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Master's Thesis
Academic Year 2022

Utilizing Local Advantages to Initiate
Community-Based Upcycling Project: A Case
Study of the Cycle Project in Nagoya



Keio University
Graduate School of Media Design

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A Master's Thesis
submitted to Keio University Graduate School of Media Design
in partial fulfillment of the requirements for the degree of
Master of Media Design

Hirona Maeda

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Abstract of Master's Thesis of Academic Year 2022

Utilizing Local Advantages to Initiate Community-Based
Upcycling Project: A Case Study of the Cycle Project in
Nagoya

Category: Design

Summary

Upcycling - the process in which used materials are converted into something of higher quality or value and in their next life - has been significantly advocated as a promising means to reduce material and energy use, and to realize a recycling-oriented society with sustainable production and consumption. Although upcycling has gradually received more attention, the promotions and actions of upcycling are still perceived as considerable issues. Small and Medium-sized Enterprises(SMEs) are confronted by challenges with industrial waste materials, and are still unable to resolve on their own.

This paper proposes a concept of local community-based project, with particular focus on Nagoya City, Aichi Prefecture. Aichi represents one of the leading industrial prefectures in Japan. Specifically, this study aims to provide insights into the collection of local industrial waste materials, collaboration work with designers and universities, workshops to share lab work with local SMEs, and an online platform for disseminating information.

In addition, this paper convenes three workshops for local businesses and one discussion session to examine possibilities of those proposals mentioned above. The process illuminates opportunities to learn about industrial waste materials from other industries in the region and a motivation to interact with outside parties for collaborative ideation in upcycling activities.

Adhering to these approaches, a platform has been launched for the purpose of validating the community-based concept in this study, it suggests future possibilities and challenges as a local community to promote upcycling of industrial waste materials.

In order to further explore this field, this paper further analyzes and summarizes upcycling activities among SMEs in Nagoya, Japan, encompassing collaborative practices, waste materials combinations and relevant experiments. Finally, it gives suggestions for future research by demonstrating setbacks and restrictions in the area of upcycling.

Keywords:

upcycle, industrial waste, local advantage utilization, cycle project

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Contents

Acknowledgements	ix
1 Introduction	1
1.1. Background	1
1.1.1 Upcycle in Japan	2
1.1.2 Industrial wastes in Japan	2
1.1.3 SDGs for SMEs in Japan	3
1.2. Research field and utilization of local uniqueness	4
1.3. Research goals	5
1.4. Contributions	5
1.5. Thesis outline	6
2 Related Works	7
2.1. Transition to product circulation	7
2.2. Current initiatives	8
2.2.1 Corporative initiatives	8
2.2.2 Case studies: Successful upcycling collaborations	10
2.3. Opportunities and challenges	14
2.3.1 List of challenges confronted by upcycling businesses	14
2.4. Platform for waste materials	14
2.4.1 For individuals	14
2.4.2 For industries	16
2.4.3 Supporting upcycle activity	18
2.5. Summary	21
3 Concept Design	22
3.1. Survey on current context and needs	22

3.2.	Design concept	29
3.2.1	Cycle Project	30
3.3.	Cycle Project flow	32
3.4.	Project activity	33
3.4.1	Manufacturing industry in Nagoya	33
3.4.2	Collection of industrial waste materials	36
3.4.3	Re-Fabrication-Lab	39
3.4.4	Workshop	46
3.4.5	Platform	47
3.5.	Community formation	52
4	User Test and Evaluation	54
4.1.	Overview	54
4.2.	Test 1	57
4.2.1	Overview	57
4.2.2	Preliminary survey	57
4.2.3	Objective	58
4.2.4	Workshop process	58
4.2.5	Survey and evaluation	60
4.3.	Test 2	67
4.3.1	Overview	67
4.3.2	Preliminary survey	67
4.3.3	Objective	68
4.3.4	Workshop process	68
4.3.5	Survey and evaluation	76
4.4.	Test 3	80
4.4.1	Overview	80
4.4.2	Preliminary survey	80
4.4.3	Objective	81
4.4.4	Workshop process	82
4.4.5	Survey and evaluation	84
4.5.	Test 4	91
4.5.1	Overview	91
4.5.2	Objective	91

4.5.3	Session flow	92
4.5.4	Survey and evaluation	96
5	Discussion	105
5.1.	Overview	105
5.2.	Views from designers	106
5.3.	Findings	108
5.4.	Limitation	110
5.5.	Launch of new service	110
6	Conclusion	115
6.1.	Conclusion	115
6.1.1	Key to success	116
6.2.	Future work	118
6.2.1	Long-term upcycling community	118
6.2.2	Possible development of upcycled products	120
6.2.3	Collaboration between local companies and external parties	120
6.2.4	Summary	121
	References	122
	Appendices	127
A.	Cycle Project Exhibition	127

List of Figures

2.1	The circular product flow, extracted from the report by The Great Recovery [1]	8
2.2	UpcycleBoard® [2] circulation process	9
2.3	Upcycled items [3]	12
2.4	Upcycled shoes [3]	12
2.5	Workshops held at FabCafe Hida [4]	13
2.6	Industrial waste brought by participants [4]	13
2.7	Figure summarizing challenges and support [5]	15
2.8	“The Collective Nula” correlation chart [6]	17
2.9	Resources Passport [7]	18
2.10	Craft-based upcycling process proposed by Wang Jing [8]	20
3.1	Views on industrial waste materials posing challenges	25
3.2	The difficulty of promoting internal upcycling practice	25
3.3	Specific issues regarding internal upcycling activities	26
3.4	Resources for learning about companies and industrial waste from other industries	26
3.5	Willingness to learn more about companies and industrial waste from other industries	27
3.6	Openness to collaborate with other companies on upcycling	27
3.7	“Win-win-win” design concept	30
3.8	Cycle Project flow	33
3.9	Field work at ARBIZ Corporation	36
3.10	Types of waste materials received	38
3.11	Lab work	43
3.12	Re-Fabrication-Lab output	44
3.13	Discussion	44

3.14	List of lab work output	45
3.15	List of lab work output-2	46
3.16	Online platform system	49
3.17	Online platform system-2	50
3.18	Online platform system-3	51
4.1	Areas of activities available for user tests	55
4.2	Overview of user testing	56
4.3	Overview of Test 1	57
4.4	Preliminary survey of Test 1	58
4.5	Verification flow for Test 1	59
4.6	Member who share local industrial waste issue	60
4.7	Lab work exhibit	61
4.8	Lab work experience	61
4.9	Lab work experience-2	62
4.10	Discussion	62
4.11	Quantitative survey result of Test 1	63
4.12	Qualitative survey of Test 1	64
4.13	Overview of Test 2	67
4.14	Preliminary survey of Test 2	68
4.15	List of used for Test 2	70
4.16	Introduce of lab work	71
4.17	A photograph of ideation process	72
4.18	Discuss and examine at their waste materials in a container for upcycle ideation	72
4.19	Results of ideation process	73
4.20	New upcycling ideas from ideation	74
4.21	Quantitative survey result of Test 2	76
4.22	Qualitative survey of Test 2	77
4.23	Overview of Test 3	80
4.24	Preliminary survey of Test 3	81
4.25	Verification flow for Test 3	81
4.26	A photograph of ideation process	83
4.27	Results of ideation process	83

4.28	Prototyping report through online platform	85
4.29	Feedback on platform contents	86
4.30	Quantitative survey of Test 3	87
4.31	Qualitative survey of Test 3	87
4.32	Overview of Test 4	91
4.33	Verification flow for Test 4	92
4.34	Talk session	93
4.35	Q&A session	94
4.36	Quantitative survey of Test 4	96
4.37	Q1: The Re-Fabrication-Lab’s lab work was inspiring and helpful for developments of upcycling	99
4.38	Q2: Greater interest in Cycle Project activities and willingness to donate materials	100
4.39	Q3: Rising willingness to learn and share online through the Cycle Project’s online platform	100
4.40	Q4: Greater willingness to work across industries and upcycle incorporating other companies’ waste materials	101
4.41	Q5: Greater willingness to obtain information on upcycling activ- ities for my own company, as well as lab works by designers and students.	101
4.42	Q6: Greater willingness to prototype or commercialize if applica- ble lab works or materials are found on the platform	102
4.43	Q7: Greater willingness to participate in a hands-on workshop with designers, students or other companies	102
5.1	Local leftover material drop-off and pick-up service [9]	112
5.2	Center point to collect the local waste material	113
5.3	The local community-based lab [10]	114
6.1	Possibility to collaborate with external designers	119
6.2	Future collaboration possibilities	121
A.1	Cycle Project exhibition(2021.12)	128
A.2	Cycle Project exhibition(2021.12)-2	128

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Chapter 1

Introduction

1.1. Background

The concept of sustainability has been a focus point and consensus over nations, with its widespread influences among policy makers, business owners and individuals, a set of Sustainable Development Goals(SDGs) was proposed by UN Member States in 2014 [11]. The ideology of SDGs has quickly gained ground because of the growing urgency of sustainable development for the entire world, SDGs have become more relevant in daily lives under forms of advertisements and other means, and have increased people's awareness of recycling-oriented society.

In consideration of forming a recycling-oriented society, issues related to environmental pollution cannot be neglected, and these issues are also addressed as priorities within SDGs. Over the last few years, the concept of “upcycling” has been gaining popularity as well as “reduce, reuse, recycle” to review consumers' throwaway behavior from consumerism. Upcycling is a relatively new concept that refers to efforts on adding new value to discarded materials and transforming them into new products. The realization of a recycling-oriented society requires a change in general awareness and behavior on both consumers and producers [12].

In order to popularize the idea of upcycling and make it more accessible, various organizations, manufacturers and designers have come up with diverse methodologies and technologies, presaging the rise and worldwide adoption of up-cycling [12]. However, there are inadequate studies in supporting inter-regional collaboration, including materials, people, and companies in upcycling [12].

Therefore, this paper focuses on three perspectives: upcycling, industrial waste, and the SDGs in Japan. Additionally, it describes the current status and challenges.

1.1.1 Upcycle in Japan

The environmental impact of mass production and mass consumption activities has begun to be recognized as a problem, and efforts are being made from individuals, corporations and political parties to mitigate waste and material pollution in order to realize a recycling-oriented society [13]. In addition, individual awareness is becoming more significant, with ethical thinking being advocated as a concept for our consumption behavior that takes into account social issues [14].

In this context, the concept of upcycling emerged as a new concept of new products from disposals [15]. The basic idea of upcycling is to give new value to waste materials and transform them into new products. Similar terms such as recycling and downcycling tend to be obfuscated, yet each has a completely different meaning. Upcycling refers to using the waste itself as it is, thus reducing the energy and cost burden during the stage of reprocessing in comparison to recycling [12].

In recent years, the market for upcycling and other sustainable products has expanded rapidly at the global level [16].

For companies, upcycling activities and the development of upcycled products are not only a response to Environmental, Social, and Corporate governance (ESG) and environmental issues, but also an effective approach to developing new markets and attracting new customers. In Japan, however, awareness of upcycling at the individual level remains low. According to a survey, only approximately 45% of respondents had heard of upcycling, which indicates a lack of opportunity to learn, as well as limited efforts by companies and small market size [17].

1.1.2 Industrial wastes in Japan

Industrial waste refers to a variety of waste generated throughout the manufacturing process [18]. It is generated daily across different industries, including agriculture, forestry, fishing, and construction etc. Particularly, the manufacturing industry accounts for the largest part of industrial waste, generating approximately 30% annually [19].

Despite the increase in recyclable materials and improvements in manufacturing processes have reduced the number of disposals, costs incurred by recycling and

disposing are still unfavorable. For smaller companies, this can be a significant burden [20].

Interviews with waste disposal companies [21], suggested that in order for SMEs to survive amid intensifying market competition and the trend toward a recycling-oriented society, new value creation for those waste is necessary, and that collaboration among manufacturers from different industries is effective for this purpose.

There are a number of successful examples of collaboration among different industries in upcycling, such as the case of Toyota Boushoku which will be detailed [3]. However, existing efforts tend to take a material-specific approach, and there is hardly any support for companies to explore opportunities for upcycling their waste materials with a variety of waste options as a combination, or the possibility of inter-company collaboration to do so.

1.1.3 SDGs for SMEs in Japan

Among the 17 goals of the SDGs, “Concretely address environmental issues” and “Responsibility to create and use” are most relevant regarding waste issues. It is also clear that companies can promote the realization of the SDGs by taking actions to reduce waste and food loss, such as upcycling and promoting a circular economy [22]. In Japan, however, there is a dramatic difference in awareness of the SDGs between large companies and SMEs. In terms of awareness, approximately 70% Large companies are actively participating in delivering SDGs, while less than 50% of SMEs are aware [23].

In fact, according to a survey report on SMEs’ SDGs initiatives, 91.8% of SMEs have not yet started working on SDGs [24]. However, 70% of these SMEs are actually aware of the importance and necessity of SDGs [24]. In other words, the SDGs do matter for the majority of companies, even for companies that are not engaged yet.

SMEs that are not working on the SDGs do not prioritize the SDGs in daily operations, this is due to lack of knowledge or human resources, they are not able to bridge the gap between operations and business activities to solve SDG-related issues [24]. The fact that operations and businesses of a company are not linked to solving SDG-related issues makes it difficult to engage in activities such as upcycling.

In Japan, 99.7% of enterprises are SMEs, they account for a very high percentage of the total number of enterprises in Japan [25].

Given this situation, it is no exaggeration to say that SME can bring more possibilities in innovation. For these SMEs to make contributions to SDG activities, generating a high level of SMEs interest in waste and participating in upcycling activities are important steps toward achieving innovation. Upcycling activities could be better promoted if companies had the option to launch a collaboration involving not only their own waste, but also waste materials from other companies. Companies will gain value from the trial and error of the upcycling process and from activities conducted between several companies, moreover, collaboration with external parties such as designer and University evokes new knowledge, ideas, and connections, these collective activities will cultivate a competitive environment and advantages for companies [26].

1.2. Research field and utilization of local uniqueness

As mentioned above, upcycling of excess industrial waste encourages the public to build a recycling-oriented society and consequently contribute to the SDGs. As a first step for this objective, community formation, opportunities for collaboration and consideration of material combinations are necessary to support local upcycling activities.

In this study, Nagoya of Aichi Prefecture is selected as a research center for further investigating those issues. Aichi Prefecture is one of the leading industrial prefectures in Japan [27], with 99.7% of the companies from the manufacturing industry and 82.4% of which are SMEs [27]. Since the dominating manufacturing background of the prefecture, numerous types and quantities of industrial waste are generated day-to-day, making it the best research site for this specific topic.

For this reason, this proposal focuses on the aspect of industrial waste issues confronted by SMEs based in Nagoya, the center of Aichi Prefecture, which has these uniqueness.

1.3. Research goals

This research aims to analyze the challenges faced by Nagoya SMEs in upcycling. It proposes a program to assess the possibility of connecting the local industrial SMEs to form a community, it then explores the different combinations of waste materials. Finally, it conducts qualitative workshops for further validation.

The research will consist of three main parts;

- 1 Case studies, challenges and supports for upcycling practice;

These studies are necessary as they provides perspective on current approaches to waste material recovery, as well as experimentation, ideation, and circulation prior to the proposal. In addition, it outlines existing available resources and channels.

- 2 Nagoya-based conceptual design for industrial waste upcycling;

The research aims to identify the affinity between upcycling and the local community, and to take the first step in the upcycling activity while offering local industrial waste materials as a supply in their own upcycling efforts.

The conceptualization process of the proposal was executed via the analysis based on the study of questionnaires and interviews of current situation while exploring challenges and needs.

- 3 Validation survey via the proposed workshops;

Workshops held provide three important aspects in validating the proposal. First, the sharing of issues or information about local industrial waste materials. Second, designers and students propose ideas and methods for combining and processing the materials. Finally, a proposal of a pioneering platform for long-term support of upcycling activities of local companies.

