification via phone.

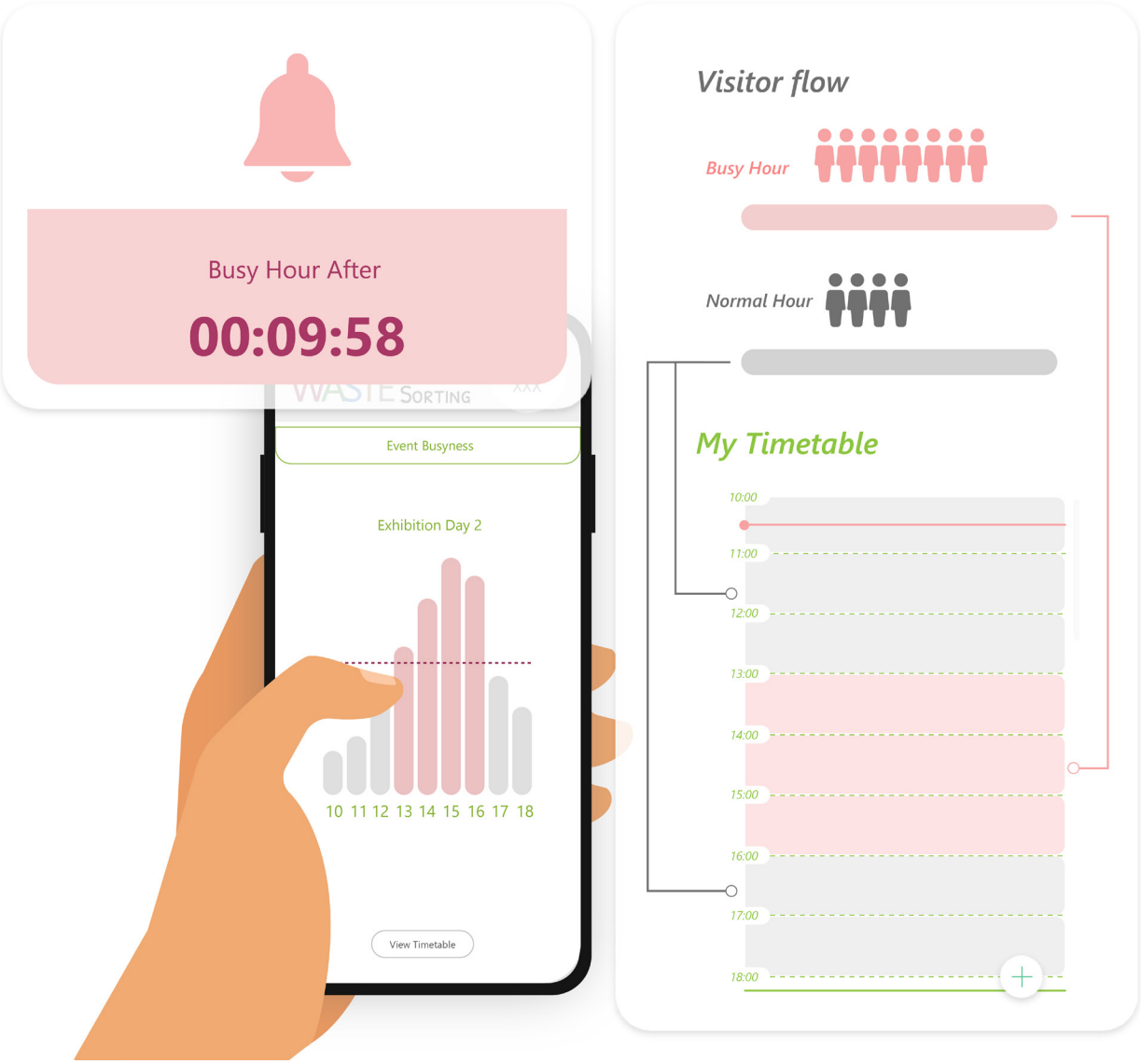


Figure5.6 Interface-Event "busy level" notification

6.2.2 Decisions & Activities of the organizers

• Define the waste sorting categories

Consultation with recycling partner about the recyclable list

Since the sorted out recyclables from different stands need be combined and processed to the recycling company, it is necessary to define the waste sorting categories based on the waste streams that the recycling company can process and recycle. Hence, the event organizer should consult their recycling partner at this step to figure out what types of recyclables can be sorted out at the event.

To lower the difficulties of waste sorting, it is also essential to discuss which recyclables are acceptable to be first collected together while the recycling company can easily separate them. If such waste streams exist, they can be collected as one category during the event.

Meanwhile, easily-contaminated recyclables, such as paper, should be collected separately.

Narrow down the waste sorting categories

Original idea:

- Gather waste stream data before the event from exhibitors.

The waste streams the recycling company can process are likely much more than the recyclable streams that will appear in the event. In this case, the organizers need to narrow down the list given by the recycling company. An example can be found in figure5.7 on page 66.

A survey can help determine the material input of each stand before the event, or based on the organizers' experience from the past events.

Evaluation

Criteria from List of Requirement:

- The design helps to increase the ability, motivation of event participants on waste collecting and sorting.
- The design helps event organizers to save cost on waste management and processing.

By narrowing down the waste sorting categories, exhibitors will have a more apparent target while sorting out their waste. Additionally, the event organizers can avoid the excessive preparation of category-specific waste sorting facilities if specific waste streams do not exist.

Solution A: Conduct survey about material input

Event organizers send the survey to exhibitors about the material input of their stand before the event, via email, or the waste sorting digital platform. The waste categories with zero or low frequency can be deleted or combined as residual waste based on the statistical results.

Solution B: Experience based quick decision

In this solution, event organizers will directly choose the waste categories from the recycling partner's original list. The organizer can make a choice based on the types of waste that often appeared in past exhibitions

Evaluation

Criteria from List of Requirement:

- The design use rewards to motivate designated behaviors instead of punishment.
- The design is efficient for event organizers to operate.
- The design helps to ensure the quality of the sorted out recyclables.

Conclusion

The evaluation was made between the two solutions to narrow down the waste sorting categories. Conducting a survey seems an inefficient and redundant step to decide the waste sorting categories. On the other hand, decisions made based on experience save more time and are feasible due to the relatively stable event waste categories. Thus, solution B is selected.

Desirability

Solution A adds up the workload of exhibitors in terms of spending time completing the survey. Comparing the two solutions, the second one is more easy and desirable for exhibitors.

Efficiency

For event organizers, conducting the survey, collecting, and analyzing all the results takes time. Since defining the waste sorting category happens in an early phase of the overall process, a long time spent defining could delay facility preparation progress in the next step.

Also, it is worth noticing how much variability is in the types of waste at the exhibition. If the types of waste streams are relatively stable, organizers can quickly confirm the waste streams based on past events without conducting the research.

Quality of waste sorting

Conducting the survey seems to be a more logical approach that is more likely to help organizers make accurate decisions than purely based on experience. However, it can be difficult for event organizers to verify the authenticity of the answers they received from exhibitors, resulting in biased decisions and may influence the sorting process.

Example of waste sorting categories

Below is an example of waste sorting streams.

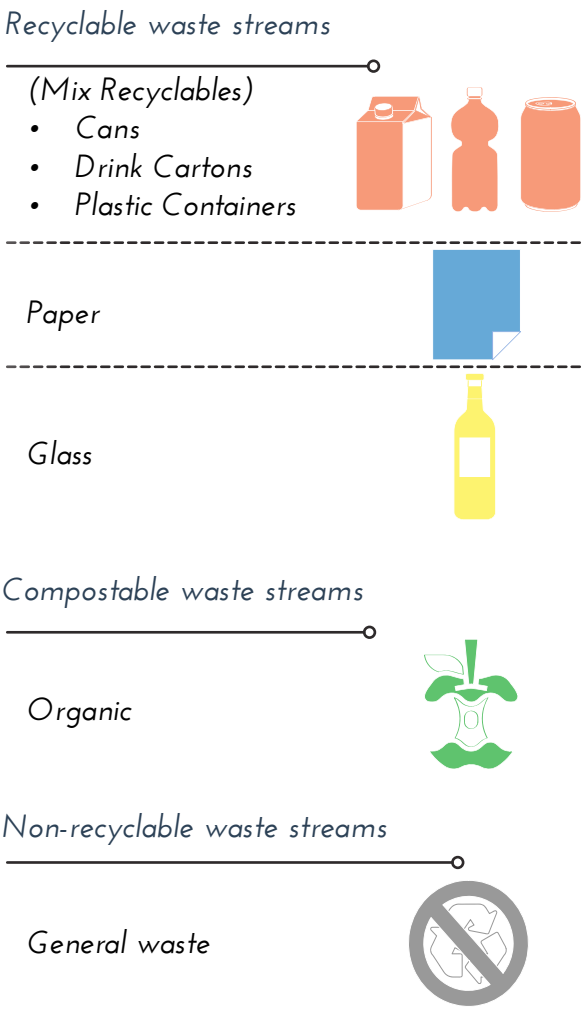


Figure5.7 Waste sorting categories at the event

- *Briefing exhibitors about the event waste sorting*

Based on the conclusion in 3.3.1, currently, there are no requirements or policies released to inform exhibitors what to do on waste sorting. Organizers should brief exhibitors the relevant information to specifies the "why" and "how" of waste sorting. (Figure 5.8)

Figure5.8 Content of briefing

• Choose the types of facilities to provide to exhibitors

From the interviews and exhibitors' journeys, it is known that the exhibitors thought the event did not provide them with enough support on waste separation, especially the facilities to sort out different waste streams. This step aims to create an online facility-purchase service that fulfills exhibitors' needs, combined with the waste sorting digital platform.

There will be two main types of waste facilities provided to exhibitors for waste collecting and sorting, including the waste bins and waste bags.

Blank waste bins

The provided waste bins will remain "blank" without specifying the category of the waste it is going to collect. However, exhibitors can use stickers provided by the event to label and differentiate their waste bins.

Alternatives

Waste bins that already labeled with specific waste streams. Similar to the waste bins prepared for the visitors, the waste bins at stands can be labeled with color coding that shows on page 70 (Afvalonline, 2020) to represent different waste streams.

Evaluation

Criteria from List of Requirement:

- The design provides products that can adapt to different occasions.

Compared to the waste bins already labeled with specific waste streams, the blank waste bins maintain flexibility in quickly changing the waste it collects. The blank bins enable event organizers to arrange and sufficiently utilize the waste bins in stock effectively.

Besides, when exhibitors want to adjust the waste categories they sort out, they can quickly adapt their facilities by changing the labels attached to the bins.

The blank waste bins also give exhibitors more flexibility to design the label to the forms that most effectively help them with waste sorting. For instance, it could be a label written in their language.

Labeled waste bags

To enable tracing back the original stand of the waste, every waste bag will be printed with a specific stand number. In this case, event organizers can find the stand if the recyclables waste inside has any quality problem. Besides, the labeled waste bags also prevent exhibitors from ditching their waste bags in the exhibition hall improperly.

Alternatives

Blank waste bags

Evaluation

Criteria from List of Requirement:

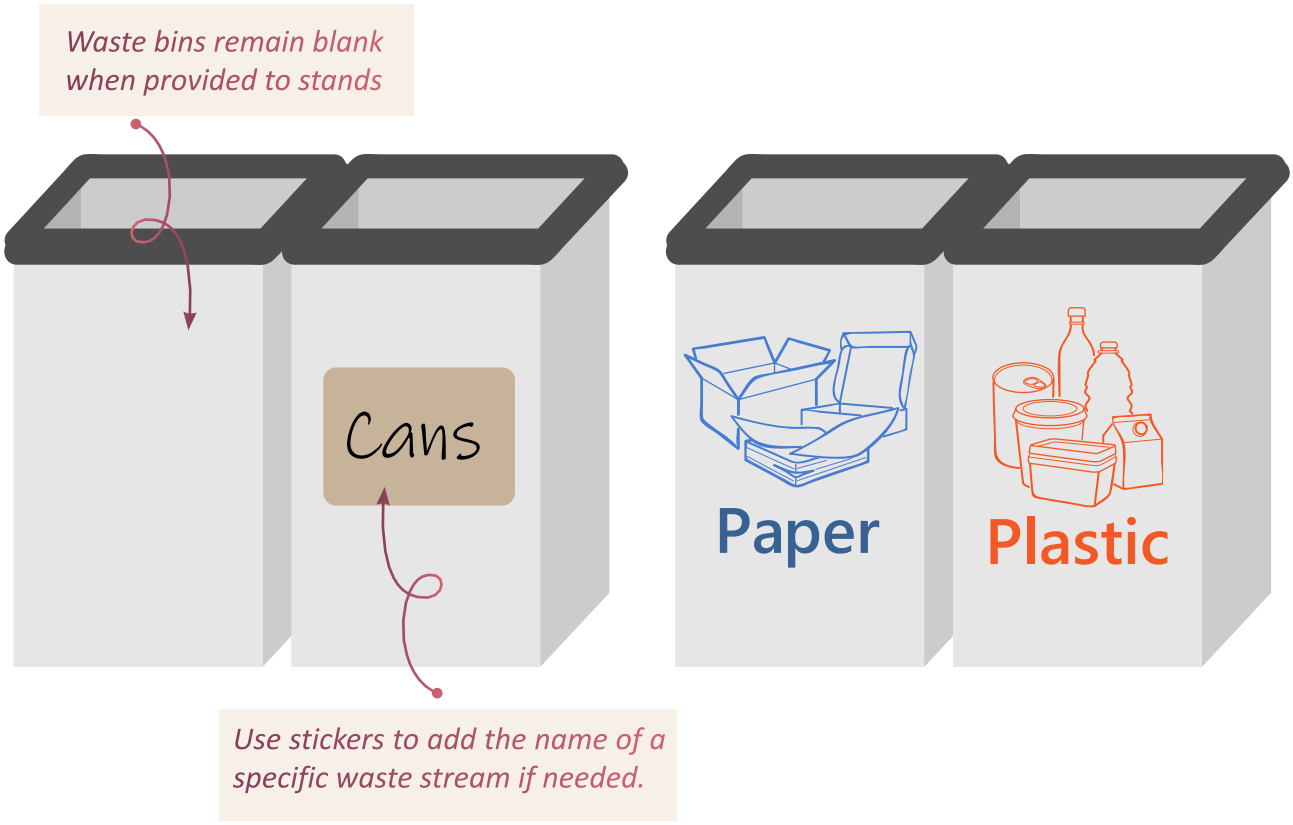
- The design helps event organizers to save cost on waste management and processing.

The labeled waste bags will increase production cost, while it is considered a necessary investment to make the cost calculation phase more organized and clear.

Conclusion

Blank waste bins and labeled waste bags are considered more suitable in this design concept, for them better fulfills the required functions.

- Blank Waste bins
- Labeled waste bins



- Labeled waste bags
- Blank Waste bags

- *Set signs to remind visitors about the waste sorting*

To collect recyclable sample package from the sampling activity, two types of “remind” can be given to visitors at the time when they get the sample and when they throw away the packaging waste.

Waste sorting remind

The first remind can be given at the touchpoint when visitors get the samples at the stand. For instance, signs can be set at the spot to notify visitors this package can be recycled at the event, with a photo of the corresponding waste bins to collect this recyclable.

With the first waste sorting remind, visitors would know what they are expected to do on recycling. The image of the recyclable waste bin also helps them to search the bin.

The second waste sorting remind will be given at the recyclable waste bin, with another sign that shows the image of the recyclable packages given by stands nearby. Thus, it is likely that the image on the signs will be varied in different areas across the event. For visitors who need to dispose of recyclables that are also shown on the sign, the message is clear and direct regarding recycling the package.

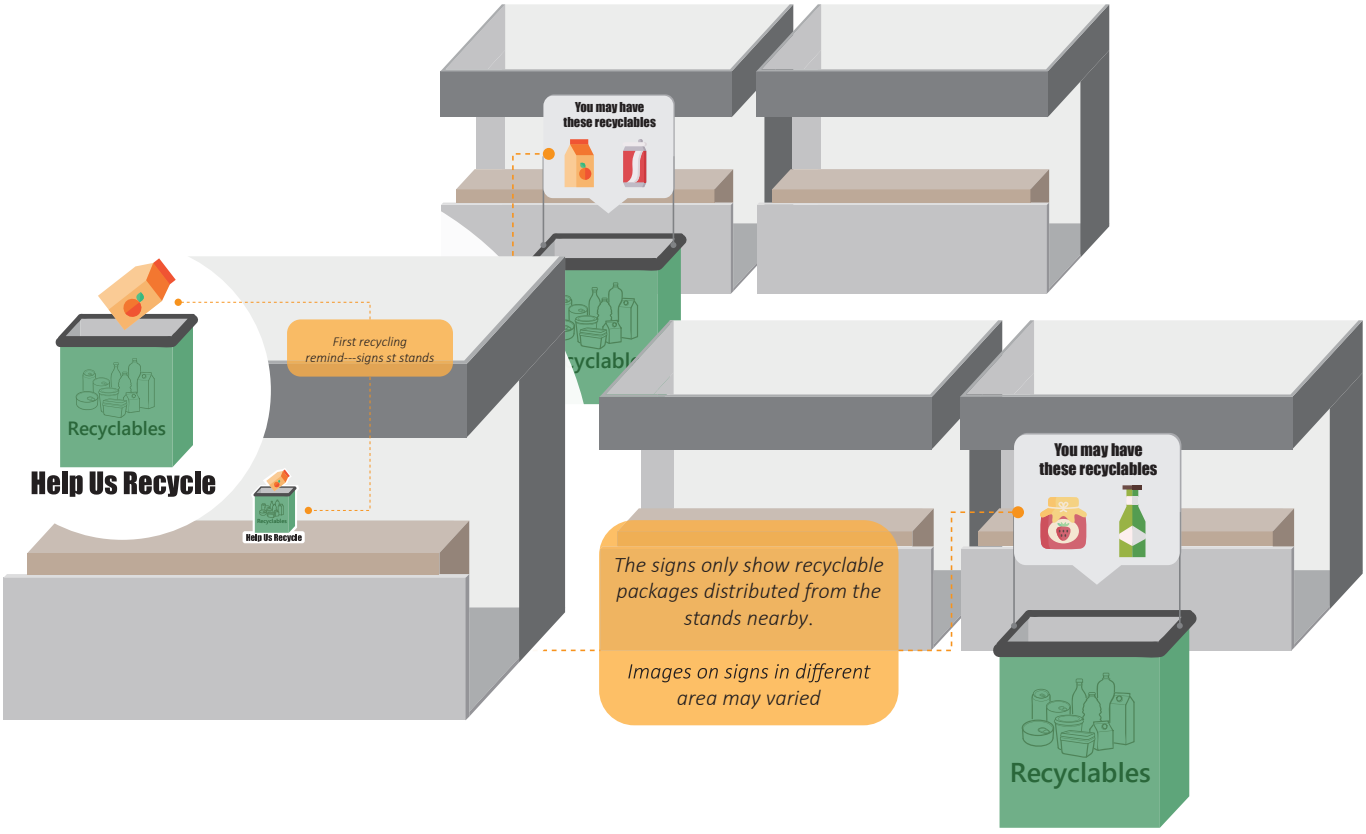


Figure5.9 Scenario-Waste sorting remind

Figure5.10 Scenario-Visitor sort waste with the help of recycling remind

• Collect waste bags after the event

At the end of the exhibition day, waste bags from each stand need be collected together based on categories. From the exhibitors' emotional curve, a need is to shorten the time spent on waste sorting after the event.

Original idea:

- Cut down the To dos of exhibitors on waste management after the event.

To reduce the exhibitors' workload, staff will go to each stand to collect and weigh the waste bags at the end of every exhibition day. What exhibitors need to do is place their waste bags on the hallway in front of their stand at the end of the day.

• Recyclable waste stream label

Recyclable waste stream labels attached to the waste bag enable event organizers to recognize the type of waste directly. Exhibitors need to attach the label correctly. The bags that do not have a specific label attached will be recognized as general waste.

Alternatives

Instead of placing the waste bags at stands for event organizers to collect, exhibitors will transport their waste to the central collecting site. The waste bags will be weighed at the collecting site by staff. A waste sorting label will be attached afterward to specify the relevant information about the waste inside.

Evaluation:

Criteria from List of Requirement:

- The design shortens the time in need of waste management after the event.
- The design is efficient for event organizers to operate.

Staff collecting waste bags at stands helps reduce the workload of exhibitors and may shorten the time they spend on waste management after the event.

As for the efficiency of operation, it seems that the first solution requires more human labor from the event organizer's side than the second one. While on the other hand, it could also be a way to efficiently finish the process by handling the task to the professional staff.

Conclusion

Based on the evaluation, the solution "Collect waste bags from stands" is considered a better option.

Figure5.11 Scenario-Waste bags being collected at the end of the day

- *Calculate the cost reductions for each stand*

Original idea:

- Provide financial incentives if the recyclables are sorted out.

According to the statistics from the document Costs for Municipal Waste Management in the EU (Hogg, D), the collecting fee for recyclable waste streams is much lower than that of general waste. In the Netherlands, collecting 1 ton of glass recyclables costs only 30% of the General waste price with the same weight. While for glass and mix recyclables (including plastic containers, cans, drink cartons), the prices are 40% and 70%. Thus, exhibitors who sort out recyclables will pay much less for their waste.

Each recyclable waste stream from a stand will be weighed at the end of the exhibition day by staff. The data will be recorded and uploaded to the system. The cost reduction of waste management will be calculated based on the number of recyclables being sorted out from the stand throughout the entire event.

Evaluation:

Criteria from List of Requirement:

- The design does not generate extra cost to exhibitors on sorting their waste.
- The design use rewards to motivate designated behaviors instead of punishment.

According to the insights from the interviews of field research, exhibitors have insufficient motivation for waste sorting behavior due to a lack of reward or punishment. Thus, exhibitors will be rewarded by cost reduction.

Meanwhile, the high cost of waste management is one of the pain points exhibitors have. Hence, it is believed that financial reward is an effective way to motivate exhibitors to take action on waste sorting.