1.4. Contributions

By highlighting local waste materials, surfacing them as resources and offering them as material options for upcycling, this study suggests the possibility of lo-

cal business-to-business collaboration and new communities through upcycling activities.

This study acquired information by focusing on industrial waste materials and an opportunity to take the first step toward engaging in upcycling activities. Within the larger scope of upcycling in Japan, this study helps to identify a new approach to initiate local enterprises and individuals to explore utilization of industrial waste that has not been found to be utilized and for which there are no research opportunities. It also discusses the positive impact of collaboration among various stakeholders and the hypothetical possibilities that can be expected.

1.5. Thesis outline

- Chapter 1 introduces the background, research field, goals, and scope of this study.
- Chapter 2 reviews related research, including guidelines for achieving a recycling-oriented society, current precedents in the effective use of waste materials, opportunities and challenges in upcycling, platforms for circulating waste materials, and tools to support upcycling.
- Chapter 3 describes a survey regarding actual conditions confronted by Nagoya's SMEs, with a highlight on the conceptual design of the proposal based on the survey.
- Chapter 4 investigates and evaluates the effectiveness of the concept through workshops and talk sessions with small and medium-sized businesses in Nagoya.
- Chapter 5 summarizes the feedback obtained through this study and discusses the conclusions and limitations of this study based on the findings.
- Chapter 6 concludes challenges, future possibilities and developments based on the results of this study.

Chapter 2

Related Works

This section discusses the effective utilization of waste and related studies based on upcycling. After discussion, it summarizes existing upcycling cases in Japan, while evaluating relevant shortcomings and providing perspective on this research.

2.1. Transition to product circulation

The Great Recovery report by Royal Society of Arts [1] introduced four design models to help achieve a recycling-oriented society, they refer to four circular models designed to transform the hitherto linear product cycle into a circular one.

The four design models are to inspire designers, companies, and others involved in product creation, and to raise awareness of the cyclical product cycle and apply the logic at the design stage. The models are as follows: “Designing for Longevity”, “Designing for leasing/service”, “Designing for re-use in manufacture”, and “Design for material recovery”.

Traditionally, the role of design has been to pursue objectives such as high functionality and beautiful presentations. However, it is seeming that the cyclicity of a product’s material flow has become a critical factor to consider. Instead of short-term product flow as in the past, a long-circulating flow must be developed in order to achieve the “Design for material recovery” process, which means that discarded materials are efficiently recovered and then recycled by reusing or up-cycling them. This presents a significant key part of the circular cycle(Figure 2.1).

The cycle of design for material recovery is what this study focuses on. It pays attention to recycling industrial waste materials that have not yet surfaced as a



Figure 2.1 The circular product flow, extracted from the report by The Great Recovery [1]

resource. This study also proposes that such a system or cycle would be especially effective in places like Aichi Prefecture, where there is uncountable industrial waste materials.

2.2. Current initiatives

Some case studies related to effective use of waste taking place in different sectors are listed below.

2.2.1 Corporative initiatives

Upcycling in Japanese clothing company

UpcycleBoard® is an original upcycled product presented by TRANS Co. [2]. The company focuses on recreating products using industrial waste such as scraps and fibers generated in the garment manufacturing process, and has developed a technology to press them into beautiful yet sustainable textile boards.

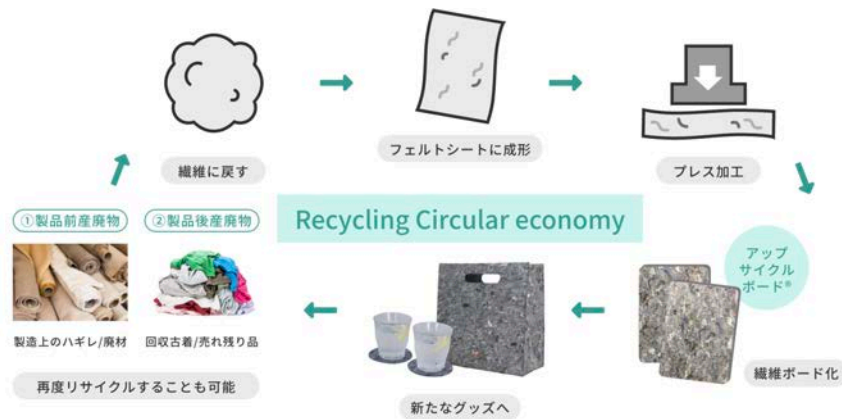


Figure 2.2 UpcycleBoard® [2] circulation process

Since this technology involves mixing a variety of fibers, it can be applied to upcycle not only fibers from the manufacturing process, but also garments collected from customers. Another significant contribution to the circular cycle is that these upcycled products can be reconverted to fibers again (Figure 2.2).

In addition, through outsourcing the upcycle process encompassing collecting, sorting, and dismantling of garments to local facilities, it creates careers and opportunities for people with disabilities, resulting in new employment and new connection within the community. This case study is an example of upcycling that focusing on a specific material.

ReMUJI: An upcycling strategy by MUJI

Since 2010, the globally recognized Japanese consumer goods brand MUJI has been collecting abandoned clothing from customers to upcycle or recycle as sustainable fabric resources [28]. MUJI encourages user participation in this activity by giving out reward points, which then can be used across their stores.

On top of that, MUJI has created a variety of upcycled products for the apparel market, such as “re-dyed clothes”, in which collected clothing is dyed with indigo, and “connected clothes”, in which different fabrics and materials are blended to recreate new garments. This case is another example of upcycling that focuses on the material or product of clothing.

Connecting local businesses and consumers through industrial waste materials

Haizai project is originated in Sumida-ku, Tokyo [29]. The project aims to build connections between numerous manufacturing companies and individuals. As a variety of waste industrial materials was made available, the Haizai project concentrated on conducting workshops for children to collect and make use of those materials.

In addition to providing children with opportunities to explore industrial waste materials, they also bridge the gap between local companies and consumers by offering children and the general public a chance to actually meet craftspeople working in local town factories. The Haizai Project focuses on the region's diverse industrial waste materials, yet this case is an example of an initiative that focuses on consumer education.

2.2.2 Case studies: Successful upcycling collaborations

Soap cases “Mu”: An upcycling activity by Shabondama Soap Co., Ltd.

According to an article by PR TIME Japan (2022), Shabondama Soap Co., Ltd. has collaborated with Kyushu Sangyo University and Technolab to co-develop a soap case “Mu”, which is made from upcycled plastic in the ocean [30].

As a soap manufacturer, the company is aware of the problem of marine pollution by detergents, and has been involved in environmental activities such as the development of additive-free soaps. It represents as a successful example of a company developing new upcycled products by expanding the scope of its activities on environmental issues and collaborating with external parties. This case is another example of success through collaboration in other fields. But this case is another example of upcycling that focuses on only marine plastic.

Collabrative upcycling: Toyota Boshoku & Japan SMEs

According to Akimoto [3], Toyota Boshoku noticed a potential upcycling practice in the disposal of seat materials used in automobiles, they then collaborated with Kotobuki Kougei, a Japanese furniture manufacturing factory, to develop upcycled cushion-like toy blocks(Figure 2.3). Furthermore, they have also collaborated with Garocha, a leather goods studio, to upcycle those seat materials into one-of-a-kind shoes(Figure 2.4). Their goal is not simply to reduce their own waste, these cross-industry collaborations between large companies, SMEs and local factories contribute to the development of new markets. Additionally, fast manufacturing and the ability to generate prototype ideas are also strengths that only a small town factory can offer. In this case, the large volume of waste materials and the fast manufacturing system unique to a small factory are well-coordinated, thus, small factories engaged in mass production can contribute profoundly to the success of upcycling.

The gradually shrinking market due to a declining population has been seen as one of the most pressing challenges as competition in the corporate marketplace intensifies, thus, “open innovation” in which cross-industry companies actively collaborate to create new products, is notably becoming more widespread these days.

The increasing number of such examples is a remedy for SMEs to survive. This case is an example of cross-disciplinary collaboration that leverages the unique strengths of a small local factory. However, it addressed a material-specific issue where it was limited to automotive seat materials.



Figure 2.3 Upcycled items [3]



Figure 2.4 Upcycled shoes [3]

Ideation opportunities between product designers and local companies

As an initiative to consider upcycling possibilities with regard to potential local waste, FabCafe Hida organized and hosted a talk session with outside designers [4]. In this session, product designers from outside the region had discussions over the potential of “waste” as a “material” while introducing examples of upcycling. Participants commented that it was a new discovery to combine scrap wood and different materials to create new value.

Conversely, the product designers who spoke at the event also had benefited from learning about potential scrap wood from local companies and processing techniques of artisans. This is a learning opportunity for both parties.

The first step in encouraging upcycling activities among local SMEs is to be inspired to alter their mindsets and gain additional knowledge. It also validated the effectiveness of cross-industry ideation.

This is a very effective example of how to promote upcycling of local small businesses, unfortunately it was only one talk session. There was no actual support



Figure 2.5 Workshops held at FabCafe Hida [4]



Figure 2.6 Industrial waste brought by participants [4]

to further develop the idea.

2.3. Opportunities and challenges

2.3.1 List of challenges confronted by upcycling businesses

Upcycling can make a significant contribution to the realization of a recycling oriented society if interventions at the business level are executed, as it leads to an extension of product life and a reduction in energy consumption over industries.

In this respect, Sung et al. [5] analyzed and discussed the challenges of engaging in upcycling business, with a highlight on solutions to these challenges.

A survey was conducted to examine small and medium-sized entrepreneurs who were attempting to enter the upcycling business in the United Kingdom, Sung et al. have pointed out that the difficulty in procuring a uniform type, quality, and quantity of waste materials is a major barrier to upcycling business, as it poses a major hurdle regarding mass production. In order to overcome the challenge, it is necessary to take action at the policy level so that waste can be procured in a somewhat stable manner.

The survey results also indicated the increasing demand for upcycling and up-cycled products through communication, such as consumer education and public relations activities, which are equally crucial for the long-term viability of the upcycling business.

The survey also identified specific support that municipalities and others can provide, such as creating a database of waste materials, designing events to promote their activities and products, providing workplaces where upcycling prototypes can be made, and supporting the formation of local upcycling communities(Figure 2.7).

2.4. Platform for waste materials

2.4.1 For individuals

Yuasa et al. from Keio University introduced a local plastic waste collection platform to reduce waste collection costs and promote the idea of material recycling [31].

This platform collects waste materials from local residents and other individuals,

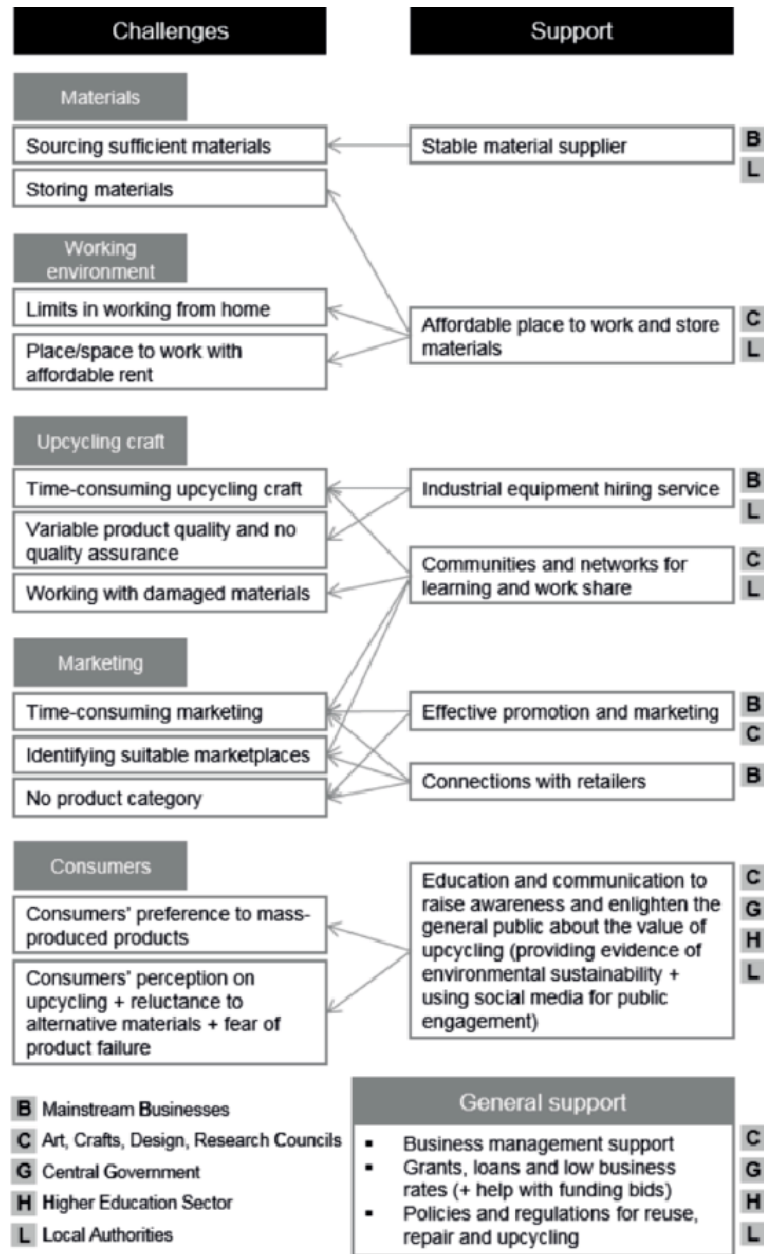


Figure 2.7 Figure summarizing challenges and support [5]

while simultaneously introducing a system that allows users to browse products and ideas that have been updated from the waste materials they provided. Such visualization leads to more willingness to participate in the platform and to raise awareness of environmental issues.

In order to achieve a recycling-oriented society, it is crucial not only to extend product life, but also to design a long-term yet permanent circular cycle, thus, the process of material recovery and recycling repeats sustainably. Based on this perspective, Yuasa et al. advocated the concept of “Leap Cycle” and they suggested sharing product material information as a database on their platform, assuming that products made from recovered waste materials will one day transform into next-generation products again.

2.4.2 For industries

Mobile apps in Singapore

Xin Shan et al. proposed “The Collective Nula” as an approach to waste issues and low awareness of upcycling in Singapore [6]. While there are various positive examples of research on upcycling of specific waste materials, there are not yet many examples of services for businesses.

It is an online platform for a mobile app that collects and sells waste materials, the platform is also designed with features to crowdsource designers upcycling ideas and waste-based products. These features serve to circulate waste and lower the entry barriers to upcycling at both individual and business level. With the rise of users on the platforms, more waste providers and buyers online are able to connect with each other, which helps to fulfill upcycling and raise awareness of the circular economy (Figure 2.8). The platform focuses on reducing waste by passing waste materials to those who need them, and does not actually support the design of effective use of waste materials.

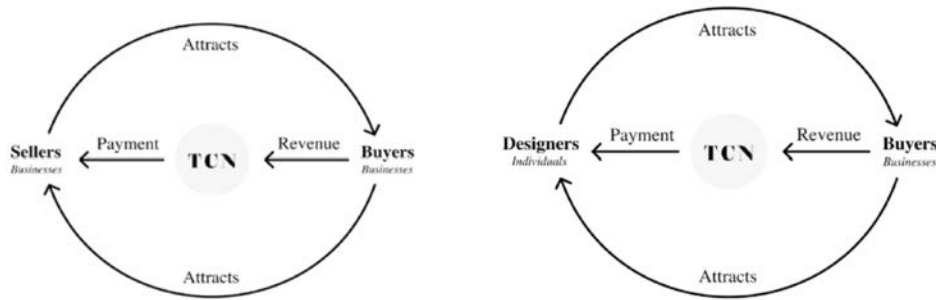


Figure 2.8 “The Collective Nula” correlation chart [6]

Data platform: waste materials in the Netherlands

In the Netherlands, Excess Materials Exchange ¹ has launched “Resources Passport”, a platform to connect companies that produce waste materials with the individuals who are in need of those materials [32].

Resources Passport applies AI and blockchain technology to connect companies with individuals. AI helps match people with the scrap materials provided. The more data it curates, the higher the accuracy.

Blockchain technology is also effective in achieving transparency in communication between users while providing security protection with respect to sensitive information, such as what waste materials and how much a company is storing (Figure 2.9).

With the use of this platform, waste providers benefit from new revenue streams, whilst service users become a new source of materials. Moreover, the platform also visualizes the sequence of how waste is designed into products, used by customers, and recycled. Simultaneously, they are attempting to standardize the format of the material data provided and share it across the supply chain to promote cross-industry exchange.

As an outcome of the platform, coffee grounds discarded by restaurants are recycled into ink, paper, and soap, and orange peels are used as fertilizer and livestock feed. This platform also focuses on businesses that circulate, buy and sell waste materials as materials. It is not intended to provide assistance in the

¹ Excess Materials Exchange https://excessmaterialsexchange.com/en_us/

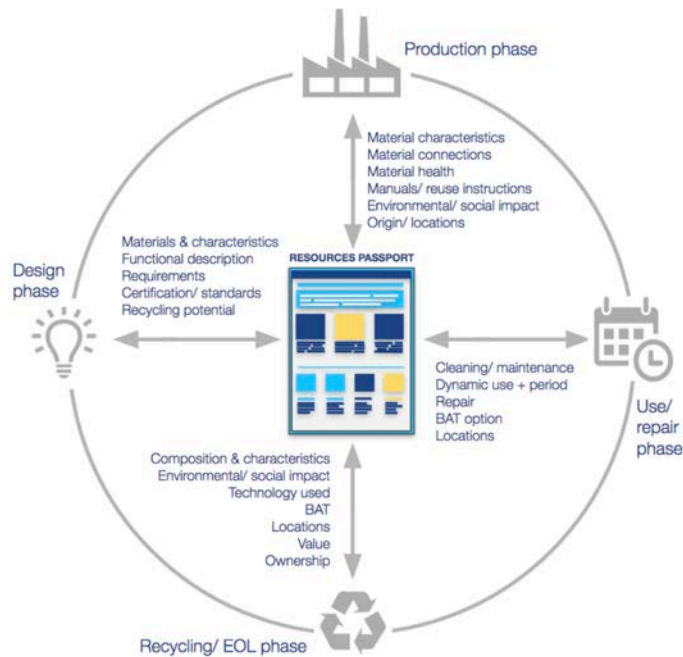


Figure 2.9 Resources Passport [7]

form of knowledge or ideas for the effective use of waste.

2.4.3 Supporting upcycle activity

Card kit and ideation

Giuditta Sartori was developing “Upkit” as a tool to assist designers and creators in their personal upcycling activities [33]. Upkit aims to inspire designers to generate new ideas with sustainability.

There are various practices and research results in upcycling, yet information and knowledge about them are neither well-known nor widespread. The lack of opportunities to learn about materials, processing methods and designs has hampered the proliferation of upcycling, restricting designers’ imaginations.

Therefore, a card game in the Upkit utilized such design thinking presages the emerging ideas in upcycling. This kit also contributes to the frequent interaction among designers and creators, furthermore, an online site for purchasing the kit was also established, where individuals can disseminate and share information.

The kit is effective as idea generation on the desk. However, it was not a hands-on support for upcycling putting in practice.

Craft-based upcycling process

Wang of Aalto University proposed a craft-based upcycling process [8](Figure 2.10), the purpose of which is to make handmade upcycling feasible and accessible to anyone, including designers and individuals, rather than the traditional craft industry approach under the traditional master-apprentice system.

This hands-on approach is beneficial since there is still a lack of research on upcycling methods and education, individuals who would like to put upcycling into practice do not always have access to the tools and equipment they need.

Wang's upcycling process aimed to take advantage of the material's characteristics to extend its function, broaden its usage, and create a higher value than the original. The positive outcome revealed in this craft approach is the discovery and knowledge gained throughout the process. However, the time and manpower costs incurred are more likely to suppress upcycling when compared to industrial mass produced goods. It grows difficult as there is no guarantee that the creator will make a return on their effort and investments. Therefore, a balance between cost and return is key to succeed in such approaches.

Wang's specific process consists of four steps. First, collect and analyze the waste materials that are available around you, research on processing methods and precedents using the Internet and other sources. Second, proceed to create an inspiration board that summarizes examples that caught attention during the research process. Third, brainstorm and generate ideas with free-thinking, without being overly critical. Finally, prototype and visualize ideas.

Wang has applied this method to create several upcycled products, for instance, during the prototyping process for a plastic bag, she discovered the advantages of vinyl material, which has more traction than cotton or acrylic yarn. The approach was labor-intensive and involves repeating trial and error. However, the inconspicuous discoveries and successes along the way are the thrill that come from a craft upcycling process, even though challenges such as lack of human resources and late adoption could happen.

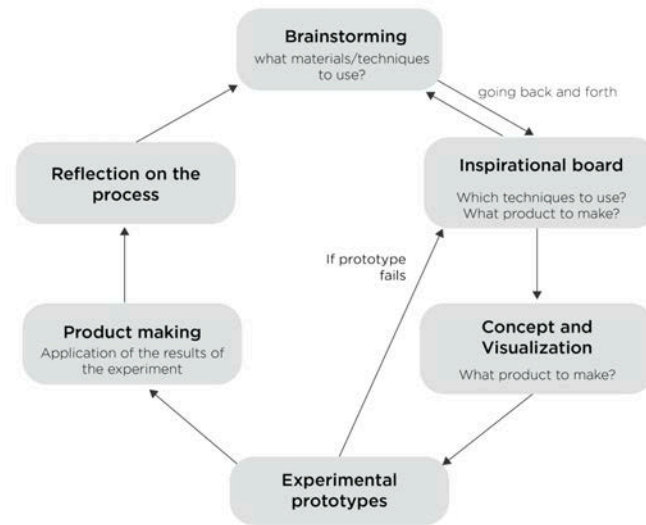


Figure 2.10 Craft-based upcycling process proposed by Wang Jing [8]

KDDI research atelier: upcycling unwanted items

KDDI research atelier has launched a project to support consumers' upcycling activities as part of its efforts to build a recycling-oriented society [34].

The project refers to a service that converts unused household items into 3D data, stores it on the cyber network, and visualizes it. It also visualizes the combination of data-based unwanted items and the image of their possible arrangement in space. Through this series of services, the company aims to enable ordinary users without manufacturing skills or expertise to engage in upcycling activities, and to circulate unwanted items scattered in households.

As an actual prototype, the project converted an user's disposable chairs into data. In addition, the project provides preview pictures with different combinations of these items, it is also developing a joint module that is independent of materials, which focuses on how consumers can upcycle unused items in their homes.

2.5. Summary

Upcycling is being addressed at various levels by companies and individuals. However, limited efforts and excessive interest in particular materials still entail a low participation in upcycling. In order to promote local upcycling, solutions encompass providing venues, equipment, and opportunities to exchange ideas are necessary.

Given the collaborations and case studies mentioned above, the creation and promotion of new ideas for upcycling through cross-industry collaboration have been proven. While there are existing examples of such effective activities, most upcycling activities are restrained owing to resource restrictions or insufficient dedication, thus, upcycling is still often treated as a one-off event. Nevertheless, upcycling can only be promoted if there is sufficient top-down support, while cross-industry communications and collaborations remain an ideal starting point for local companies to engage in upcycling.

Chapter 3

Concept Design

This chapter focuses on industrial waste materials from local businesses in Nagoya and describes proposals to support their upcycling.

3.1. Survey on current context and needs

To identify the challenges and needs of local SMEs and reflect them in the conceptual design, a survey and interviews with fourteen individuals from ten manufacturing companies based in Nagoya were carried out to examine their views on industrial waste materials and upcycling. A six-point rating scale was applied for measurements, ranging from Strongly Disagree to Strongly Agree. The approach consisted of six survey questions and interviews with manufacturing companies respectively.

First question introduces manufacturing workers' views on industrial waste materials posing challenges, followed by the difficulty of raising upcycling-related activities. The third to sixth question will discuss some specific issues and future motivations regarding upcycling activities. Interviews will be detailed after summarizing survey results.

The first question examined the perspective on industrial waste materials being seen as potential challenges, results show that eleven respondents Strongly Agree and Agree; three being neutral and none of respondents Disagree.(Figure 3.1)

Some interviewees argued that they sell their own industrial waste materials to suppliers as recycled materials. However, this generates little revenue, while companies accept to utilize their materials for new manufacturing and other initiatives, some companies could not recycle their own waste materials since they are composite materials, thus having no choice but to discard them as industrial

waste. In order to address their waste challenges, it is necessary to explore new ways to utilize these wastes as materials and explore new possibilities for them as resources.

The second question probed perceptions of issues related to internal upcycling activities, this was answered by companies that are engaged in upcycling and those that are planning to engage in upcycling.

According to the results of the survey, ten respondents Strongly Agree and Agree, four respondents selected neutral, and zero respondents Disagree(Figure 3.2). The results indicate that the majority of companies are experiencing challenges in addressing upcycling.

The third question was assigned to companies who have experienced challenges with internal upcycling to complete a selective assessment of specific challenges they were facing. Companies were required to select the applicable items in the evaluation. Multiple selections were allowed.

The assessment (Figure 3.3) demonstrated that:

- 8 respondents indicated that they lack opportunities to combine other materials with their industrial waste materials or to try new processing methods;
- 7 respondents answered that they are not able to share information about their industrial waste materials with external organizations;
- 7 respondents answered that they do not have the ability to generate ideas for new product development or to obtain relevant ideas and knowledge;
- 5 respondents answered that they lack opportunities to obtain ideas and knowledge from outside the company;
- 5 respondents selected Insufficient cost for R&D within the company;
- 3 respondents chose “Others” and went on elaborating, the free answers conclude as follows: “The overall concept of upcycling and cost-effectiveness is uncertain”, “I think there are issues related to entry barriers”, “Priority of actions tends to be driven by immediate matters rather than the importance from a medium-to-long term perspective”, and “I need equipment and a place for prototyping”.

These responses indicate that their upcycling activities require opportunities to gain outside knowledge and to design a forum to discuss processing methods and ideas.

The fourth question investigated the likelihood of obtaining waste information from other companies and industries:

Twelve respondents stated that they had little-to-no opportunity to obtain and two respondents answered they had ample opportunity to know(Figure 3.4).

This also reflected on their own waste materials information was not made available outside the company, nor were there opportunities to obtain information about them.

The fifth question probed whether respondents would like to learn about other companies and industrial waste materials in other industries.

According to the results, seven respondents gave positive feedback, six respondents stayed neutral and one respondent expressed opposition(Figure 3.5). This confirmed their high level of interest in other companies' waste materials.

The sixth question asked if companies would like to upcycle by combining internal and external industrial waste materials.

The results showed that eleven respondents were willing to engage, two stayed neutral and one was reluctant(Figure 3.6). This shows an interest in the possibilities of combining waste materials from other companies with their own waste materials and a high level of willingness to engage in such new upcycling.

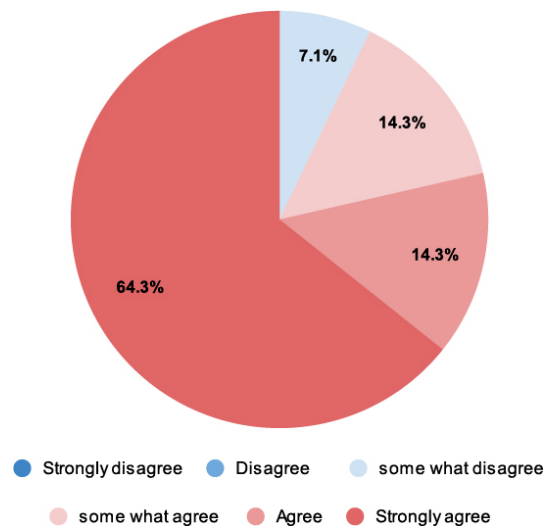


Figure 3.1 Views on industrial waste materials posing challenges

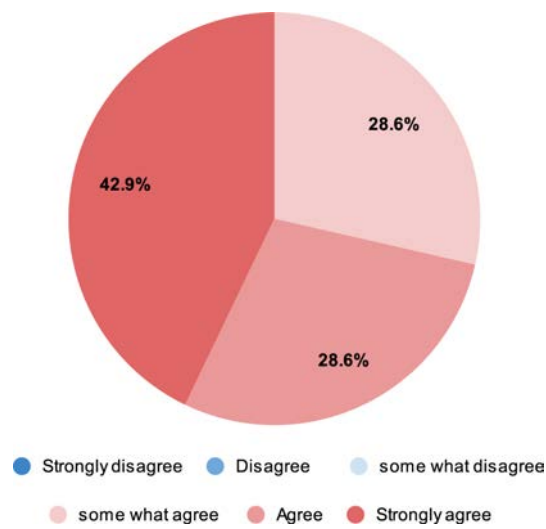


Figure 3.2 The difficulty of promoting internal upcycling practice

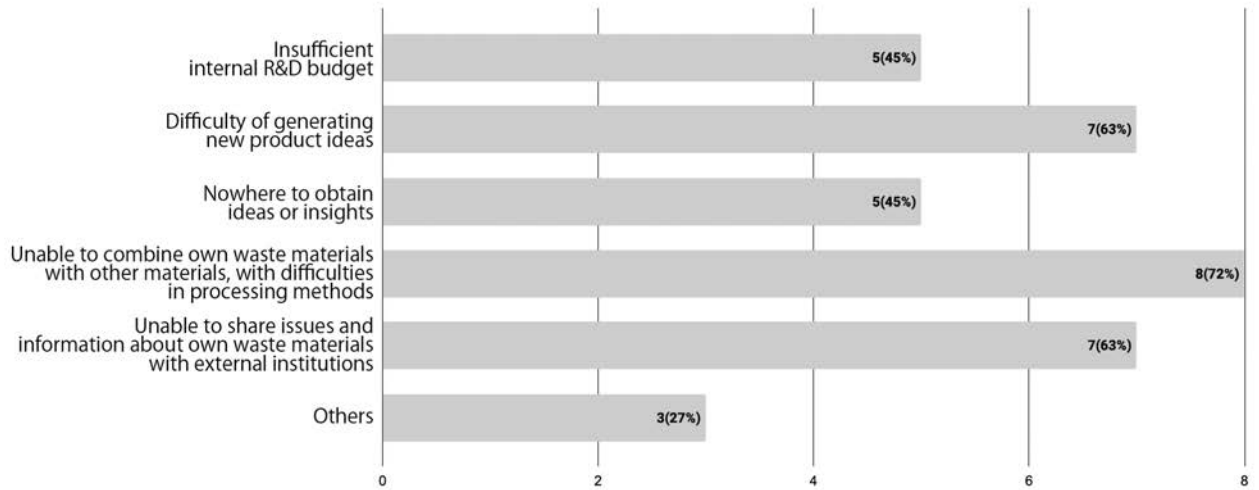


Figure 3.3 Specific issues regarding internal upcycling activities

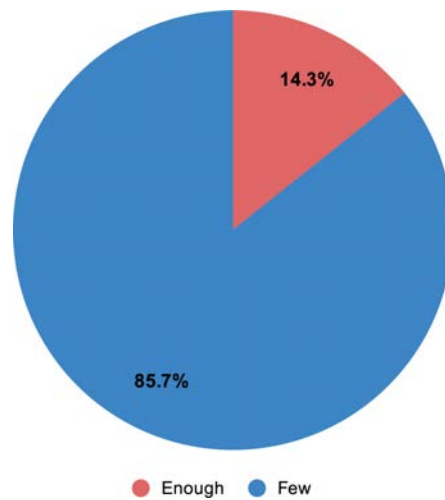


Figure 3.4 Resources for learning about companies and industrial waste from other industries