However, the cost reduction will also increase the workload of event organizers in calculating each stand's cost. Another challenge could be how to ensure the quality of the recyclables being sorted out and collected at stands since the organizers will probably be the one to cover the cost if any unqualified recyclables failed to trace back to the original stand. The solution to this problem will be to label each waste bag with a specific stand number.

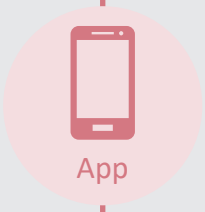
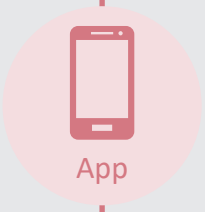
5.3 Service blueprint

The service blueprint on page76 to 79 illustrates the overall waste management process, including both the waste produced by exhibitors and the waste produced by visitors. It consists of three stages: The preparation before the event, Waste sorting during the event, and Waste collection after the event.

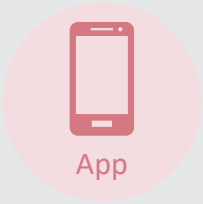
The preparation before the event

Exhibitor's Action	Learn the policy of waste management and relevant information about waste sorting	Make decisions about whether or not to join the waste sorting activity at the event		Get to know the waste sorting category.
Touchpoint (Digital)	App	App		App
Touchpoint (Physical)				
System Operations		Process the decision of exhibitors to the event organizer		
Organizer's Action	Create the content for the briefing	Receive the list of exhibitors who will participate in waste sorting	Consult recycling partner company about the accepted recyclable waste streams	Finalize and inform exhibitors of the waste sorting categories
External Support			Recycling partner company	

The preparation before the event

Complete the survey "Recyclable package."	Sign/Not sign the agreement.	Order waste facilities	Receive the waste facilities	Label waste bins with a specific category	
 App	 App				
			Waste bins	Waste bins	
Send the survey "recyclable package" to exhibitors		Promote the use of Bio-disposables			
	Inform exhibitors of the agreement of "Eco-friendly bag."	Prepare waste facilities based on the orders	Provide waste facilities to the exhibitors		Arrange waste facilities in the exhibition hall
		Waste facility supplier			

Waste sorting during the event

Visitor's Action	Get a free sample from the stand Eat & Drink	Notice the 1st recycling remind at stands	Look for waste bins at the event	Notice the 2nd recycling remind at waste bins	So as su
Touchpoint (Physical)					
Exhibitor's Action	Generate waste	Collect and sort waste	Receive the event busyness notification	Plan event tasks and adjust waste sorting strategy	
Touchpoint (Digital)					
Touchpoint (Physical)					
System Operations	Monitor the data of visitor flow	Monitor the data of visitor flow	Monitor the data of visitor flow		
Organizers Action			Send the notification about the change of the event's busyness degree.		
External Support					

Waste collection after the event

rt waste
the sign
uggests

Leave the event

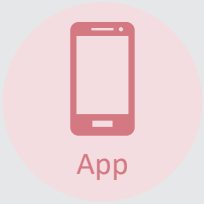
Finish waste collecting and sorting at stands

Attach recyclable labels to the waste bags

Place waste bags in front of the stand

Leave the event

Receive the bill and pay the waste management cost



Calculate the waste management cost for each stand and process the cost to exhibitors

Collect the waste bags

Weigh the bags and record relevant data

Process the waste to the recycling partner

Recycling partner company

Chapter 06

Concept validation &Final design

6.1 Concept validation

To learn how exhibitors perceive the overall waste management process as well as the relevant services and functions involved, the design concept was validated via the form of interviews with 3 exhibitors.

6.1.1 Validation with exhibitors---Online interview

- *Materials*

1. Service blueprint
2. Interfaces of the App "Event Waste Sorting"

- *Procedure*

Exhibitors were first briefly introduced with the research problem and design goal. The design concept was then explained with the service blueprint to find out exhibitors' attitudes towards the overall waste management process.

After that, a more detailed validation was conducted regarding the steps and measures relevant to exhibitors. These solutions were introduced with the relevant interfaces. After that, feedback and suggestions from exhibitors were gathered.

- *Validation of Step 1*

Feedback:

For the policies, exhibitors agree that it is essential for them to learn the benefit of waste sorting other than protecting the environment. The cost reduction system was also considered useful for them to take action on waste sorting.

- *Validation of Step 3*

Feedback:

In general, exhibitors show positive attitudes towards the function of waste bin recommendation. While the filter "stand type "and "stand size" (intend to recommend waste facilities based on the specific stand of the exhibitor) were not considered relevant. Instead, they suggest the selection can be made based on volume and the size of the bins.

- *Validation of Step 4*

Feedback:

Exhibitors think this function is useful for them to manage their time during the event better.

For receiving the notification in time, exhibitors prefer to have an overview of the visitor flow for the coming exhibition day, which can be sent via email or accessible on the app. This allows them to have sufficient time to make plans.

Additionally, the strategy of "visitor flow control" is mentioned, aiming to control the visitor flow in different hours and make it more evenly distributed by specifying the hours. of the visit on the tickets.

- *Validation of Step 5*

Feedback

Regarding the waste collection, exhibitors prefer to see the measures to validate their waste weight since the weighing process is carried out behind the scenes by staff of the organizer.

- *Validation of Intervention 1&2*

Feedback:

Exhibitors do not express any concerns regarding completing the survey and placing the signs of recycling remind. Some of them think the signs would help to indicate the sustainable awareness of their brand. While they would like to make sure the sign will not interfere with their stand activity in terms of the size and the way it is facilitated.

Validation of Intervention 3

Feedback:

Exhibitors think it is possible to promote disposables. Exhibitors may still prefer to still use their disposables due to specific requirements that can not be met, or the price is still too high even with a discount provided.

The attitudes towards the Eco Shopping bag campaign were positive.

Insights for iteration

Step 3

- Change the filters “stand type” and “stand size” to the bins' volume and list the bins' measurement.

Step 4

- An overview of the event busyness that sends in advance would be more useful for exhibitors to manage their time and make plans for relevant activities.
- Consider the strategy “visitor flow control” as the basis for obtaining the data of “overall busyness level” throughout the exhibition day.
- The notification can also be sent via email in advance.

Step 5

- Consider how to validate the weighing process that is conducted by the staff behind the scene.
- Consider adding a notification to remind exhibitors the step “Attach the recyclable labels.”

Intervention 1&2

- Specify the sign placed at the stand, including size, appearance, and ways of facilitation.
- Explain on the survey page about how the data is going to be used.

6.1.2 Validation with visitors---Act out the service

The solution "Waste sorting signs" was validated with participants who have the experience of event visiting to find out how they think of the solution and the set up of the signs regarding helping them better sort different waste.

- *Materials*

1. Prototypes of waste sorting signs
2. Props "Waste sample," "Waste bin."

Figure6.1 Prototype-1st waste sorting remind

Figure6.2Prototype-2nd waste sorting remind

- *Procedure*

Two types of scenarios were set up to mimic the conditions with/without the waste sorting signs. Then, participants will take the role of "event visitors" to experience the process illustrated in diagram 6.3 under the two conditions, and sort the waste samples randomly.

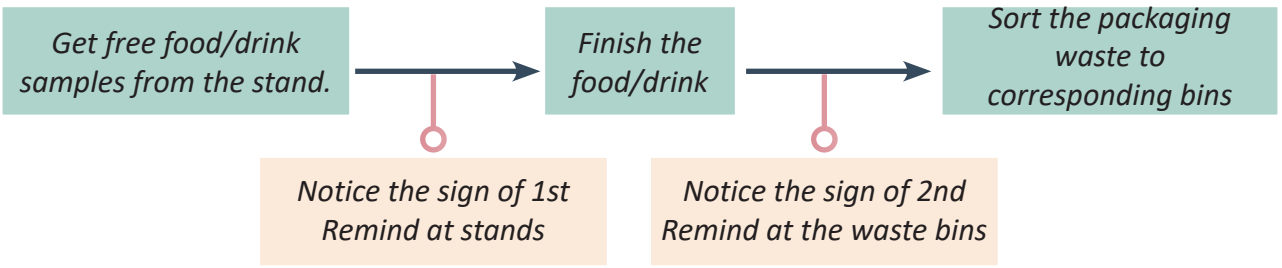


Diagram 6.3 Process of acting out

General feedback from participants:

In general, participants have positive attitudes toward this solution. They think the facilitation of the two signs can increase people's awareness of waste sorting.

Insights for an iteration:

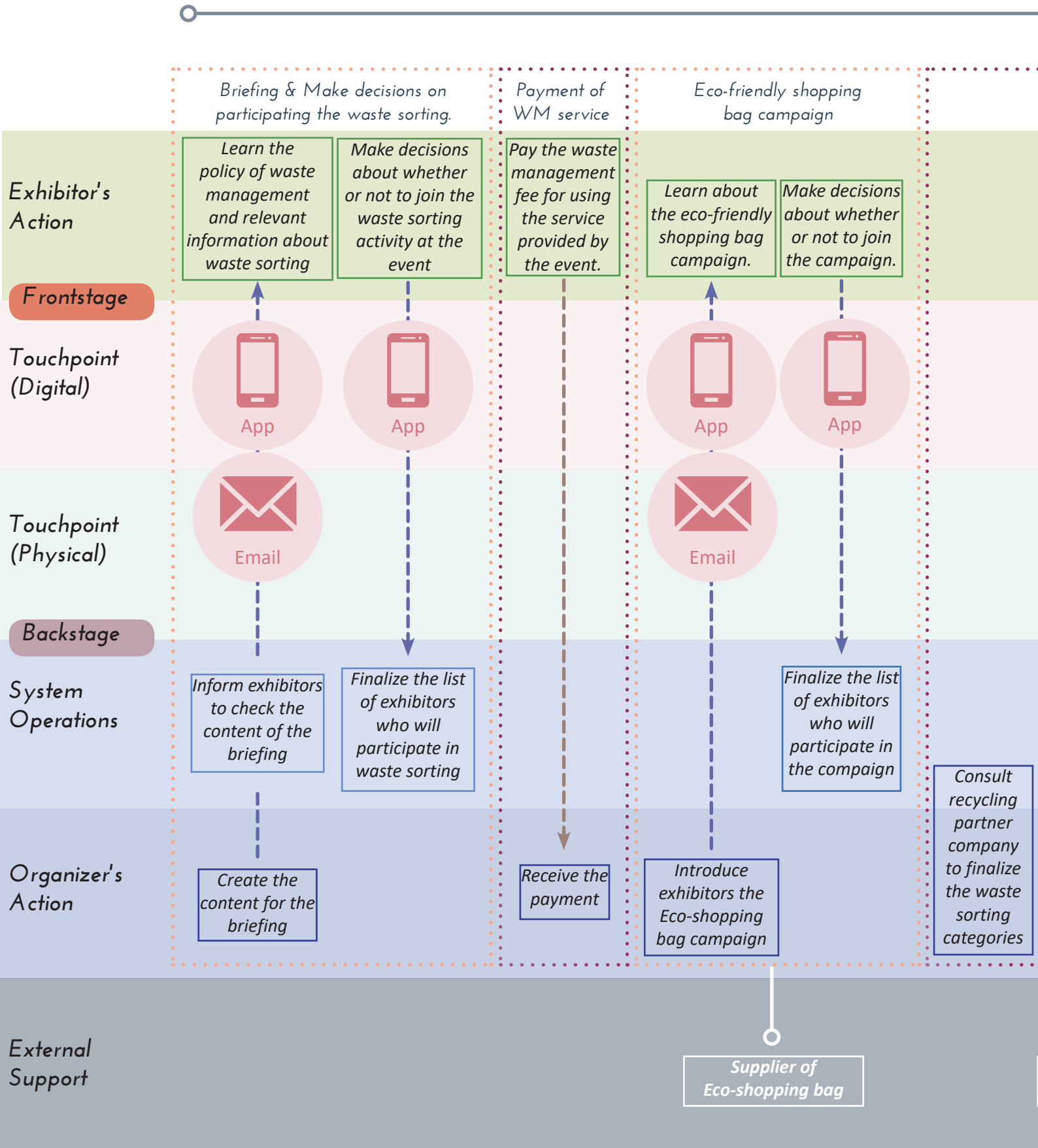
Based on the participants' feedback, the name of the waste category "Mix recyclables" itself is unclear about what kind of waste should the visitors throw-in. It is suggested to only keep the specific waste streams (e.g., Plastic container, Cans, Drink Cartons), use more clear visuals to represent each of the waste streams.