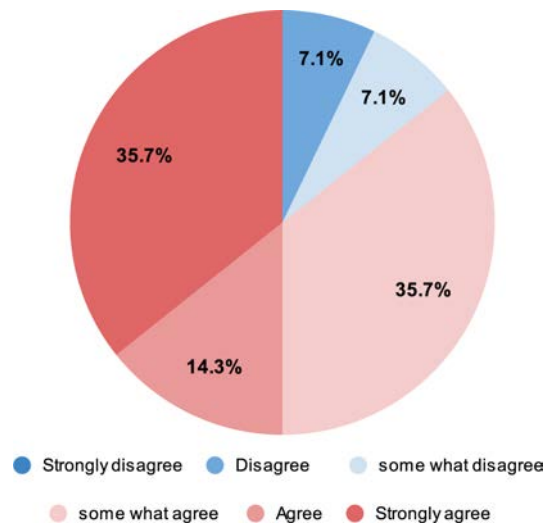


Figure 3.5 Willingness to learn more about companies and industrial waste from other industries

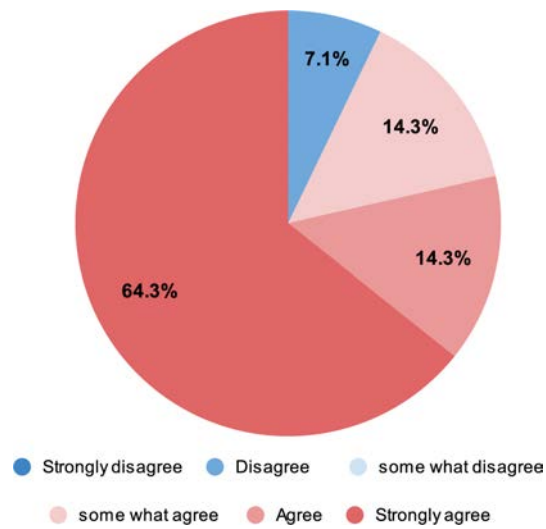


Figure 3.6 Openness to collaborate with other companies on upcycling

Summary of the survey

The survey results clearly demonstrated that local manufacturers tend to be highly aware of the challenges they face with industrial waste materials(Figure 3.1).

The most common response is an inability to engage in upcycling activities, or being challenged by high entry barriers, followed by the lack of occasions to combine industrial waste with other materials or to apply new methods(Figure 3.2).

In personal interviews, one respondent commented on the difficulty of coming up with new products and designs using only their own waste materials. This phenomenon was also reflected in question 6, where a high percentage of respondents would like to upcycle by combining internal and external industrial waste materials(Figure 3.6). This indicates that they can foresee the possibility of cross-company upcycling, demonstrating a great interest in collaborative upcycling.

Additional opportunity can be identified based on the responses in questions 4, the high percentage of respondents suggested there are little-to-no opportunities to learn about industrial waste materials from other companies and industries(Figure 3.4), this associates with question 5(Figure 3.5), where manufacturers want more opportunities to learn comprehensively.

Aside from learning about industrial waste materials, manufacturers have expressed a need for opportunities to obtain knowledge and ideas from external parties, which allows them to share with external parties the challenges that the company faces(Figure 3.3).

What was particularly surprising in the interviews was that companies do not want to engage in upcycling just for immediate profit or waste reduction, in fact, they would like to explore new ways of producing and to gain new insights and enjoyment through collaboration with other companies, together with associations from other industries, designers, universities, and etc.

However, companies that took part in interviews have also addressed that upcycling industrial waste materials by collaborating with only other companies will inevitably lead to conflict of interest, particularly profit perspectives. This entails a need for institutions such as universities to intervene and take action to explore manufacturing challenges and help bridge connections.

The interviews also revealed that although manufacturers specialize in materials

and processing methods related to their own business, they have no knowledge on other fields. Manufacturers also addressed that since the company is running as a small elite group, it benefits from the flexibility and quick decision-making process, which helps them to contend with issues effectively.

To unlock the full potential of upcycling, my proposal below starts from bringing local industrial waste to the forefront and connecting it to activities which involve various expertise in manufacturing, as a consequence, it contributes to the realization of upcycling through collaboration among local firms.

3.2. Design concept

According to Markovic [35], it is suggested that local companies are generally seeking occasions to share knowledge and ideas, such exchanges of ideas and competition between different disciplines is effective for corporate innovation.

To elaborate Markovic's contention, this paper continues to propose a community-based upcycling lab to examine how local businesses can execute their own upcycling activities through access to other companies' scrap materials and designers' ideas and insights. This concept aims to create a win-win-win relationship for waste material providers, local SMEs and individual designers.

Industrial waste materials that have not yet been utilized in the region will be collected, the laboratory work will be conducted with designers and universities to study processing with basic experiments. Furthermore, the proposal is to promote upcycling activities in the entire region by sharing the lab work results across companies with common interests and challenges, it helps companies to venture and originate new upcycling ideas through combining local waste materials.

For the waste material providers, it offers waste reduction and a potential new inter-regional cooperation; for local SMEs, it offers opportunities for new product development, access to outside knowledge, and collaboration; and for individual designers, it offers opportunities for cross-disciplinary research activities, a place to share ideas, and new collaboration possibilities(Figure 3.7).

The program in general will encourage the emergence of new collaborations. Consequently, this win-win-win scenario will contribute to the exploration of new possibilities for upcycling and lead to new product development opportunities.

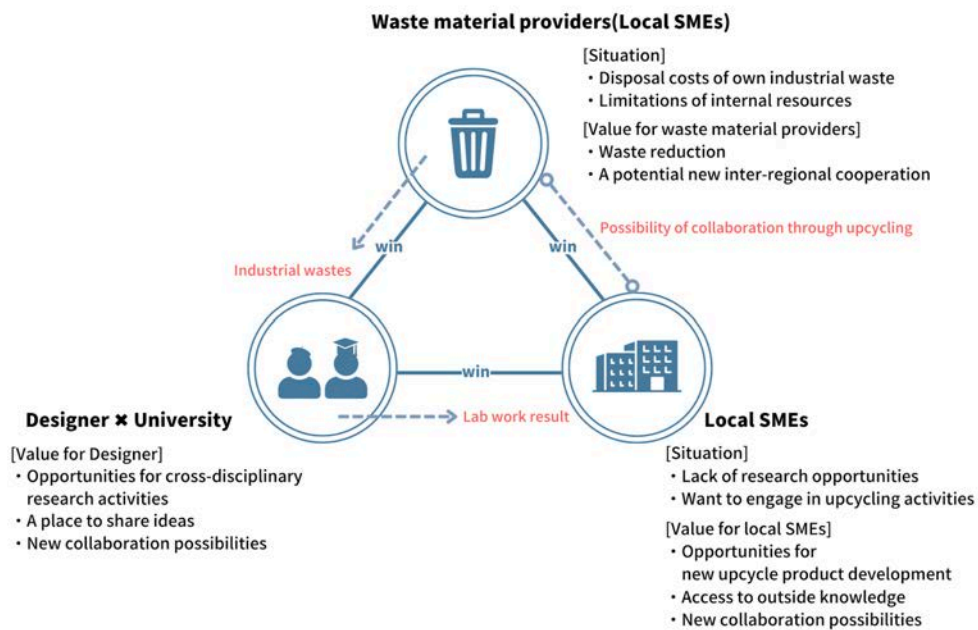


Figure 3.7 “Win-win-win” design concept

3.2.1 Cycle Project

In order to validate these design concepts, “Cycle Project” was launched as a starting point in this research. It refers to a collaborative project between the Future Crafts Project of the Graduate School of Media Design at Keio University, its partner RYOTA YOKOZEKI STUDIO, and external partner FabCafe Nagoya.

The main activities of the project are as follows:

- 1 Fieldwork in local industries and collection of industrial waste;
- 2 Experimentation with designers through processing the collected waste;
- 3 Conducting workshops for local SMEs to share the results of experiments and discuss the potential of upcycled products;
- 4 Building an online platform to archive and share the information about waste and activities 1 to 3.

Project vision, members and a specific outline of activities will be detailed in the following sections.

Vision

The Cycle Project aims to provide a forum for community member who wish to explore industrial waste materials via experimental and research approaches. Our vision is to create opportunities for people to encounter new materials, explore material combinations and processing methodologies, gain inspiration, enjoyment, and stimulation for hands-on making things.

Partners

We involved designers in this project to examine the positive effects of working with outside parties when engaging in upcycling activities.

In this study, the cooperation between designers was essential for testing out the effectiveness of their participation in upcycling as idea contributors. Therefore, I decided to work with a design company, RYOTA YOKOZEKI STUDIO¹, to validate this concept. The director of the studio, Mr. Yokozeki agreed to the series of concepts and cooperated with us on time, location, and human resources for the lab work.

In this study, we interviewed Yokozeki over issues he encountered as a designer regarding industrial waste materials, as well as his motivation of participating in the lab work.

Yokozeki stated that he is a mass-production product designer and the work process produces substantial industrial waste and other garbage, in this case, he is deeply concerned about the issue of industrial waste materials. During the transition period to a recycling-oriented society, the industrial waste issue should never be neglected, product designers should not perform unless they know about waste. *“In this day and age, I don’t think we have the right answer about the circular economy yet.”* Yokozeki says. His motivation for this activity is that he wants to practice it himself and create some output through trials and errors.

He added: *“My activities may be spread around, as a result, I may be able to influence the mass production market. I want to start out by doing lab work and creating output as a form of self-expression.”*

1 RYOTA YOKOZEKI STUDIO <https://www.ryotayokozeki.net/>

External partners

An essential part of making this project community-based is our connection with local businesses. As we have to give credibility to individuals involved in this cooperation, we have formed a partnership with FabCafe Nagoya² for concept validation.

FabCafe Nagoya is highly aware of the need to create a recycling-oriented society. For this reason, they have been involving themselves in specific activities, such as organizing events together with companies that are willing to take part in recycling. It follows that the companies immediately consented to participate and allied, a Nagoya-based community was then formed and they endorse the concept of upcycling industrial waste materials.

Moreover, the community started to plan and organize workshops for local companies in parallel with the operation of the cafe. Hence, connections with local companies were gradually expanding. They also have a significant influence and diffusion effect through their platform.

3.3. Cycle Project flow

The first layer of building a lab community starts with Cycle Project members working with external partners such as FabCafe Nagoya, which already has numerous connections with local manufacturers with substantial industrial waste. From here, local manufacturers who own industrial waste will offer their waste for lab testing through the online platform and publish the relevant results of various tests. This accounts for the first stage of the connection and underpins a solid foundation for a stable supply of industrial waste within the cycle.

The Cycle Project has established a Re-Fabrication-Lab to test different combinations and fabrication methods of recovered materials and to define new values. The lab's tests will be archived in a platform-like format and can be shared across social media. Workshops are held regularly to present the results of the lab's tests, to explain and to discuss them. Local makers and designers will be invited to brainstorm new fabrication ideas and product development opportunities.

² FabCafe Nagoya <https://fabcafe.com/jp/nagoya/>

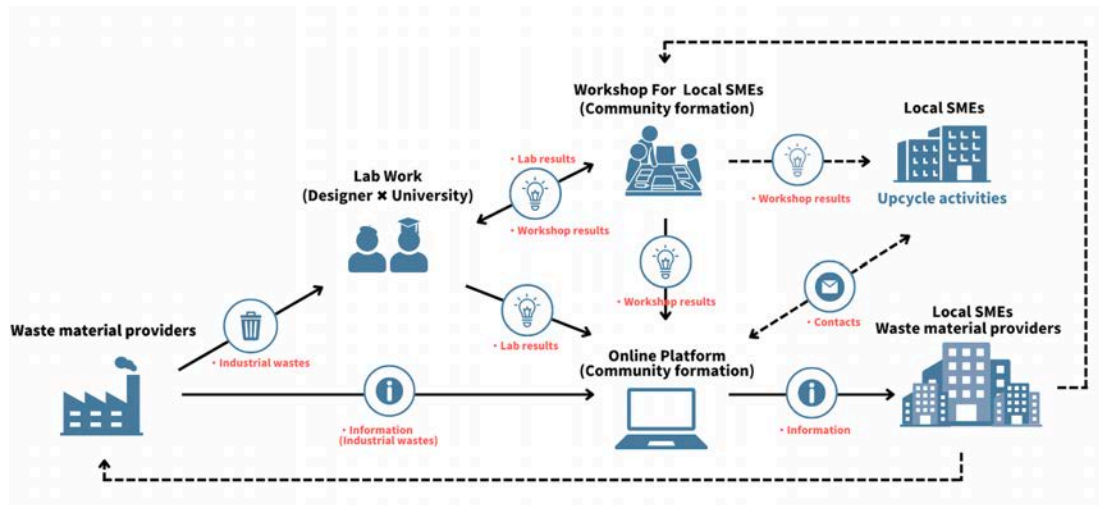


Figure 3.8 Cycle Project flow

The second layer of the lab community is formed during the workshop, where local makers and designers jointly discuss opportunities for product development. The key point is when makers and designers gather in the lab community, it increases the likelihood of identifying new possibilities and issues during the workshop. New fabrication ideas can be brought back to the lab for new testing, and product application can be further explored, as well as industrial waste producers which can be converted into products that can be mass-produced. Even if it does not lead directly to product development, it is crucial for individuals to learn about and grow interest in industrial waste materials.

As a result of creating the upcycling flow, manufacturers, companies, independent designers and other parties are able to encourage upcycling collectively. (Figure 3.8)

3.4. Project activity

3.4.1 Manufacturing industry in Nagoya

A number of fieldworks were conducted around manufacturers and factories in Nagoya City of Aichi Prefecture. This series of fieldwork was conducted to research on local industrial waste issues and, in support of the Cycle Project concept, to

provide waste material samples for concept validation.

Tsuda Glass Co.

The first interview was conducted with Tsuda Glass Co.³, a glass manufacturer and supplier for the construction industry based in Nagoya. Through the interview, I found out the pre-existing yet severe waste problem in glass manufacturing. The company has been disposing of glass waste in the construction industry since its foundation in 1960's, they have been disposing uneconomically for years.

Tsuda Glass discards about 30 tons of glass per year, the annual disposal cost is over 1 million yen. These discarded glasses cannot be melted down to make new glass products owing to unqualified purity, which refers to being mixed with insulating materials or having special treatment on the surface. Therefore, most of the waste is either crushed and buried in landfills or incinerated. Despite the fact that they are involved in the upcycling business, such as making glass accessories, they feel that there is a greater potential regarding glass upcycling. However, they have encountered challenges such as the lack of opportunities to collaborate with other companies, mainly due to scarce workforce resources and limited ideas from other fields. Furthermore, acquiring knowledge from outside the construction industry was also a challenge.

Kumagai Co. Ltd.

In the area of traditional crafts, Kumagai Co. Ltd.⁴ is engaged in the development of "Arimatsu-shibori" products, a traditional craft which often results in large amounts of disposed thread through the process of shibori shaping. These threads are used to tie the cloth up during the dyeing process. After dyeing, the threads themselves are tangled and shriveled, they cannot be reused and therefore discarded. The enormous volume of these discards poses a problem within the industry. While several companies are seeking new ways to utilize them at a cost of a few million yen, most companies fail to devote sufficient time to engage in such activities.

3 Tsuda Glass Co. <http://tsuda-glass.jp/>

4 Kumagai Co. Ltd. <http://k-lamp.com/>

Nagoya Jushi Kogyo Co. Ltd.