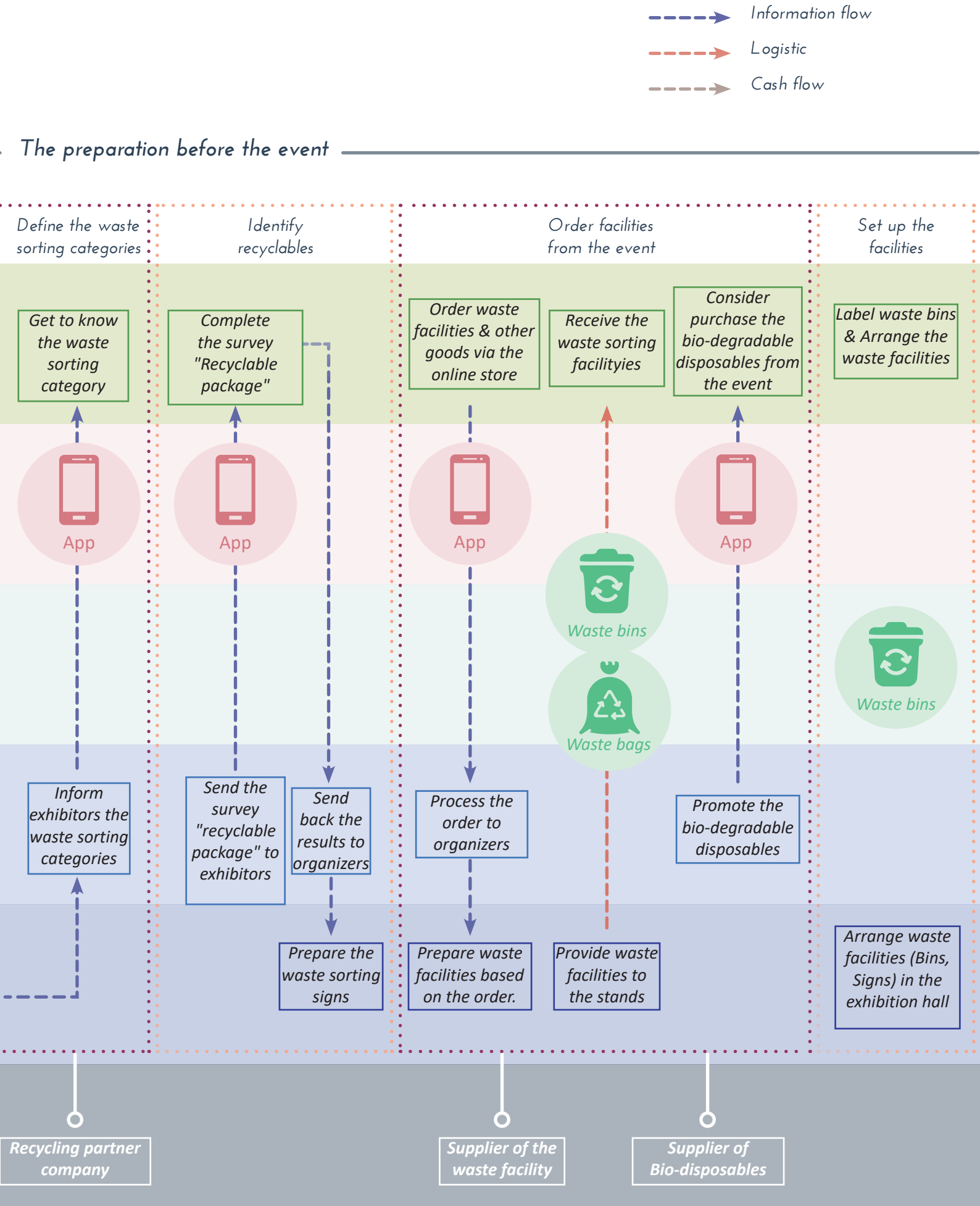
- The visual of the first waste sorting notification is not explicit enough to throw the waste into the bin.

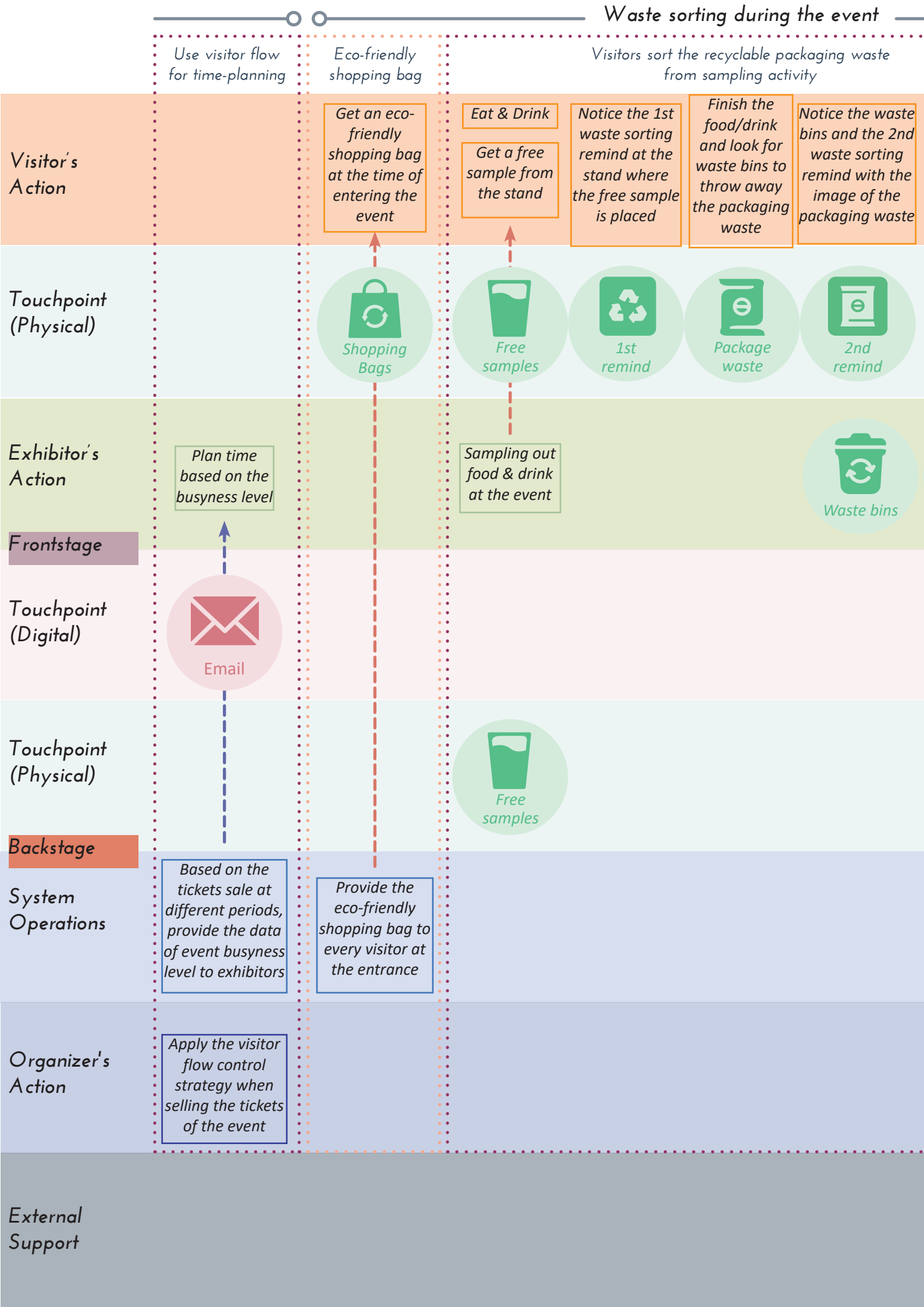
6.2 Final design

The insights from the 6.1 concept validation were used to iterate the concept and results to the final design of this project, including a service blueprint of the waste management process, a high-fidelity version of the waste sorting app critical scenarios of visitors' waste sorting.

6.2.1 Service blueprint-Waste management during the event




Information flow
Logistic
Cash flow
The preparation before the event
Define the waste sorting categories
Identify recyclables
Order facilities from the event
Set up the facilities
Get to know the waste sorting category
Complete the survey "Recyclable package"
Order waste facilities & other goods via the online store
Receive the waste sorting facilityies
Consider purchase the bio-degradable disposables from the event
Label waste bins & Arrange the waste facilities
App
App
App
App
Waste bins
Waste bags
Waste bins
Inform exhibitors the waste sorting categories
Send the survey "recyclable package" to exhibitors
Send back the results to organizers
Process the order to organizers
Promote the bio-degradable disposables
Prepare the waste sorting signs
Prepare waste facilities based on the order.
Provide waste facilities to the stands
Arrange waste facilities (Bins, Signs) in the exhibition hall
Recycling partner company
Supplier of the waste facility
Supplier of Bio-disposables


Waste sorting during the event
Use visitor flow for time-planning
Eco-friendly shopping bag
Visitors sort the recyclable packaging waste from sampling activity
Visitor's Action
Get an eco-friendly shopping bag at the time of entering the event
Eat & Drink
Get a free sample from the stand
Notice the 1st waste sorting remind at the stand where the free sample is placed
Finish the food/drink and look for waste bins to throw away the packaging waste
Notice the waste bins and the 2nd waste sorting remind with the image of the packaging waste
Touchpoint (Physical)
Shopping Bags
Free samples
1st remind
Package waste
2nd remind
Exhibitor's Action
Plan time based on the busyness level
Sampling out food & drink at the event
Waste bins
Frontstage
Touchpoint (Digital)
Email
Touchpoint (Physical)
Free samples
Backstage
System Operations
Based on the tickets sale at different periods, provide the data of event busyness level to exhibitors
Provide the eco-friendly shopping bag to every visitor at the entrance
Organizer's Action
Apply the visitor flow control strategy when selling the tickets of the event
External Support