Nagoya Jushi Kogyo Co. Ltd.⁵ specializes in processing acrylic resin using a technique called sheet molding. They thermally process and form various types of acrylic sheets, yet the process itself produces substantial scrap material. The company sells the reusable acrylic scrap to recycling companies. However, the composite material which is not recyclable is incinerated as industrial waste. Director of Nagoya Jushi Kogyo stated that the volume of such waste is exceptionally redundant to an extent that they are not able to calculate the exact quantity.

Nevertheless, they were very enthusiastic about upcycling activities. The director was passionate about promoting a change in the industry, rather than being driven by profit.

ARBIZ Corporation

ARBIZ Corporation⁶, a factory engaged in recycling business, conducted a site visit to a recycling plant of automobile-related waste materials and home appliances, which is a unique plant located in Nagoya (Figure 3.9). Regarding automobile-related waste, there were considerable amounts of materials with potential for upcycling, such as unused airbags and seat belts that were disposed of as is.

However, plastic-based waste materials which incur high energy costs for recycling, together with other materials such as fine metals, are often not recyclable and ultimately end up in landfills, it poses a challenge to reusing those materials.

Summary of fieldwork

The fieldwork was divided into two situations: companies that were highly motivated to do upcycle activity themselves and wanted to participate, and companies that thought their waste materials had possibilities for upcycling, yet did not devote time to participate themselves.

5 Nagoya Jushi Kogyo Co. Ltd. <http://www.nagoyajushi.co.jp/>

6 ARBIZ Corporation <http://www.arbiz.co.jp/about/>

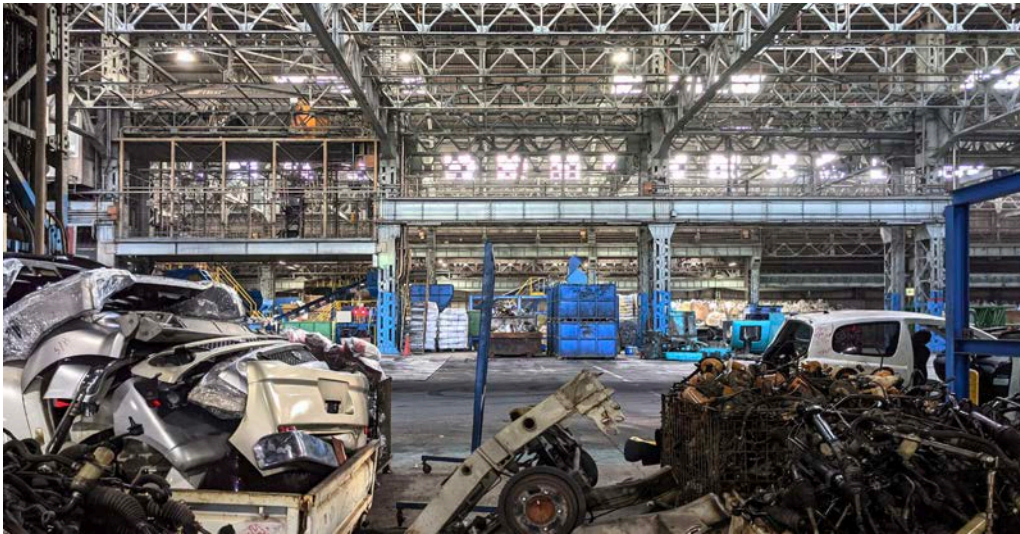


Figure 3.9 Field work at ARBIZ Corporation

Others mentioned that they would like to offer their waste materials. However, owing to the fact that those materials are often large, it is unfavourable to transport and difficult to guarantee a specific amount, as waste materials are not produced in fixed quantities.

For verification purposes, among the wide variety of industrial waste materials available, we decided to deploy waste materials with low transportation costs, stable consistency and risk-free application in processing or experimenting.

3.4.2 Collection of industrial waste materials

Ten (shown below as A to J)(Figure 3.10) industrial wastes were collected from six companies, including the companies involved in the conducted fieldwork. For the purpose of verifying the project concept in this study, some industrial waste materials provided by clients of Ryota Yokozeki Studio were also put into practice.

These wastes pose a variety of challenges, for instance, the inability to find effective ways to utilize them, their high cost to manufacturers, disposal in landfills and the energy cost. In addition, companies have expressed interest in upcycling, but lack the time to conduct their own upcycling activities or to devote to research and development, thus, they are unable to find new value in the waste.

- A Plastic (derived from home appliances), approx. 5kg;
- B Plastic (derived from plastic containers), approx. 5kg;
- C Plastic (from food plates), approx. 5kg;
- D Plastic (vacuum-formed plates after use), approx 3kg;
- E Ferrous metal (from pipe chairs), approx 5kg;
- F Ferrous metal (from cars), approx 10kg;
- G Fiber (from dyed products), approx 1kg;
- H Washi-1 (from Japanese paper), approx 3kg;
- I Washi-2 (from Japanese paper), approx 1kg;
- J Wood chips, approx 1kg











	Material	kg	Provider	Source of material	Current Situation	
A		Plastic	5kg	Industrial Waste Recycling Plant	They were used in plastic industry and have oil stains and metal powder on them.	Melt down again and recycle
B		Plastic	5kg	Industrial Waste Recycling Plant	Plastic derived from home appliances. They were crushed at the plant.	Melt down again and recycle
C		Plastic	5kg	Industrial Waste Recycling Plant	Crushed plastic used for food trays. Since they were used in food factory, they were clean.	Melt down again and recycle.
D		Resin	3kg	Creative Studio	This resin was used for vacuum forming as a prototyping experience in a creative studio for children.	Sell them to recyclers.
E		Iron	10kg	Manufacturing Plant	Metal pipe scraps from the pipe chair manufacturing process.	Outsource to industrial waste contractors.
F		Metals	10kg	Industrial Waste Recycling Plant	Fine metals from dismantled vehicles including copper and iron, which are often landfilled.	Landfill disposal.
G		Fiber	1kg	Dyeing Studio	Thread used to tie clothes up in traditional dyeing process, tangled and not reusable.	Outsource to industrial waste contractors.
H		Japanese Paper	3kg	Washi Studio	Scraps from Wachi manufacturing process, they were collected and hardened. Mixed washi varies in colors and materials.	Outsource to industrial waste contractors.
I		Japanese Paper	1kg	Washi Studio	The edge parts cut off in the Japanese paper manufacturing process.	Outsource to industrial waste contractors.
J		wood chips	1kg	Furniture Studio	Wood dust from cutting wood in a woodworking studio.	Outsource to industrial waste contractors.

Figure 3.10 Types of waste materials received

3.4.3 Re-Fabrication-Lab

Lab concept

The Cycle Project has established the Re-Fabrication-Lab. One of the challenges confronted by companies is that they cannot afford research and developments. Upcycling ultimately means adding more value. In order to achieve this, steady experimentation and ideation on materials is necessary. However, for a SME who cannot devote time and human cost to do so, it is believed that encouraging and supporting upcycling activities by conducting various experiments with industrial waste materials collected from the community is essential, accompanying with applying not only the waste materials but also the results of these experiments.

The goal is to help local companies incorporate waste materials in the region with their own upcycling efforts, thereby contributing to the realization of upcycling that transcends industry boundaries. The lab will experiment in this respect with the recovery of industrial waste, which is often seen as a challenge, and explore the possibilities of upcycling.

This activity will be of value to the designers participating in the lab work. It is an opportunity to study local industrial waste, express concepts and ideas and make connections with new local companies. Due to the fact that the lab itself runs as a community, industrial waste providers, local manufacturers, designers and universities are able to participate in upcycling, each with its own advantages and strengths.

The new discoveries and possibilities from the lab's activities will be shared through an online platform and workshops to manufacturers who are reluctantly challenged by a lack of ideas and knowledge. Through these opportunities, the lab aims to encourage manufacturers to gain knowledge about local industrial waste materials and put upcycling into practice, this can be done with combining their own waste materials. As a result, it creates new upcycled products for local businesses and consumers. This series of processes cultivate connections through inter-regional collaboration.

Another objective of setting up the lab is to eventually produce a product, yet the output can be developed into ideas, methods, valuable information and new issues discovered in the process.

Based on the concept of this lab, three designers from RYOTA YOKOZEKI STUDIO and two students from the Future Craft Project conducted a series of experiments.

To sum up, the lab is responsible for the following activities:

- 1 Separate the collected waste materials into different categories;
- 2 Research upcycling cases and experimental cases for specific materials;
- 3 Ideation and Hypnosis;
- 4 Conduct experiments;
- 5 Discussion

Experiments

At the Cycle Project, waste materials are not categorized since participants were not experts in any particular field. Likewise, our member designer does not have any special processing techniques or equipment.

Therefore, we decided to use the craft-based upcycling method as a method of experimentation for the lab [8]. This refers to an upcycling method by briefly processing them with tools and materials that are physically around us. The advantage of the craft-based method is that anyone with the right materials can imitate its techniques or adapt them to their own originality.

The purpose of the lab is not limited to design a product, but to focus on exploring the design expression of materials. Additionally, the lab conducts experiments with different processing methods and explores the possibilities of this material, its compatibility when mixing with other materials, and its potential for products that take advantage of its design characteristics.

To begin, we first tried to process plastic industrial waste. An example of plastic upcycling is a technique called Precious Plastic [36]. It refers to a technique in which plastic is melted by heating and pressing into a mold. As we do not have special equipment, we used a gas burner and a bowl instead(Figure 3.11). We found that even with this technique, there are differences in the way the plastic

melts, depending on the type of plastic used, and that the design, such as the texture of the product, differs(Figure 3.12).

Washi, thread, and wood shavings could also be crushed or mixed finely to create another new design. These design results may be junk by themselves. However, if ideas and processing methods are developed and improved over time, they have the potential to be produced as products. After various experiments, we had a discussion on outputs produced, as well as insights and possibilities.(Figure 3.13)

In addition, since the Re-fabrication-Lab collects a wide variety of materials, it is mandatory to consider not only how to process the materials themselves, but also how to combine materials with each other. For example, we combined plastic and metal, this alone could be an upcycled product.

We conducted several experiments and documented the results and the design expressions we created. This series of records can be seen in the figure below(Figure 3.14).

This list(Figure 3.14) is the output we produced in three months of lab work.

Designers are not able to control time allocation on experiments as they are often employed on a full-time basis. In this respect, the involvement of individuals like students who can spend relatively more time on experimental activities is crucial for pushing the progress. We had a zoom meeting once every two weeks to report and discuss our progress, and spent the rest of the time doing our own, or collective experiments.

While participating in this activity, it is noticeable that companies without excessive time and manpower budget are significantly difficult to practice such work or experiments. However, there are many discoveries and insights to be gained from these series of activities. For example, even within a single frame of plastic, differences in its origin, milling methods, and processes have resulted in changes in output. The blend of Japanese paper and yarn can give it a unique softness, and the mixture of wood shavings retains its aroma.

This experiment was conducted at the Hacking Studio of the Keio Graduate School of Media Design and the atelier in the RYOTA YOKOZEKI STUDIO. Due to the limitations of the equipment, we were unable to conduct experiments such as melting metals, and the materials we were able to process were limited to those

listed above. We believe that this argument can be addressed by expanding the scope of lab work activities and increasing the number of specialized personnel in the future.

In the experiments, the equipment we used and the considerations we took into account are also included in the list(Figure 3.14). During processing, ventilation was necessary as some items emitted odors, gloves and relevant gears were prepared to avoid burn, together with safety considerations such as the use of goggles and masks when handling wood chips.



Figure 3.11 Lab work



Figure 3.12 Re-Fabrication-Lab output



Figure 3.13 Discussion





























Material	Tool	Method	Output	Idea
	-glove -hot plate -cooking sheet	After heating on a hot plate, apply the sheet and peel it off before it hardens.		-Painting-like design -Decorative (combined with glass or acrylic)
	-glove -hot plate	Crushed plastic and heated on a hot plate.		-Mosaic style design
	-glove -gas stove -steel bowls	Crushed plastic, placed in a bowl and heated on a gas stove.		-Opal design with completely melted plastic and mixed colors
	-glove -gas stove -mold	Crushed plastic is placed in a mold, heated on a gas stove, and then unmolded.		-Marbled design -Molded, simple small container
	-glove -hot plate	Crushed plastic and heated on a hot plate.		-Cobblestone-like design -Does not completely dissolve the plastic
	-glove -hot plate	Crushed plastic and heated on a hot plate.		-Marble-like design
	-glove -gas stove -steel bowls	Crushed plastic, placed in a bowl and heated on a gas stove.		-Cobblestone-like design -Does not completely dissolve the plastic
	-glove -gas stove -mold	Crushed plastic is placed in a mold, heated on a gas stove, and then unmolded.		-Marbled design -Molded, simple small container
	-glove -hot plate	Crushed plastic and heated on a hot plate.		-Cobblestone-like design -Mixing two materials when melting
	-glove -hot plate	Crushed plastic and heated on a hot plate.		-Like glass and marble mixed design -Mixing two materials when melting
	-glove -hot plate	Crushed plastic and heated on a hot plate.		-Glass-like design with reflections by cutting the plastic sheet into small pieces and not melting it completely.
	-glove -hot plate	Crushed plastic and heated on a hot plate.		-Glass-like design with reflections by cutting the plastic sheet into small pieces and not melting it completely.
	-glove -gas stove -mold	After the crushed plastic is melted in the mold, the metal is inserted and waited for it to harden.		-Fusing metal with plastic, simple small goods
	-glove -hot plate	Crushed plastic and heated on a hot plate.		-Crunch-like design by not melting the plastic completely

Figure 3.14 List of lab work output


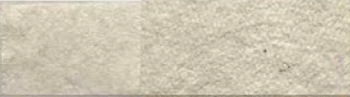
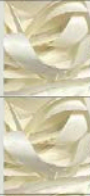




















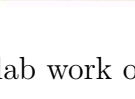
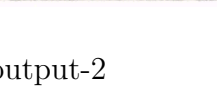
	Material	Tool	Method	Output	Idea
I		-mixer -trays -net	-Mix finely ground paper with water, strain through a net, and let dry.		-Easy to create and use as paper -Folding and writing are also available
I	 	-mixer -trays -net	-Mix finely crushed paper, wood chip, and water, strain through a net, and dry.	 	-The scent of the wood remains. -Folding and writing are also available
I/J	 	-mixer -trays -net	-Mix finely crushed paper, wood chip, and water, strain through a net, and dry.	 	-The scent of the wood remains. -Folding and writing are also available
I/J	 	-mixer -trays -net	-Mix finely crushed paper, wood chip, and water, strain through a net, and dry.	 	-The scent of the wood remains. -More wood gives a cork-like feel to the touch.
I/G	 	-mixer -trays -net -scissors -glue	Mix finely crushed paper, cut threads, water and glue, strain through a net and let dry.	 	-Threads are blended together to create a stiffness and strength.
I/G	 	-mixer -trays -net -scissors -glue	Mix finely crushed paper, cut threads, water and glue, strain through a net and let dry.	 	-Threads are blended together to create a stiffness and strength.
I/G	 	-mixer -trays -net -scissors -glue	Mix finely crushed paper, cut threads, water and glue, strain through a net and let dry.	 	-Increasing the amount of yarn will result in a cloth-like fabric. It also becomes stronger.

Figure 3.15 List of lab work output-2

3.4.4 Workshop

Workshops are held to share the results of lab work with local companies and further develop ideas. It is also an opportunity for companies to discuss with outside parties, experience hands-on ideation, and gain knowledge.

Specifically, we provide content for companies to come up with upcycling ideas that combine external waste with their own waste, companies can implement those ideas and carry out testing through lab work. These activities will accelerate the emergence of innovative ideas and insights of upcycling their own waste, and will simultaneously bring about opportunities to meet university students and designers to discuss upcycling issues respectively.

As for the location, the workshops are mainly held at FabCafe Nagoya, our external partner, which is a convenient location for Nagoya-based companies, besides, we are able to bring in scrap wood samples for the workshop. This is another

advantage of conducting the workshops in a community-based manner.

In the workshop, we also prepared sample packages of some local industrial waste we had collected and had used in our lab work, in case there were materials to be utilized for our own upcycling or experiment in the future.

3.4.5 Platform

We propose online communication as well as realistic venues such as workshops. To further support and develop upcycling activities, we have launched an online platform for reviewing the Cycle Project's series of activities with local businesses.

The series of activities are archived and publicly shared, SMEs can benefit from saving time and excessive costs as it does not require physical attendance, another advantage is that companies can absorb as much information about the Cycle Project.

The platform consists of three main contents:

- Information on collected industrial waste materials ;
- Archive Re-Fabrication-Lab's initiatives;
- Archive of workshops held.

Firstly, with the cooperation of companies, we collect and post samples of industrial waste materials which they are potentially stocking. The goal is to facilitate upcycling through inter-regional collaboration based on specific industrial waste materials. As the survey revealed, a large portion of companies were interested in finding out other companies' waste materials, which leads to an expansion of the possibility that waste may be utilized as a valuable material. A list of the industrial waste and respective quantities will be shown below(Figure 3.16).

Secondly, we archive the lab work and record the whole process of it. This serves as a source to obtain hints and inspirations for incorporating waste materials into their own upcycling activities. The archive will list out the lab work pieces and allow users to tap on the image to discover the tools and materials used to create the design, as well as the discoveries and possibilities that were gained. This user-friendly sharing of information helps users select and replicate what they want to incorporate(Figure 3.17).

Thirdly, the purpose of the workshop is not only to publicize the activities of the Cycle Project, but also to motivate people to participate, to apply their own upcycling ideas and promote interest in the series of upcycling activities. It encourages individuals with different backgrounds to be part of the Cycle Project, thus, gathering information and insights for their own upcycling attempt, besides, it develops an gradual interest when delving into those activities(Figure 3.18).

In order to extend connections with participating companies after the workshop, we have also created a form to collect results from participants, such as prototypes of ideas using the samples we gave them at the workshop(Figure 3.16). This will not only develop the lab work, but also provide ongoing support to the participating companies.

By visualizing a series of upcycling activities in this way, waste providers can learn how their waste materials were used, what the ideas were and could be generated, and so on.

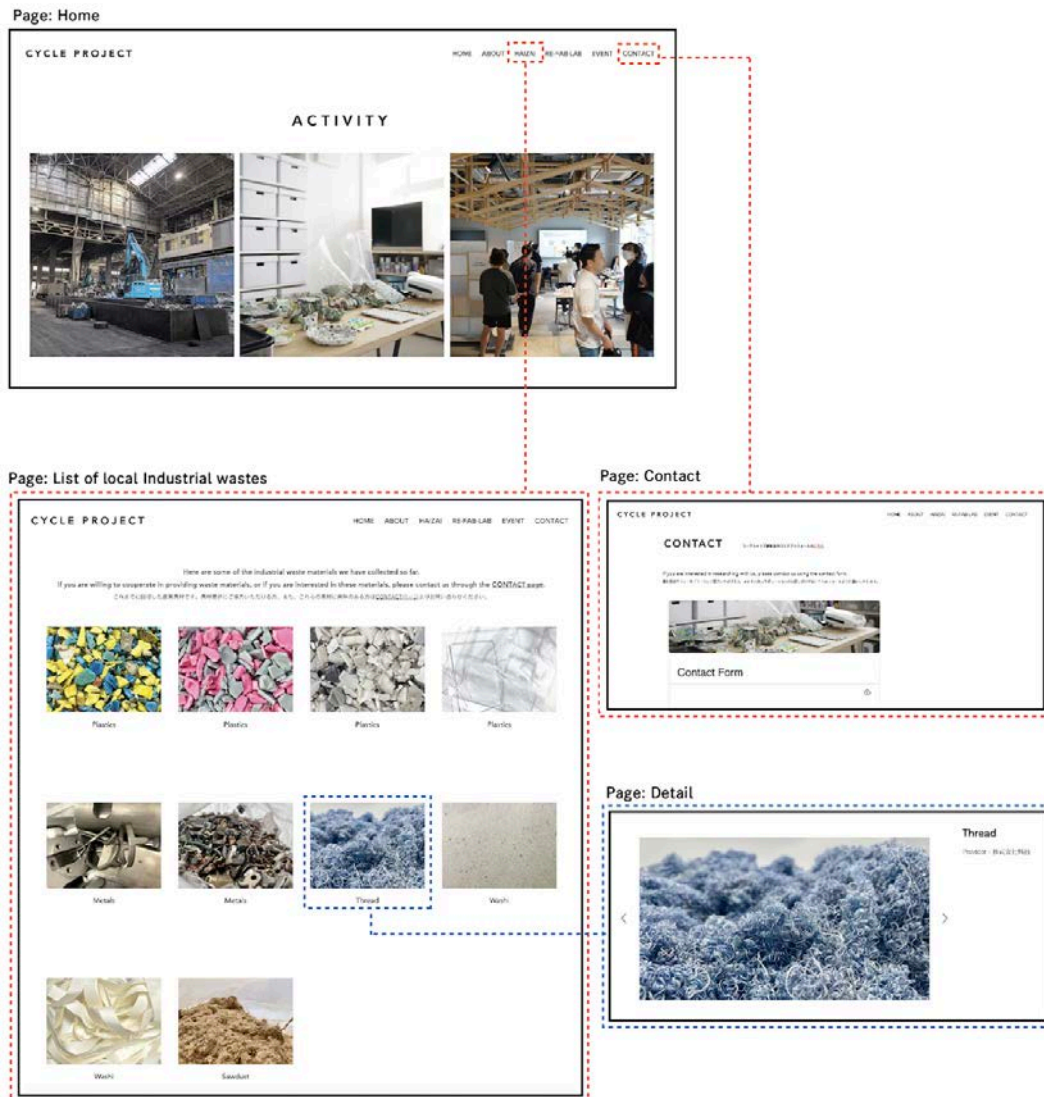


Figure 3.16 Online platform system

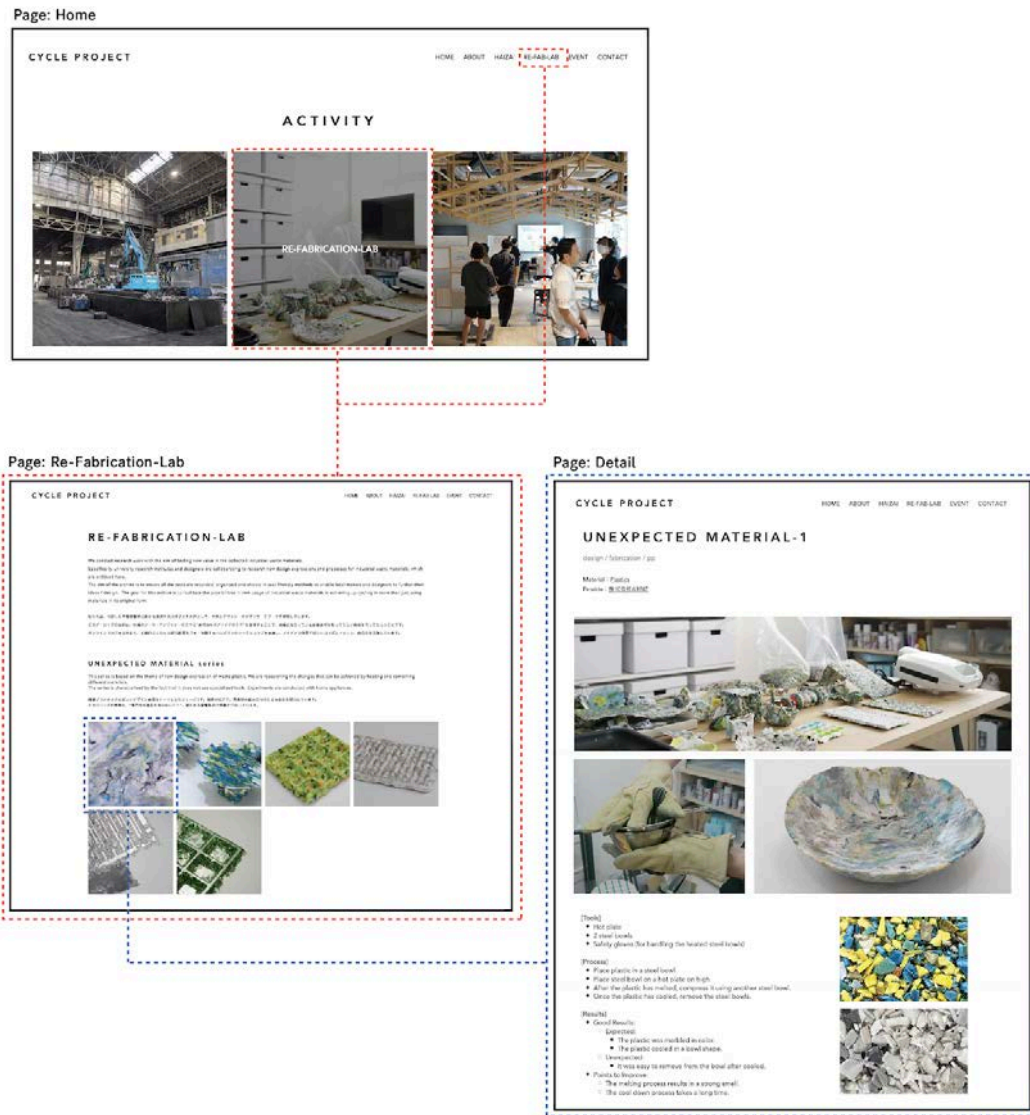


Figure 3.17 Online platform system-2

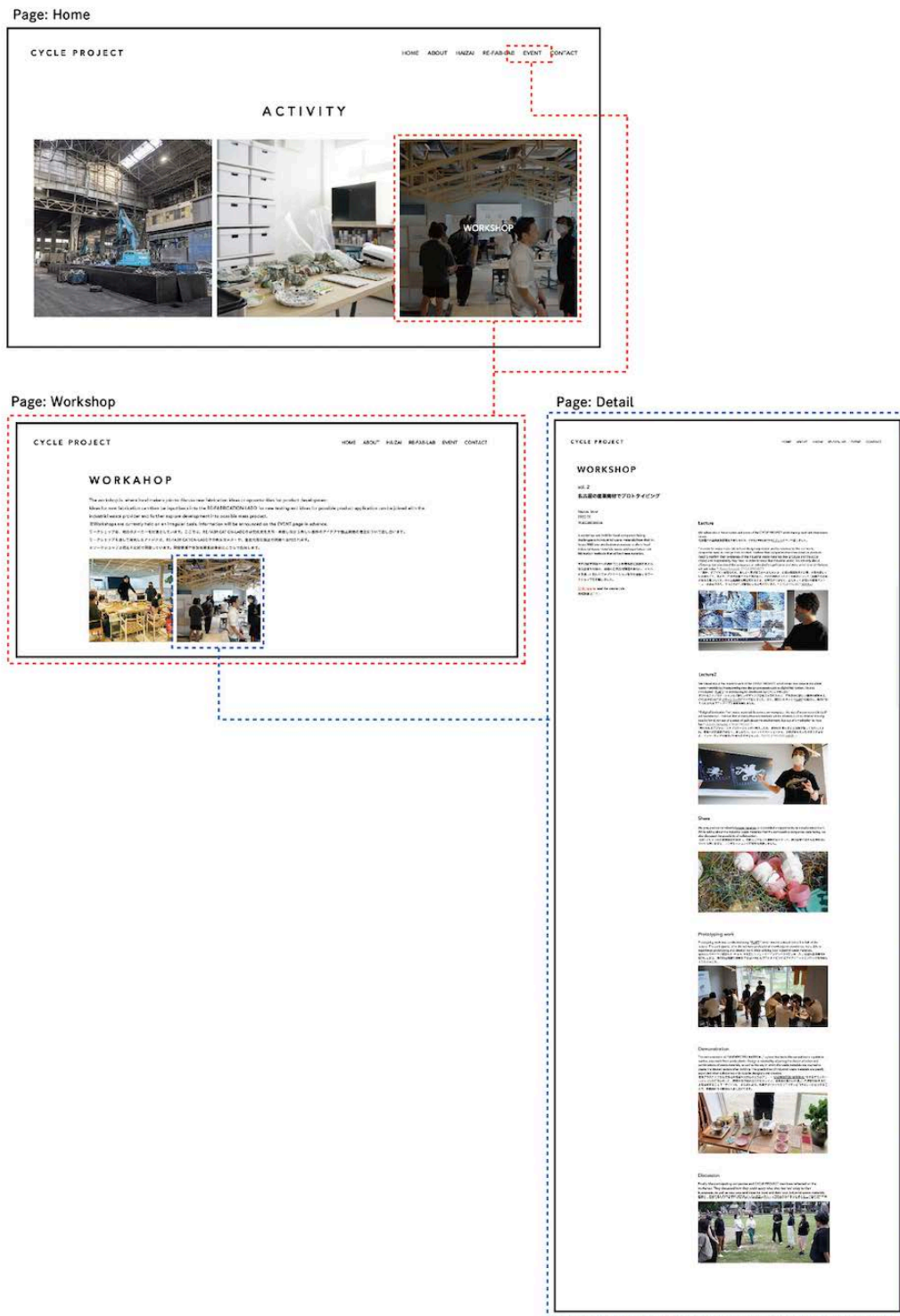


Figure 3.18 Online platform system-3

3.5. Community formation

Among industrial waste providers

The Cycle Project targets those who have costly industrial waste materials to dispose of, but who cannot afford to upcycle themselves due to insufficient time or budget.

If they provide a certain amount of their waste as samples, Cycle Project members could unlock their potential as reusable materials, moreover, workshops could lead to other companies using those materials for their own upcycling. Upcycled products could ultimately be developed through local company collaborations.

In addition, by posting information about scrap materials on an online platform, information can be spread to an unspecified number of readers. It allows people who are not involved in the Cycle Project to connect with others who need scrap materials.

The online platform also archives and shares the content and results of lab work and workshops. Readers can explore how the waste materials you provided were used, what ideas were actualized, and who was interested.

Among local companies

Local companies are interested in upcycling and would like to create upcycled products using their own waste materials. However, they also encounter challenges such as lack of prior knowledge or time, or have certain limitations on their applicability as manufacturers. They are generally passionate about gaining knowledge, and to discuss and exchange ideas with external parties for better research and development output. Companies are interested in manufacturing with students and designers.

Such companies are considered to be the core target of Cycle Project's services. Local companies can embrace Cycle Project's online platform for the available information about local industrial waste materials and lab work findings.

Additionally, companies participating in workshops expound their challenges with Cycle Project members and apply the knowledge and methodology to their own upcycling activities. The archives of the workshops remain open on the platform, hence you can view on other companies facing similar challenges in the

region and gather information, which lead to a better understanding of initiatives about companies that are actively upcycling.

Among individuals

Cycle Project has been conducting lab work with recovered waste materials, accompanying designers and creators who are interested in being part of the activities. Designers with diverse backgrounds and expertise are welcome to engage in fields of upcycling, waste materials, and collaboration.

Chapter 4

User Test and Evaluation

4.1. Overview

Four trials are conducted to test the effectiveness of the proposed Cycle Project set of concepts for local upcycling activities. As a primary task to validate the concept of the upcycling process flow, this study focuses on how designers and universities can contribute to upcycling activities of businesses, notably by sharing local industrial wastes and laboratory works with local businesses, as well as establishing an online platform.(Figure 4.1)

Three of the trials were workshops for local manufacturers, and one was an exchange session for people from multiple regional industries.(Figure 4.2) The local companies participating in this trial were introduced to us through FabCafe Nagoya's connections.