Waste collection after the event

Sort the packaging waste based on the instruction

Information flow

Logistic

Cash flow

Package waste

Waste bins

Waste collecting & sorting at stands

Cost refund from waste sorting

Collect and sort waste at stands

Receive the notification of attaching the recycling label

Attach recyclable labels to the waste bags

Place waste bags in front of the stands in the hallway

Can weigh the waste bags & know the weight in advance if doubted the weighting process conducted by the staff

View result of cost-saving from waste sorting

Receive the cost refund

App

App

Email

Waste bins

Labels

Waste bags

Weighing Scale

Send notification to remind exhibitors to attach the recyclable labels

Calculate the cost-saving from waste sorting and send the result to exhibitors

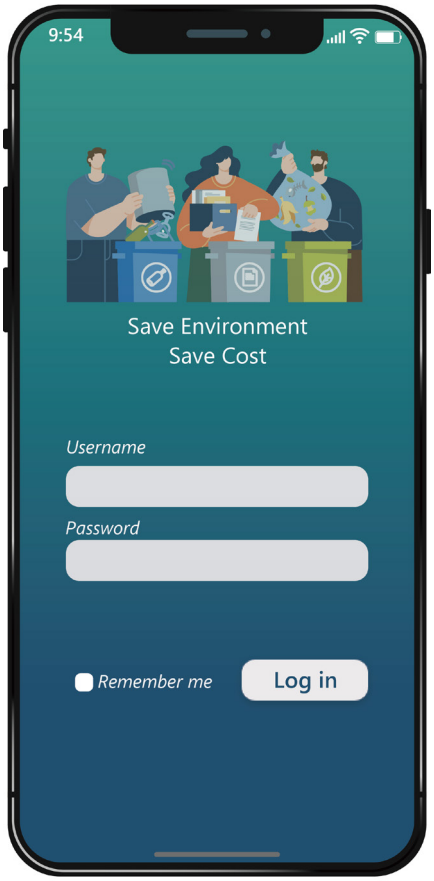
Provide weighing scale at the event for exhibitors to weigh the bags in advance

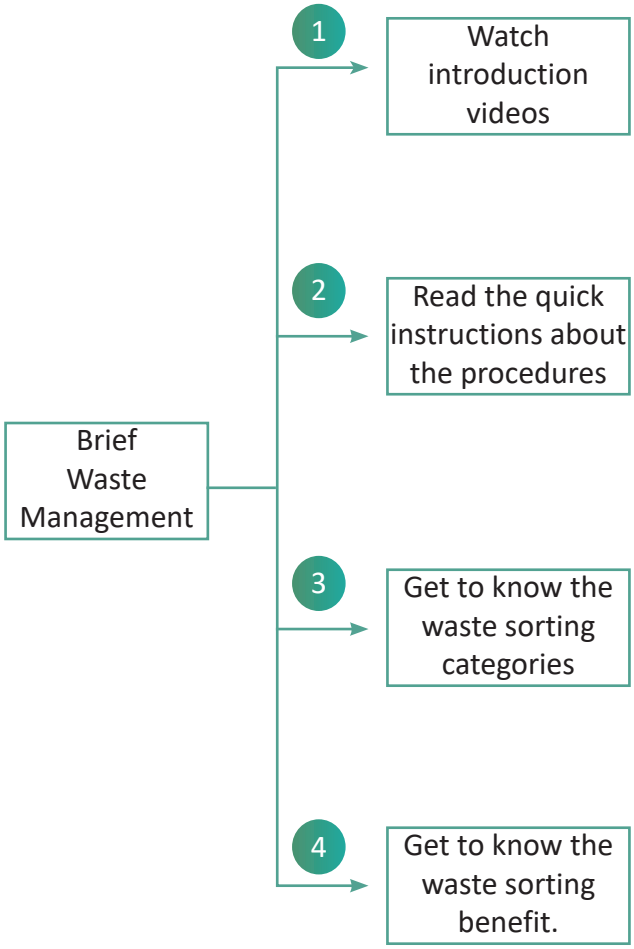
Collect, Weigh the bags at each stand and record the data

Refund the cost-saving to exhibitors

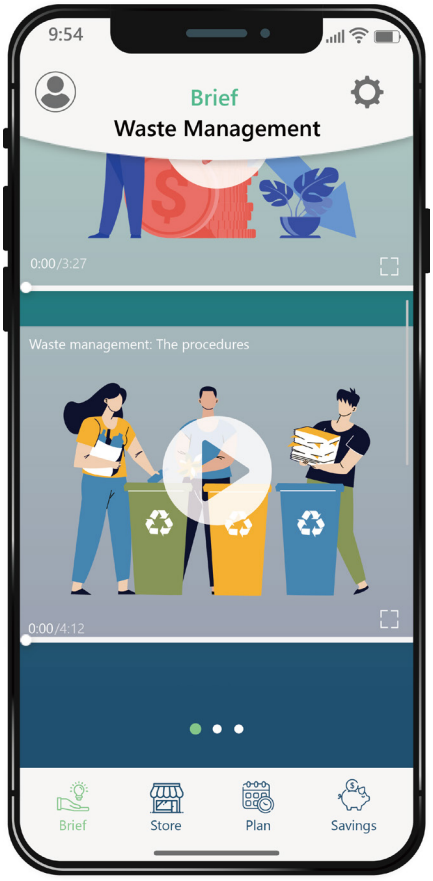
Recycling partner comapny

6.2.2 Waste sorting app for exhibitors





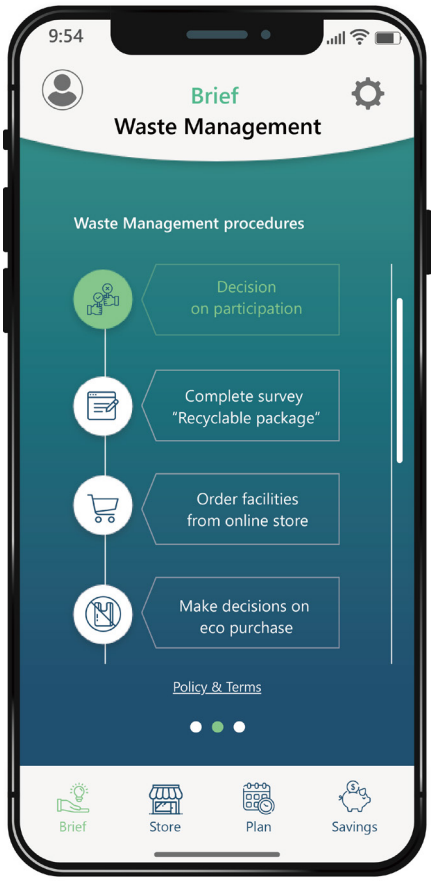
1


9:54
Brief
Waste Management
0:00/3:27
Waste management: The procedures
0:00/4:12
Brief
Store
Plan
Savings

2

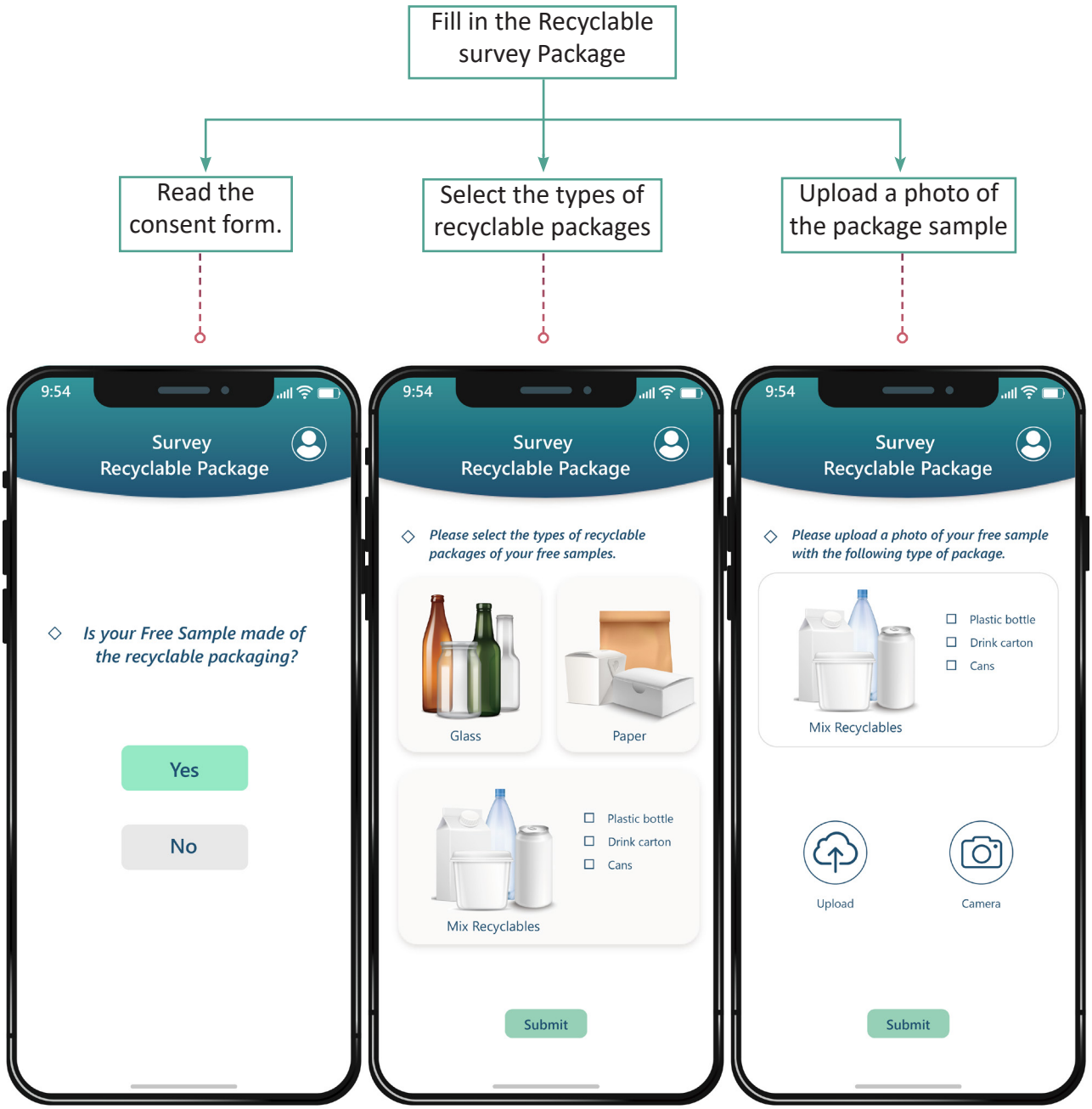

9:54
Brief
Waste Management
Waste streams you can sort out at event
*Broken glass will not be accepted
Glass
*Only dry & clean paper recyclables are accepted
Paper
Cans
Drink Carton
Plastic
Policy & Terms
Brief
Store
Plan
Savings