The main objectives of each trial are as follows. The first and second test aims to analyze from the upcycling perspective, the third test explores the online platform aspects. Finally, the fourth test provides insights into the local community.

Specific objectives and overview of each trial will be described in detail in the following sectors. The evaluation methods for each test will be analyzed and discussed from questionnaires, interviews, and observations successively.

The questionnaire collected personal statements from the participants. The analysis is based on a six-point numerical rating for each question with open-ended comments and impressions.

No particular format was restricted for the interviews. Insights were gained by incorporating pre-prepared questions into the conversation and with an expansion on participants' answers. For observation purposes, videos and photographs were taken on the testing day. Additionally, participants' reactions, movements, and discussions would also be taken into consideration. This user test focused on

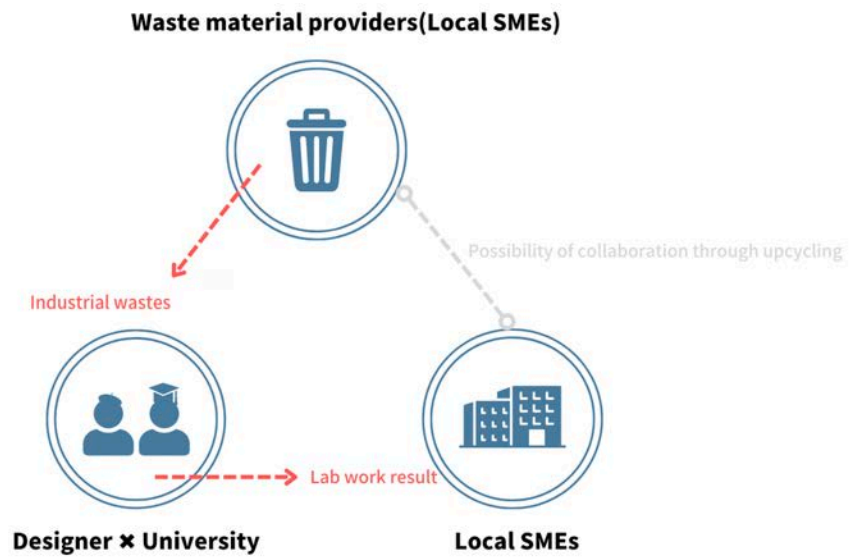


Figure 4.1 Areas of activities available for user tests

qualitative evaluation.

	Objective	Contents	Evaluation Methods
Test 1	<ul style="list-style-type: none"> • Obtain new ideas for upcycling • Increase interest in local industrial waste materials 	STEP1: Introducing the concept of cycle project STEP2: Experience Re-Fab-Lab work process Work thema "Design expression by combining various plastic waste materials" STEP3: Discussion STEP4: Surveys and Interviews	<ul style="list-style-type: none"> • Survey • Interviews • Observation • Video Shooting • Photography
Test 2	<ul style="list-style-type: none"> • Increase interest in local industrial waste materials • Acceleration the creation of new upcycling ideas that incorporate local industrial waste materials 	STEP1: Introducing the concept of cycle project STEP2: Introducing Re-Fabriation-Lab STEP3: Ideation work Work thema "Upcycle idea by combining other industrial waste" STEP4: Discussion STEP5: Surveys and Interviews	
Test 3	<ul style="list-style-type: none"> • Increase interest in local industrial waste materials • Acceleration the creation of new upcycling ideas that incorporate local industrial waste materials. • Effectiveness of an online platform 	STEP1: Introducing the concept of cycle project STEP2: Introducing Re-Fabriation-Lab STEP3: Ideation work Work thema "Upcycle idea by combining other industrial waste" STEP4: Validating the concept of online platform STEP5: Surveys and Interviews	
Test 4	<ul style="list-style-type: none"> • Connect with companies that have challenges with waste materials and upcycling • Examine the need for activities from diverse industries 	STEP1: Presentation STEP2: Free Discussion STEP3: Surveys and Interviews	

Figure 4.2 Overview of user testing

Test1			
Objective	Target	Evaluation Methods	Work contents
<ul style="list-style-type: none"> • Obtain new ideas for upcycling • Increase interest in local industrial waste materials 	<ul style="list-style-type: none"> • An SME umbrella manufacturer • 10 employees 	<ul style="list-style-type: none"> • Survey • Interviews • Observation • Video Shooting • Photography 	STEP1: Introducing the concept of cycle project STEP2: Experience Re-Fab-Lab work process Work thema "Design expression by combining various plastic waste materials" STEP3: Discussion

Figure 4.3 Overview of Test 1

4.2. Test 1

4.2.1 Overview

This workshop targeted an SME umbrella manufacturer in Nagoya, Japan. The company has grown interest in upcycling and would like to actively engage in it internally. Throughout the manufacturing process of umbrellas, there are many discards owing to printing errors, slight scratches on items, dysfunctional handle parts and metal fittings. They also addressed that the industry as a whole is confronted by numerous challenges, including but not limited to discarding misplaced or unclaimed umbrellas.

This workshop was held at FabCafe Nagoya. Since it was held at the same time as other workshops, each session was limited to 30 minutes. Participants were 10 employees of that company, with five members from the Cycle Project participating as facilitators.(Figure4.3)

4.2.2 Preliminary survey

We have asked each participant to fill out a questionnaire in order to find out the current situation of the company. The questionnaire was answered by participant A, B and C, who were sales assistant, administrative staff and president respectively.

A six-point rating scale was applied for measurements, ranging from Strongly Disagree to Strongly Agree(1: Strong Disagree, 6: Strong Agree). Each question and answers are shown below(Figure 4.4).

Preliminary Survey	Participant A	Participant B	Participant C
Q1: Do you feel that your company's R&D activities for upcycling are being challenged?	5	3	4
Q2: Do you think that there are only few opportunities at present to find out industrial waste from other companies?	5	3	4

Figure 4.4 Preliminary survey of Test 1

In Q1, Those with a rating of 5 stated that “priorities for action tend to be driven by the most immediate matters, rather than their importance from a medium to long-term perspective.” While those with a rating of 4 stated that they need equipment and a place for prototyping. Despite the fact that individual differences exist, we found that there are hardly any opportunities to actively enroll in learning about waste materials in the region and thus R&D has become a challenge.

4.2.3 Objective

This workshop examines whether the content we provide can ultimately contribute to the rise of upcycling activities and whether companies can grow their interest in industrial waste from other institutions.

For this purpose, we have prepared two sessions: one was to share the concept of the Cycle Project and the second was to involve companies in the lab work of Re-Fabrication-Lab. The details will be explained in the following sections.(Figure 4.5)

4.2.4 Workshop process

Step 1: Introducing the concept of cycle project

First, to have the participants understand our series of activities, we have introduced our project concept and activities beforehand. Here are some specific topics we went through, for instance, vision of the Cycle Project, the local industrial waste, introduction of the fieldwork, concept of the Re-Fabrication-Lab and results of the lab work(Figure 4.6).

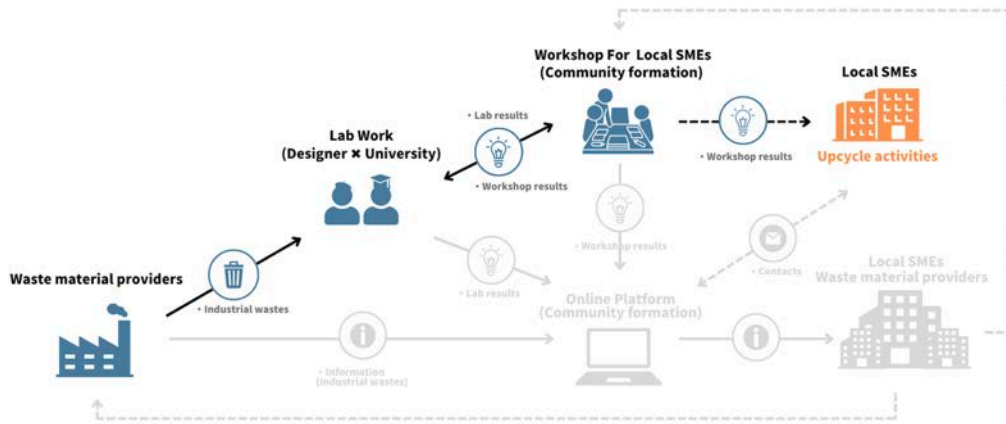


Figure 4.5 Verification flow for Test 1

During the talk, project member Ryota Yokozeki, a designer, spoke about his motivation as follows.

“In order for waste wood to have design expression and be returned to the real world, it is necessary for companies to change their mindset. I think it is crucial for companies that mass-produce products to reaffirm their awareness of industrial waste materials produced in their manufacturing processes, their social impact, and their responsibility. Reusing industrial waste is not only about efficiency, but also about the company’s or individual’s significance and story, which I believe is the added value.”

This statement showed an awareness of the industrial waste issues from the standpoint of a designer and empathy for the project. The concept we are proposing requires a strong awareness of the issues and the ability to take action by participants involved in this type of manufacturing. Yokozeki had a strong standpoint and well highlighted the significance of this project.

Step 2: Experience Re-Fabrication-Lab work process

We had heard in advance that participants involved in umbrella manufacturing were struggling to re-utilize plastic waste materials generated in the manufacturing process, correspondingly, we showed them Re-Fabrication-Lab work(Figure 4.7) in which plastic was processed using several techniques, we suggested how it was made with relevant ideas, and eventually gave them hands-on prototyping



Figure 4.6 Member who share local industrial waste issue

experience.

What kind of plastic waste materials are produced by different companies, their shapes and qualities vary. In this hands-on session, we showed them that by mixing several plastic waste materials or melting them together, it could be turned into interesting designs(Figure 4.8)(Figure 4.9).

Step 3: Discussion

Finally, participating companies and Cycle Project members reflected on the workshop and gave their impressions(Figure 4.10). We did not prepare a set format, but rather elicited prepared questions in the course of natural conversation. The specific opinions obtained are evaluated in Summary of Findings.

4.2.5 Survey and evaluation

As there were 10 participants with time constraints, only 3 participants responded to the survey and were interviewed. The survey results will be detailed, whilst participant A represents sales staff, participant B as administrative staff and participant C is president of a company.



Figure 4.7 Lab work exhibit



Figure 4.8 Lab work experience



Figure 4.9 Lab work experience-2



Figure 4.10 Discussion

Quantitative Survey	Participant A	Participant B	Participant C
Q1: Was today's session useful for your company's R&D?	4	3	5
Q2: Has upcycling collaboration with individuals from different disciplines, such as designers, students, and researchers, been effective for your company's upcycling?	5	2	6
Q3: After today's series of sessions, were you interested in combining your own waste materials with others to create new upcycled products?	4	2	6
Q4: Would you like to learn more about other companies' waste materials?	4	2	6
Q5: Would you like the opportunity to discuss fabrication methods for own company's upcycling in the future?	5	2	6

Figure 4.11 Quantitative survey result of Test 1

Quantitative approaches

A six-point rating scale was applied for measurements, ranging from Strongly Disagree to Strongly Agree (Figure 4.11).

Q1: Those who answered “3” said: “The experiments were interesting, but I couldn’t imagine processing my company’s scrap wood with this kind of method. while those who responded “5” addressed that “It was meaningful not in the sense of immediately applying this method to our company, but in the freshness of gaining new insights and new perspectives in this way.” The results show that even if the methods learned in the work cannot be directly applied to their own upcycling, the fun and stimulation can work positively.

Q2: To specify, a participant who gave a rating of 6 said: “Today’s session was like an exercise. Opportunities like this inspire and stimulate in a way that I don’t usually feel.” This proved to be a valuable and effective opportunity for them to gain outside insight.

Q3: The participants seemed highly interested in learning about other companies’ waste materials. However, they also seemed to need to consider how to specifically combine them and their methods.

Q4: For them, opportunities such as this one proved effective in increasing interest in other companies’ waste.

Q5: They were generally positive about the opportunity to gain knowledge, but

Qualitative Survey
Q1: With open answers, what did you learn from today's series of sessions?
Q2: Did any new ideas come to you through today's session?
Q3: Please feel free to describe your impressions about today's session.
Q4: How often would you like these opportunities?
Q5: Please answer any materials you would like to consider upcycling in the future.

Figure 4.12 Qualitative survey of Test 1

seemed more interested in methods for combining their own waste materials with other companies' waste materials, or methods for processing other companies' waste materials, rather than methods for processing their own waste materials.

Qualitative approaches

In Q1(Figure 4.12), the respondents addressed a challenge that a true recycle-oriented society cannot be created without fundamental systems and changes in design. And another answer was that the idea of how to make new things is fairly common in different fields. Overall, the session had a positive impact on them as a new learning opportunity.

In Q2, the respondents stated that they wanted to create upcycled products using materials that are as biodegradable as possible, they have also revealed an interest in various types of waste materials for upcycling. This work triggered inspirations for upcycling, participants seemed to have gained new ideas, concepts, and visions for oncoming productions.

In Q3, a common phenomenon from respondents was that they gained a new perspective on discarded materials. For example, "I thought it was important how to upcycle waste materials to reduce the energy needed for recycling", "I felt that in upcycling, it is important to design materials so that they are not

immediately discarded again”, and “When I pondered how to remake I realized that when you think about how to remake things, things that used to be thrown away can become resources”.

In Q4, more than half of the respondents expressed a desire to hold these meetings on a regular basis, such as once every six months or once a month.

This response indicates that these occasions for reciprocal connections and ideas should not be held as a one-off event, but with higher frequency, this implies a need for long-term support for their upcycling activities.

In Q5, the respondents answered aluminum, steel, fiberglass, and umbrellas (including fabric, bones, handles, etc.). They found that stocking large amounts of waste materials is a challenge, since they have not had the opportunity to share these challenges with the outside world. It is crucial that companies have opportunities to share these challenges with the outside world, for instance, a forum for such issue sharing.

Findings

【Verification against objectives】

This verification focused on whether a series of tasks could help the company gain new ideas for its own upcycling activities and whether it could increase the interest of other companies in industrial waste.

As in this case, it became obvious that the experience of connecting with people from other fields and creating new products outside the company was helpful regarding awareness and perspectives.

We also found that learning about industrial waste as an outsider and effectively experiencing lab work increased their ability to combine wastes from other companies during upcycling. This motivated us to further study about other companies' waste materials.

【The need for such opportunities】

It also revealed a desire for the event to be held with some regularity. Since companies sense that R&D poses a significant challenge, having long-term support would be necessary. The frequency and duration of the sessions also need to be well-designed based on whether the purpose of the session is to exchange ideas or a concrete prototyping for commercialization.

【Awareness】

An obvious trend in the responses to this survey is the difference in willingness to participate and awareness of issues across different positions. The president was remarkably active in upcycling and was highly motivated by this occasion to generate new ideas, even if there were no immediate benefits. However, administrative staff were not participating with their own will, as they could not benefit from those sessions directly. Such internal disparities may be inevitable.

Nevertheless, about 90% of Ogawa Corporation's employees participated in this session, they gave positive feedback on the importance for everyone to be exposed to new manufacturing practices such as upcycling, for the sake of common awareness and action throughout the own company. In SME, with someone in a senior position such as the president, it showed that this proactive attitude would lead to the company's overall ability to act.

【Summary】

To sum up, this session demonstrated that the lab work experience with local waste was generally effective in stimulating interest in local waste, it contributed to generation of ideas and inspiration for upcycling. However, that needs to be considered with hurdles involving other companies' waste materials and to incorporate lab work into upcycling their waste materials.