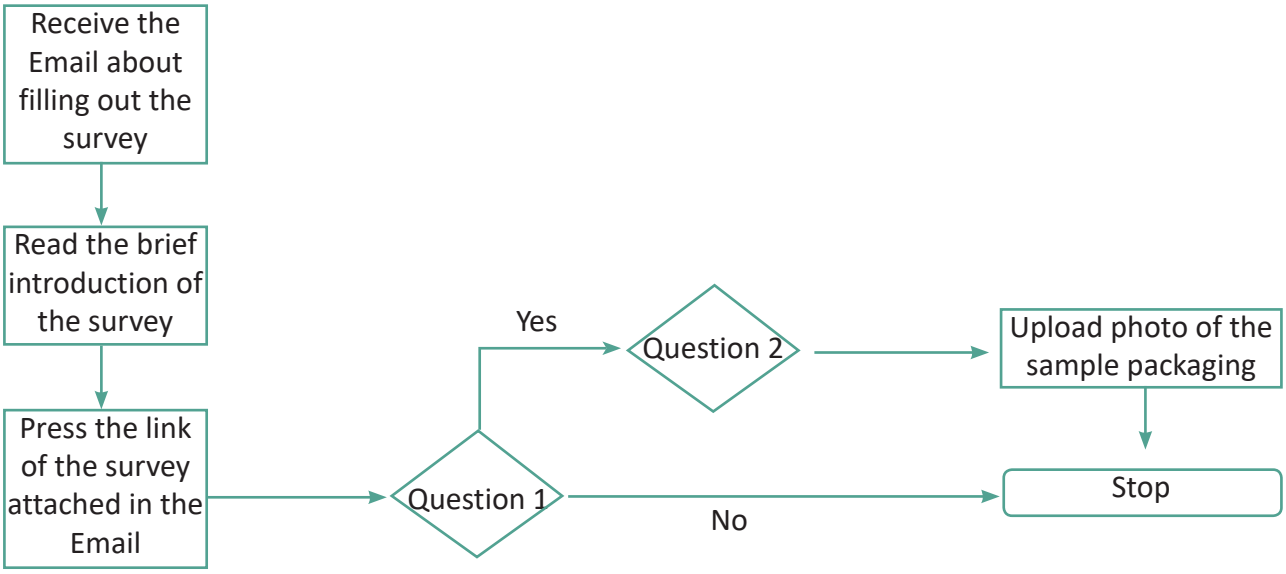
3

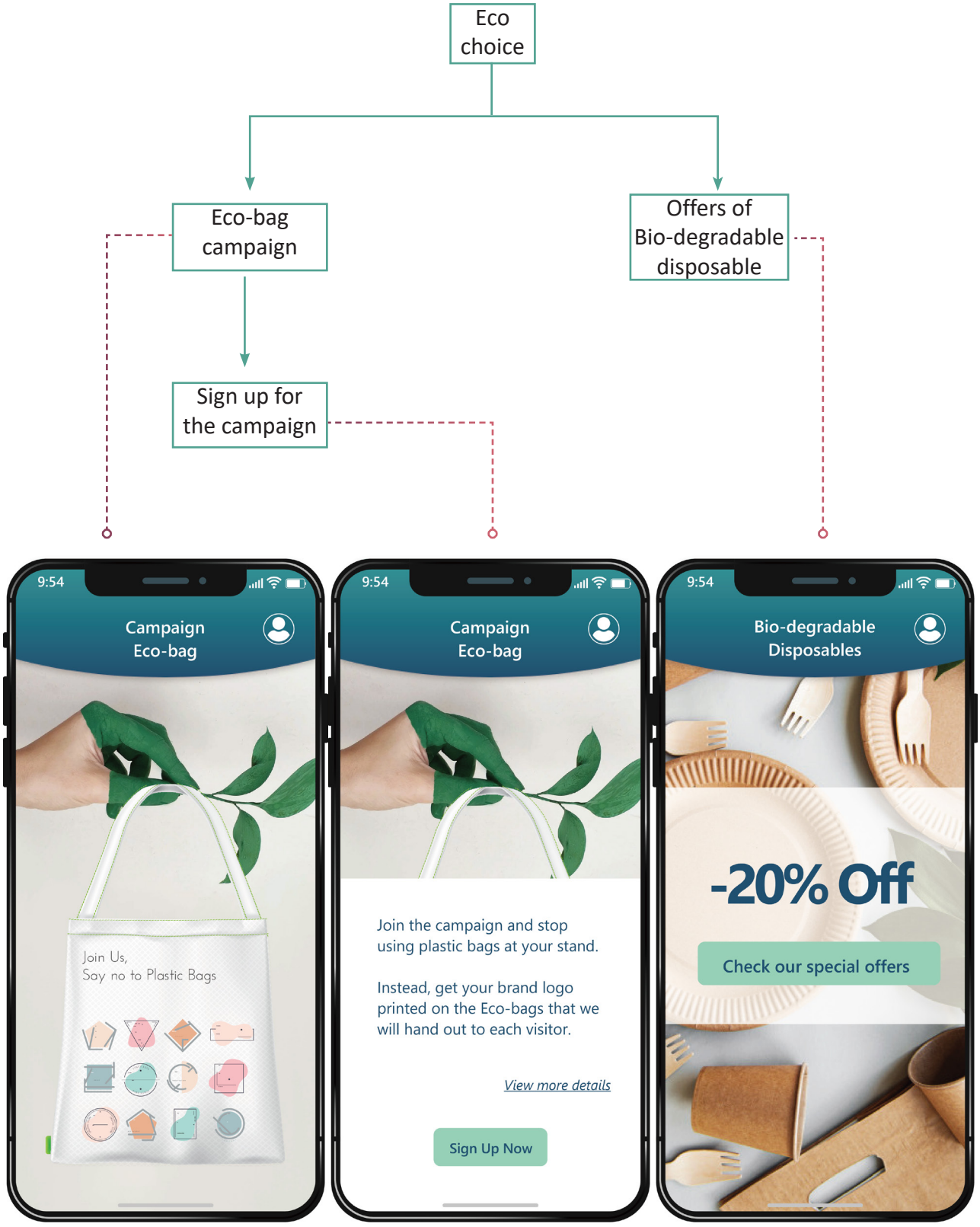

9:54
Brief
Waste Management
Waste Management procedures
Decision on participation
Complete survey "Recyclable package"
Order facilities from online store
Make decisions on eco purchase
Policy & Terms
Brief
Store
Plan
Savings

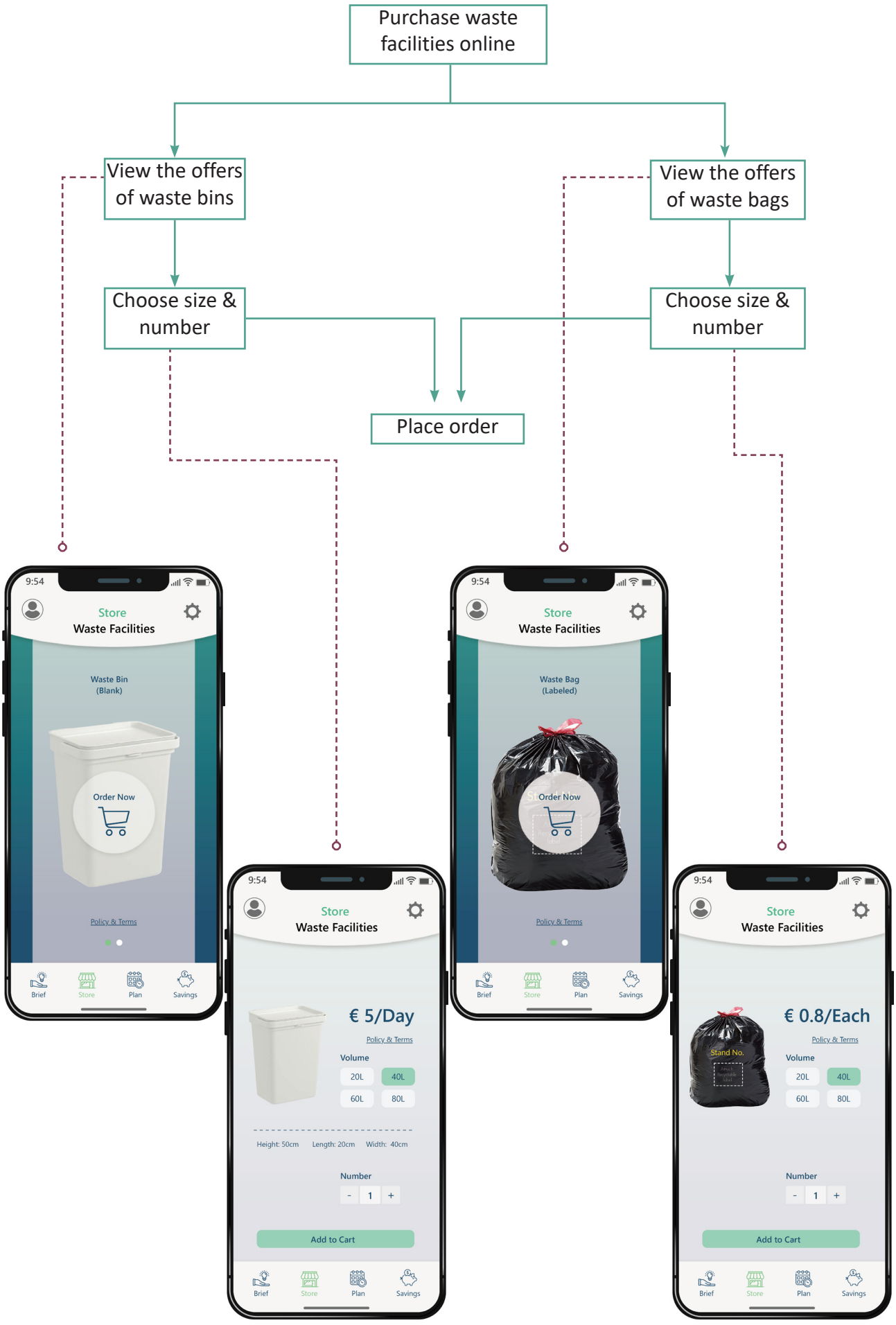
4


9:54
Brief
Waste Management
Cost reduction compared to General Waste/kg
Save
70%
Save
40%
Save
30%
Policy & Terms
Brief
Store
Plan
Savings

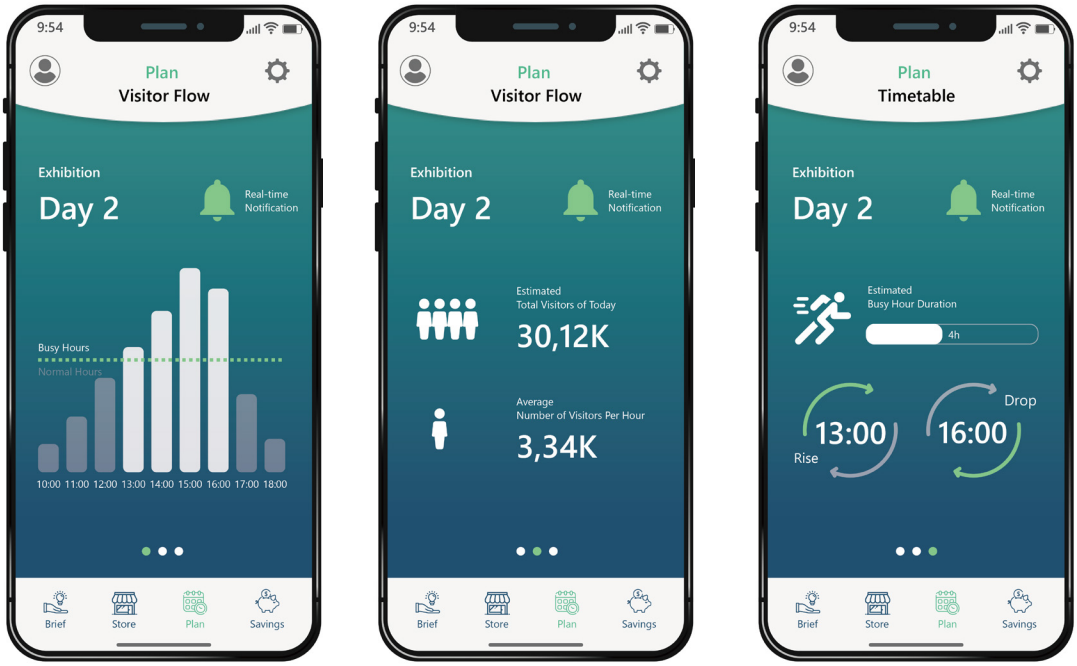

Fill in the Recyclable survey Package
Read the consent form.
Select the types of recyclable packages
Upload a photo of the package sample
9:54
Survey Recyclable Package
Is your Free Sample made of the recyclable packaging?
Yes
No
Please select the types of recyclable packages of your free samples.
Glass
Paper
Plastic bottle
Drink carton
Cans
Mix Recyclables
Submit
Please upload a photo of your free sample with the following type of package.
Upload
Camera


Receive the Email about filling out the survey
Read the brief introduction of the survey
Press the link of the survey attached in the Email
Question 1
Yes
Question 2
No
Upload photo of the sample packaging
Stop

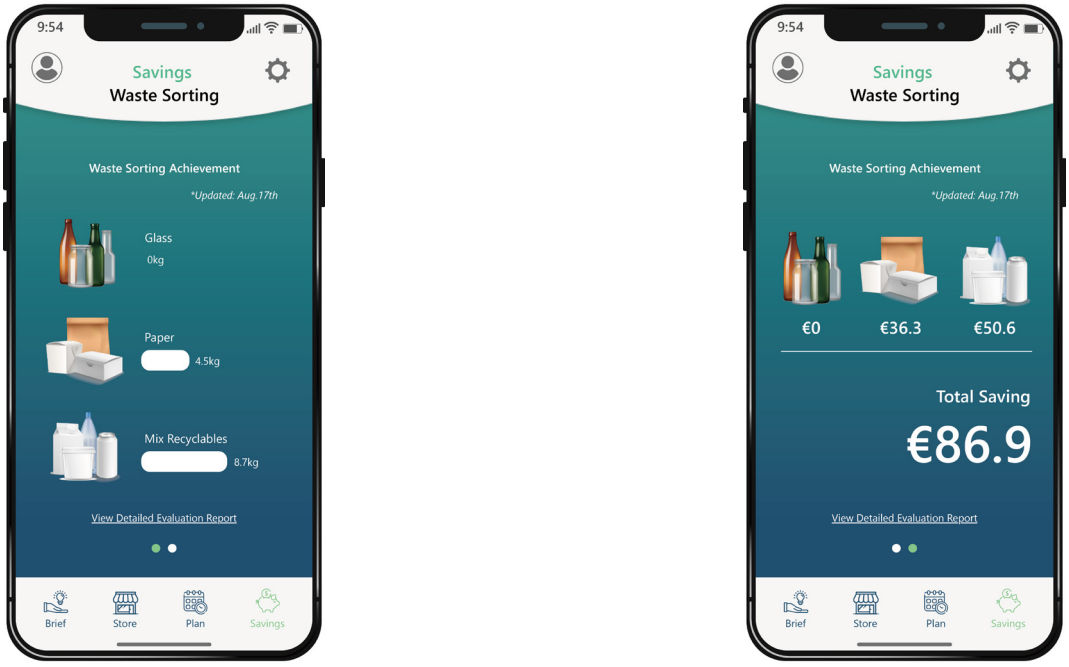

Eco choice
Eco-bag campaign
Offers of Bio-degradable disposable
Sign up for the campaign
9:54
Campaign Eco-bag
Join Us,
Say no to Plastic Bags
9:54
Campaign Eco-bag
Join the campaign and stop using plastic bags at your stand.
Instead, get your brand logo printed on the Eco-bags that we will hand out to each visitor.
View more details
Sign Up Now
9:54
Bio-degradable Disposables
-20% Off
Check our special offers


Purchase waste facilities online
View the offers of waste bins
View the offers of waste bags
Choose size & number
Choose size & number
Place order
9:54
Store
Waste Facilities
Waste Bin (Blank)
Order Now
Policy & Terms
Brief
Store
Plan
Savings
9:54
Store
Waste Facilities
Waste Bag (Labeled)
Order Now
Policy & Terms
Brief
Store
Plan
Savings
9:54
Store
Waste Facilities
€ 5/Day
Policy & Terms
Volume
20L
40L
60L
80L
Height: 50cm
Length: 20cm
Width: 40cm
Number
- 1 +
Add to Cart
Brief
Store
Plan
Savings
9:54
Store
Waste Facilities
Stand No.
€ 0.8/Each
Policy & Terms
Volume
20L
40L
60L
80L
Number
- 1 +
Add to Cart
Brief
Store
Plan
Savings

View the visitor flow



View the cost reduction



6.2.3 Scenarios of visitor's waste sorting

First Remind
Visitors notice the signs at the stand about recycling the package

Second Remind
Visitors see the signs with the image of the packaging at the waste bins.

Sort waste as following the instruction

Chapter 07

Reflection

7.1 Final design reflection

In this part, the final design is reflected in two ways. The first part is to reflect the overall solution from the desirability, feasibility, and viability aspects. The second part considers the implementation of the final design, including the possible barriers and the recommendations.

7.1.1 Desirability, Feasibility, and Viability

Desirability

- *Exhibitors*

The new service gives exhibitors the freedom to choose whether or not to separate the waste during the event based on their willingness. The app integrates the services and products they need for managing their waste at the stand, which also makes it more straightforward for exhibitors what they should do along the process. Exhibitors from the test generally think the service is desirable to use.

However, the solution does not decrease much of the exhibitors' workload on waste management. With the current solution, exhibitors still need to conduct most of the work manually by themselves, which they might still consider a "burden" to do at busy events.

Another aspect that could make the experience less desirable is the doubts about the cost reduction. Exhibitors may doubt the waste sorting results published by the event since it is mostly conducted behind the scenes by the event's staff.

- *Visitors*

The final design provides necessary facilities for visitors to waste separation with more intuitive instructions to guide them correctly sort out recyclable waste. During the test, it is also confirmed that the signs are understandable to visitors.

However, it is still possible that the signs are not desirable enough in some cases, in which the visitors may regarded them as "distractive" or "redundant". For instance, people who only want to focus on the event itself, or they already have sufficient knowledge to separate the waste correctly.

Feasibility

The techniques involved in the digital platform and the physical facilities are both feasible to implement.

The visitor flow control strategy discussed in the final design has been tested by some events and proved feasible. Besides, no investigation will be conducted on personal information, which also eliminates privacy concerns.

Viability

- *Exhibitors*

The design enables exhibitors to save some costs on waste management by sorting out the recyclable waste. However, the amount of cost saving can still be too limited for a company.

However, the "reward" of waste sorting behavior can be complemented with extra marketing exposure, which is more attractive for business according to exhibitors' original intension of joining the events illustrated in the exhibitor's journey. (Further explanation can be found on p.106 Discussion)

- *Event organizers*

The solution is viable for event organizers since the cost that event organizers spend on processing the visitor's waste will be reduced when the recyclables are sorted out.

7.1.2 Unexpected situations & Recommendations

- *Revenue streams of the Eco-bag campaign*

The revenue streams to produce the eco-bags include the following two aspects.

- Participation fee of the campaign
- Eco-compensation

Since the eco-bags are handed out to visitors as a substitute for plastic bags that exhibitors were used to wrapping their product in sales activities, exhibitors who agree to use eco-friendly bags during the event save the cost of preparing the plastic bags for their customers. However, there will still be a participation fee for the exhibitors who participate in the campaign to cover the eco-bags' production cost.

Simultaneously, exhibitors who refuse to join the campaign but still would like to use plastic bags will face an "environmental compensation" fee for the use of plastic bags.

In general, the sum of the Participation Fee and the Eco-compensation fee should cover the cost of Eco-bag production and the possible waste processing cost of plastic bags.

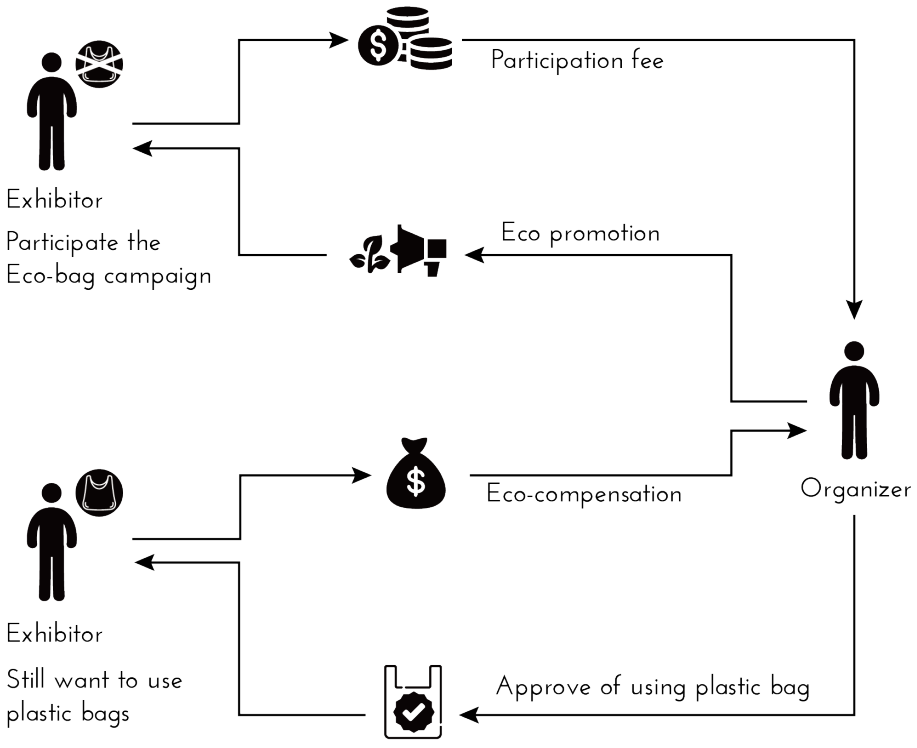


Figure 7.1 Revenue streams of the production cost of eco-bag

- *Difficulties in the step "Identify recyclables."*

In the step "Identify recyclables," information about the sample packaging will be collected from the exhibitors via an online survey. However, the implementation of this step can be challenging in terms of exhibitors filling out the survey correctly.

In some cases, it may not be easy to finish the survey. For instance, the contact person who will fill out the survey may not have clear information about the packaging materials or does not have access to take a photo of the packaging. In this case, they might need to take extra steps to complete the survey (e.g., reach out to other colleagues/contact other departments), making the survey a time-consuming and less desirable task for the exhibitors complete.

Simultaneously, since the completion of the questionnaire is not directly linked to exhibitors' interests, their participation in filling out the questionnaire may be relatively low.

Recommendation

To solve the above problems, organizers need to evaluate the event to check if the photos of the packaging and the signs facilitated before the event still match the stands' free samples. A quick adjustment can be made based on the result of the evaluation.

For events that last multiple days, event organizers can also attach the photos and arrange the signs after evaluating the first day's information. In this case, it enables organizers to avoid excessive investment in the production of recycling signs and further make sure the selected recyclable waste is profitable to collect separately.

- *Select profitable recyclable waste*

With the current final design, the specific recyclable waste from sampling activity will be identified before the event.

Instead of producing signs for all the recyclable packaging waste, the event may select only the "high quality" recyclable waste that is profitable to collect separately, for they can be sold to other manufacturers or recycling companies.

Since the event needs to spend extra cost on making the signs of waste sorting, it would be more viable to further ensure that the investment can be returned when selling these recyclables.

Event organizers will have more time contacting manufacturers or recycling partners who would like to buy the recyclables by identifying the recyclable waste early before the event.

- *Collect & evaluate the sorted recyclables*

The cost reduction is calculated based on the weight of the recyclables being sorted out. In this case, it is ncessary for the organizer evaluate the quality of the recyclable waste.

Recommendation

Due to the organizer's limited resources, it may not be possible to conduct quality inspections on a large scale. One strategy is to conduct a sample survey at the end of every exhibition day to make the inspection more efficient. The event can randomly select a certain number of bags each day to check the recyclables' quality.

Meanwhile, the evaluation result will be shared with exhibitors via the app. Identified unqualified recyclables will negatively influence the sum amount of cost reduction.

- *Adjustment in recyclable waste collecting for One-day event*

The events that the project researched last multiple days. However, if the event's duration is only one day, there might be some new challenges for waste management.

First, the total amount of waste being produced from each stand during the event is relatively small. In this case, the incentive for cost reduction will be less interesting for exhibitors due to the limited money they can save from one-day waste sorting activity. In contrast, purchasing extra waste bins/bags for separating different types of waste increase their waste management investment.

Additionally, the overall schedule for a one-day event can be tight. Exhibitors may be busy with setting up in the morning and demolition at the end of the day. There would be less time for them to get used to the waste management process. At the end of the one-day event, the demolition work can make the spot chaotic, which makes it hard to organize waste sorting activity under this situation.

Recommendation

Based on the above situation, sorting waste at stands in a one-day event requires the organizers to make more effort in setting up the facilities in advance. Also, the categories of waste sorting can be made less complicated, such as only including recyclable waste and non-recyclable waste.

For collecting the waste, labeled waste bins with specific stand number can be facilitated to each stand in advance. Exhibitors are no longer need to attach the recyclable labels to the waste bags at the end of the event. Hence, the time required for waste sorting can be shortened.

7.1.3 Discussion

The final design provides the conditions that enable exhibitors and visitors to sort their waste during the event. Currently, most of the exhibitors and visitors do not separate their waste at the time of disposal, which can lower the quality of the recyclable materials while increasing the difficulty of later waste processing.

Hence, the design aims to strengthen environmental awareness and form waste separation behavior of the participants. The incentives such as the cost reduction can be viewed as an added-value while encouraging the exhibitors to do good to the environment. With the implementation of the solution, participants, including the visitors and the exhibitors, are expected to develop the habit of waste sorting in the long run.

Visibility of the waste sorting signs

The design of the waste sorting signs facilitated at the waste bins is highly visibl. This design may be more suitable for consumer fairs or trade fairs such as the Household fair. The reasons are as follows:

- The consumer fair's environment is more casual, where people have less pressure to behave appropriately on waste disposal and separation.
- The event's environment is more likely to get dirty due to all the eating and sales activities.
- The waste streams at consumer fairs can be complicated.

Hence, a straightforward notification is necessary to be facilitated to empahsize the waste separation and guide the behavior of visitors.

However, this notification format might be too "loud" to match the overall event vibe for some high-end exhibition or business event.

Compared to consumer fairs, these events are usually more formal professional, where the participants mind their behaviors more in such occasions.

In this case, the message of waste sorting may not be necessary or can be provided subtly, which would not attract much attention.

Cost reduction incentive

According to relevant statistics, the amount of money that a stand can save from cost reduction is still too limited for a company. The purpose of waste sorting is turning the event to be more sustainable, while the cost reduction can be regarded as an added benefit for exhibitors.

Besides the cost reduction, the event can introduce other incentive strategies such as more marketing exposure opportunities.

For instance, the event first evaluates the waste management performance of all the stand based on the waste sorting result and the amount of waste generated in total from the stand.

After the evaluation, the event can announce the name of the companies that got the top performance in waste management via its official website or other social media channels. This can be regarded as an extra chance of marketing promotion for those companies, which also indicates the sustainable awareness of their brands.

Visitor flow control

Some events have applied the visitor flow control strategy, which is proved to be a feasible technique to implement. The visitor flow described in this project is still primary, for it does not involve investigating how many people will visit a particular stand in a specific period. Based on the total number of visitors at different times, exhibitors can get a general view of the peak and non-peak hours.

The advanced visitor flow research that predicts the number of visitors to specific stands based on personal information will give exhibitors more accurate information regarding the number of visitors at their stand. However, this still has unsolved privacy concerns and relevant policy issues regarding the personal information that visitors need to provide to the event.

7.2 Personal reflection

7.2.1 Contribution of the project

This graduation project found out the current waste management problems during Household fair and Horecava through qualitative research. The phenomenon that lead to excessive waste that could have been avoided or reduced was identified.

Meanwhile, exhibitors' and visitors' pain points on dealing with their waste were also specified and analyzed, categorized into factors that decrease the ability and motivation. The research insights can be used by event organizers to sensitize key stakeholders' needs when optimizing their waste management strategies.

Based on the pain points and needs, a new waste management process was created, which involves a series of solutions on separating the reducing the waste. The final solution still needs more development to be implemented in a real context. Simultaneously, it pointed out the value of identifying the specific recyclable waste before the event, and the financial benefit of waste separation.

7.2.2 Limitations of the project

This graduation project has a practical problem to solve regarding waste management during the event. The case study of Rai is the primary basis of the problem definition and ideation phases.

The insights from the interviews with exhibitors and visitors play an important role in the decision-making of the project, while the organizers' voices are missing.

In the case study of Household Fair and the Horecava, although problems regarding waste management were found, it is still unknown why Rai's organizers make such choices on waste management during the event and the considerations behind. The lack of input from the organizers' side makes it hard to know the implementation challenges.

The pain points and problems were solved with a package of solutions in the final design. However, the design may sometimes lose its focus since the relations between different problems/pain points were not mapped out. In this case, most of the solutions are split in the ideation phase and have not been developed in-depth enough in the later stage.

- *Literature Review*

The problem of the literature review is that few theories or models were directly applied or reflected in the later design phases. As a result, the theories are not well connected with ideation or concept evaluation.

- *User research---Interviews*

One difficulty of this research is to find exhibitors for interviews. Due to the Covid-19 pandemic, no exhibitions were held offline during the research phase of this project, while the contact information of exhibitors can be found online is also very limited.

In the end, the exhibitors that were interviewed were most from start-ups or medium-sized companies. Simultaneously, there was no opportunity to reach out to big companies to find out their difficulties and explore their motivation for waste sorting.

The insufficient variety of the interviewees may lead to a biased attitude towards the final decision since smaller companies are more sensitive to the waste management cost and are easier to be motivated by the cost reduction strategy. In contrast, the factor that could motivate big companies to engage in waste sorting can be very different.

- *Ideation & Conceptulization*

The overall ideation phase sometimes focuses too much on illustrating the overall waste management process, while did not develop the core concept a step further with more novelty.

The concept is generated mainly based on the insights from the interviews. More scenarios and aspects, such as how to adapt the solution to different types of events, are not reflected in the final solutions.

The ideas generated are more focused on the functionality, while it may lack the consideration from the emotional perspectives of the users.

- *Evaluation*

Since the final design involves tangible products such as the signs of waste sorting, it would be better to evaluate the idea with real visitors and a real event context. Unfortunately, the evaluation only involves online interviews with exhibitors and prototype tests with design students.

Like the research phase, the two groups of participants in the tests also lacked variety in the backgrounds. Again, this can leads to more detailed findings being missing out. As the exhibitors did not try the service in practice, some problems can be overlooked when only imagine what will happen along the process.

7.3 Conclusion

The project discussed the topic of waste management at big events. Taking the example of the convention center Rai Amsterdam, problems on waste separation were found in the stage "during the event," which is finalized as the later research and design focus.

Followed by Rai's case study, two events (The Household fair and The Horecava) held by Rai were chosen as cases to study further. Relevant exhibitors and visitors were interviewed. Based on Fogg's behavior model, the factors that caused insufficient ability and motivation of exhibitors and visitors were mapped out.

For exhibitors, the lack of time and support on facilities, high financial cost on waste management, and unclear about the process/ policies are identified as the main barriers that decrease waste separation. The main obstacle for visitors is the lack of waste sorting facilities and the knowledge gap in waste classification.

Meanwhile, most of the waste that ended up as visitors' waste was from the material input of the stands at the event, especially the free samples' handing. Thus, the behavior of exhibitors become the central focus of the designing phase. On the one hand, they produce waste at the stand while also determine the waste streams that the visitors will have at the event.

Through the research, it is found that a reduction in waste management cost is feasible through waste separation, which is then utilized as the incentive to motivate exhibitors to sort their waste.

Based on the above insights, the project aims to reduce both the negative environmental influence and the financial cost for exhibitors and organizers in collecting and processing the waste.

In the final design, the digital platform integrates the support of waste sorting. Exhibitors can easily access throughout the event to check relevant instructions, plan their time wisely according to the visitor flow, and know their waste separation achievement.

Besides, the digital platform also serves as a channel to gather information about free sample waste streams from exhibitors. This enables the event organizers to identify the specific target for visitor's waste separation and thus prepare more intuitive instructions (e.g., The recyclable packages' images) for visitors that fill the knowledge gap.

The project identifies the waste problems caused by an insufficient separation. It provides solutions that include a service blueprint and a digital platform to reduce the negative impact of event waste by enabling relevant stakeholders to sort out the recyclable waste. The motivator of financial incentive and the strategy of waste stream information gathering to make the waste streams predictable can inspire event organizers to implement and tailor for their specific event contexts.

Chapter 08

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