Test 2			
Objective	Target	Evaluation Methods	Work contents
<ul style="list-style-type: none"> • Increase interest in local industrial waste materials • Acceleration the creation of new upcycling ideas that incorporate local industrial waste materials 	<ul style="list-style-type: none"> • An SME that specializes in architectural glass • 3 employees 	<ul style="list-style-type: none"> • Survey • Interviews • Observation • Video Shooting • Photography 	STEP1: Introducing the concept of cycle project STEP2: Introducing Re-Fabriation-Lab STEP3: Ideation work Work thema "Upcycle idea by combining other industrial waste" STEP4: Discussion STEP5: Surveys and Interviews

Figure 4.13 Overview of Test 2

4.3. Test 2

4.3.1 Overview

The subject of this workshop is a small to medium-sized Nagoya company with 11 employees that specializes in architectural glass.

They were interested in upcycling and were actively putting into practice internally. The workshop was held at the headquarters of the company, it lasted about two and a half hours.

The workshop was attended by the president of the company (Participant A) and clerical staff (Participant B and C), a total of three members and one of cycle project members. (Figure 4.13)

4.3.2 Preliminary survey

In the questionnaire that was filled out in advance, a six-point rating scale was applied for measurements, ranging from Strongly Disagree to Strongly Agree.

In terms of the survey (Figure 4.14), respondents seem to be vigilant about their own waste materials, upcycling activities and insufficient opportunities to learn about industrial waste.

Notably, for Q2, there were additional comments such as lack of cost for in-house R&D, lack of opportunities to obtain ideas and knowledge from outside sources and lack of platform to share their waste materials issues.

Preliminary Survey	Participant A	Participant B	Participant C
Q1: Does your company feel that industrial waste is a challenge?	6	6	6
Q2: Do you feel that upcycling activities within your company is a challenge?	6	6	4
Q3: There are insufficient opportunities to learn about industrial waste.	6	6	6

Figure 4.14 Preliminary survey of Test 2

4.3.3 Objective

The purpose of this workshop is to speed up the creation of new upcycling ideas that incorporate local industrial waste materials.

In this respect, the concept of the cycle project was introduced and we conducted ideation sessions while having participants look at local industrial waste materials and lab work.

The previous workshop focused on generating interest in other companies' waste materials, which highlighted the challenges for companies to actually realize upcycling by combining own and other waste materials. Therefore, this workshop covered perspectives on challenges in in-house waste materials, accompanied with discussions on waste combinations.

4.3.4 Workshop process

Step1: Introducing the concept of cycle project

As before, we introduced our project concept and talked about topics including vision of the Cycle Project, local industrial waste, fieldwork and the collected industrial waste.

Step2: Introducing Re-Fabrication-Lab

Next, the collected waste materials were arranged by label, and the participants were asked to pick up and look at them one after another, explaining specifically where the waste materials came from and what kind of manufacturing process

they were generated in. Afterwards, visitors were able to hold and look at Re-Fabrication-Lab's lab work that uses these materials.

We also provided an instruction manual for each of the processing methods, in this case, visitors could learn not only about the works but also about the processing methods. There were 7 lab work items and 9 samples of industrial waste materials prepared for this project(Figure 4.15)).

In the previous test, we introduced various plastic waste materials and related lab work to companies who were interested in plastic waste materials(Figure 4.16). However, this time we prepared a diverse range of waste materials for companies dealing with glass waste materials, as we believe they have affinities with all kinds of materials and offer broader possibilities.

Step 3: Ideation process

During this time, since the workshop was also a fieldwork and was held at their head office, we were not able to actually launch the lab work. Correspondingly, we conducted an ideation process, participants were requested to come up with possibilities of application, processing methods, waste materials combinations for their own upcycling activities and what upcycled products could be made from them(Figure 4.17).

In addition, a large amount of their waste material was stored in a container next to the headquarters, participants along with the project members were able to observe it and explore the possibilities of collaboration with lab work and other companies' waste materials we collected(Figure 4.18).

While the previous workshop focused on growing interest in other companies' waste materials through the lab work experience, this particular workshop focused on application of waste materials in relation to their own upcycling activities through the ideation process.

The process consisted of the following:

- 1 Which piece of work in lab-work are they most interested in.
- 2 Ideas and processing methods in the lab work that apply to own upcycling work.

Samples of industrial waste materials		Lab-work items		Method
	Plastic	①		After heating on a hot plate, apply the sheet and peel it off before it hardens.
	Plastic	②		Crushed plastic and heated on a hot plate.
	Plastic	②		Crushed plastic is placed in a mold, heated on a gas stove, and then unrolled.
	Iron	③		Crushed plastic and heated on a hot plate.
	Metals	④		Crushed plastic and heated on a hot plate.
	Fiber	⑤		Crushed plastic and heated on a hot plate.
	Japanese Paper	⑤		-Mix finely crushed paper, wood chip, and water, strain through a net, and dry.
	Japanese Paper	⑥		Mix finely crushed paper, cut threads, water and glue, strain through a net and let dry.
	wood chips	⑦		After the crushed plastic is melted in the mold, the metal is inserted and waited for it to harden.

Figure 4.15 List of used for Test 2



Figure 4.16 Introduce of lab work

- 3 Waste material samples from other companies that want to combine with own waste materials.
- 4 Specific upcycled products and design thoughts.

Ideation result

【Participant observation】

During the ideation, Participant C had about 20 minutes to finish filling out the worksheet after touching Re-Fabrication-Lab's work and local waste materials. He then proceeded to ask a few questions about the tools used in the processing.

Participant A and Participant B, on the other hand, took more than an hour to generate ideas. This is not due to an inability to come up with ideas, since they had asked various questions and had discussions before coming up with ideas. They addressed questions from a variety of angles, such as how they collected the materials, from which companies, in which processes the waste materials were generated and what ideas the designers had for processing experiments.

【Result】

This figure below demonstrates the results of the ideation process. During the ideation, each participant proposed a unique idea, they had shown a strong inter-



Figure 4.17 A photograph of ideation process



Figure 4.18 Discuss and examine at their waste materials in a container for upcycle ideation

	(1)	(2)	(3)	(4)
ParticipantA	⑥	⑥	<ul style="list-style-type: none"> • Japanese Paper • Fiber • Wood chips 	<ul style="list-style-type: none"> • Renovative material made from a combination of our own discarded glass and metal. • Wood waste is reused for packaging of upcycled products and as an air freshener. • Tablecloths combining Japanese paper waste and glass waste
ParticipantB	②, ④, ⑤	②, ⑤	<ul style="list-style-type: none"> • Japanese Paper • Metals (From car parts) • Fiber 	<ul style="list-style-type: none"> • Plastic waste and our own glass waste used as decorative items and used as wall and building materials in stores. • Want to do a combination of glass(our waste) and natural materials such as Japanese paper, wood, etc
ParticipantC	②, ⑤, ⑥	①, ⑥	<ul style="list-style-type: none"> • Metals (From car parts) • Plastics (From food tray) 	<ul style="list-style-type: none"> • By grinding our own glass waste and mixing it with Japanese paper, we may be able to create beautiful design expressions. • Ornaments/phone cases made by fusing glass waste and plastic waste. • Would like to try on combining fine metal waste and glass waste.

Figure 4.19 Results of ideation process

est in other companies' waste materials, not only because of their compatibility with their own waste glass, but also due to their personal preferences of materials(Figure 4.19).

Participants expressed interests in lab work and had suggested upcycling ideas which expanded on them, illustrating a positive impact of conducting basic processing experiments in lab-work(Figure 4.20).

Step 4: Discussion

After the ideation process, we had a discussion on ideas that each participant came up with, went onto brainstorming development possibilities and concluded all the findings.

In those discussions, we prepared several themes for the talks, which were freely discussed to attain insights by expanding the scope of conversation. Project members were to provide the topics and facilitate the discussion from a neutral position.

【Theme 1: What did you notice through the ideation process?】

- Participant A: *“The architectural glass waste we are dealing with is a single sheet of glass, and it is difficult to melt and mix it with other materials. But I think we can make things look beautiful just by combining or sticking them*

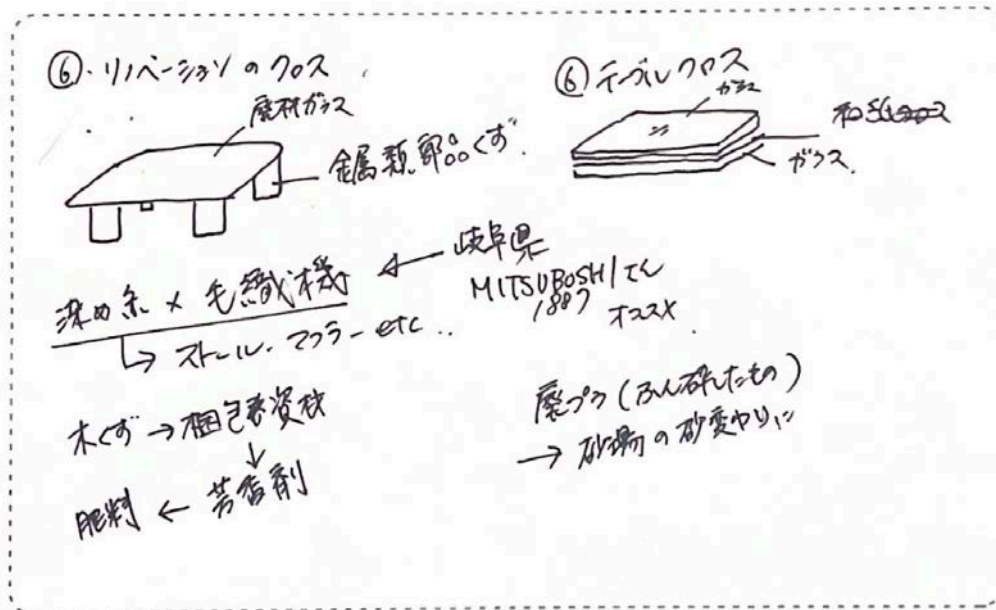


Figure 4.20 New upcycling ideas from ideation

with other things. Thread and wood shavings could also be used for packaging upcycled glass products. I would also like to use all local waste materials for packaging when delivering upcycled products to consumers.”

- Participant B: “After a glimpse of the lab work, I thought plastic and glass would work well together. I can make something quickly with this combination alone. I would like to make new wall decorations. Also, the fine metal scraps are beautiful and very interesting.”
- Participant C: “Couldn’t a single sheet of glass be mixed with other things if it was shattered and made fine? It might be dangerous, though. I’m curious to see what kind of design output we can create, so it would be interesting to experiment with it.”

Theme 1 showed that each of the participants have successfully gained new insights and perspectives, they have also acquired ideas that were specifically linked to their own upcycling.

【Theme 2: What do you think about industrial waste from other companies in the local area?】

- Participant B: *“The idea of upcycling by collaborating with other companies’ waste materials has never come up to me before. I would like to see more waste from other companies. There are many different manufacturers in this area, so I think everyone has a variety of waste materials. There is Merukari (A Japanese online marketplace for pre-owned items) as a platform for selling unwanted items, so how about recommending that we sell at such a place?”*
- Participant A: *“I think they don’t try to sell industrial waste on Merukari. I think we need a dedicated platform for industrial waste and for companies to take advantage of.”*
- Participant B: *“Indeed it is. In that sense, it might be good to limit the platform to the region. In this case, users can actually meet each other.”*

Theme 2 revealed their growing interest in other companies’ diverse industrial waste materials. The participants also perceived the need for a platform as an opportunity to gather local companies, and were aware of the potential value of their industrial waste.

【Theme 3: What motivates your company’s upcycling activities?】

- Participant A: *“I am not doing this for profit. I want to change the glass industry. I have always been aware of the problems with the current situation with mass disposal. I have not been involved with other companies in the glass industry because they are my rivals, but from now on I want to share more and make friends in order to change the industry. The waste issue in the glass industry is severe. However, we only have knowledge about glass, and there are many people around us who don’t know where to start in upcycling. That is why we want opportunities to gain knowledge and ideas from outside, and we want to collaborate with them. We want to actively challenge ourselves to create new things.”*

After the discussion on Theme 3, it was astounding to notice the president of the company with such awareness in terms of upcycling, he was similarly motivated to be proactive, not only for profit but also as a remedy for the problems encountered in the industry. Rather than in the name of reducing waste, they are most energized by new manufacturing and unexpected expansion of their activities.

Quantitative Survey	Participant A	Participant B	Participant C
Q1: Through the ideation process, I was able to gain new insights and ideas on how to combine and process waste materials for the development of upcycled products.	6	6	4
Q2: Rather than just looking at the waste materials itself, it would be more helpful to look at the product or combined samples to generate new ideas.	6	6	5
Q3: After going through today's work, I would like our own waste materials to be used for lab-work, proposals and idea work for other companies.	6	6	6
Q4: After going through today's work, I want to create new upcycled products by combining our own waste materials with waste materials from other companies.	6	6	6
Q5: I would like to experiment and prototype by incorporating the processing methods introduced in this article for my company's upcycling.	6	4	4
Q6: I felt that this series of work was effective as a step toward learning about other companies' industrial waste materials and incorporating them into our own upcycling activities.	6	6	6
Q7: I would like to be active on an online platform where I can share my company's waste materials and study information about local industrial waste materials.	6	6	4
Q8: I would like to participate in a workshop where I can actually perform hands-on processing of my waste materials and various waste materials from other companies, with an experiment with combining them.	6	4	5

Figure 4.21 Quantitative survey result of Test 2

4.3.5 Survey and evaluation

Afterwards, we reviewed the work and conducted a questionnaire which consisted of quantitative and qualitative approaches.

Quantitative Approaches

A six-point rating scale was applied for measurements, ranging from Strongly Disagree to Strongly Agree. As a reminder, participants A refers to the president of the company, participants B and C refer to clerical staff.(Figure 4.21)

In response to Q1, two respondents answered 6, clearly indicating that this series of idea work contributed to gaining new insights and ideas for upcycling by combining waste materials from other companies.

In Q2, two participants answered 6, revealing that the lab work with the designers was a positive influence regarding generation of upcycling ideas.

In Q3, all respondents answered 6, indicating that they wanted to connect with other companies through upcycling.

Qualitative Survey
Q1: Please feel free to describe your impressions of today.
Q2: How often would you like these opportunities?
Q3: After today's session, what actions would you take in the future?

Figure 4.22 Qualitative survey of Test 2

In Q4, all respondents answered 6, indicating a positive attitude toward upcycling that incorporates local waste materials and that it encourages their upcycling activities.

In Q5, two respondents remained neutral, indicating that they tended to have a less positive attitude toward prototyping and participating in lab work on their own.

In Q6, all responded 6, indicating that learning about other companies' waste materials and the designers' works from the Re -Fabrication-lab had a positive impact on improving support for their own upcycling activities.

In Q7, two participants responded 6, revealing a distinct need for an online platform in order to exchange information on local waste materials, which supports their upcycling efforts.

In Q8, two respondents gave positive feedback while one respondent stayed neutral. Although it was only an ideation work session, it suggested that the series of processes was meaningful to them and motivated them to participate in the next session, where they would like to actually prototype their ideas.

Qualitative approaches

As for Q1(Figure 4.22), The positive impact was evident in the comments of those who expressed a desire to continue building relationships, such as wanting to change the industry collectively and exchanging information interactively, as well as gaining hints for ideas and that it was meaningful to conceive ideas with individuals from other industries.

In Q2, The president, who was optimistic about upcycling, mentioned the need to hold such workshops and experiments on a regular basis. However, the remaining clerical staff were conservative about holding on a regular basis. This may be due to differences in proactiveness and recognition of issues based on position and role, as also seen in Test 1.

In Q3, participants left the following comments: “I was interested in Japanese paper and thread waste, so I would like to experiment with samples of these. I will consider how they can be used as packaging materials.”, “I would like to reach out to the people around me about today’s experience, as I reckon there are many people who would be interested.”, “I would like to brush up these ideas and I hope to commercialize them.”

It summarizes that feedback was affirmative. Through this series of work, they were able to identify concrete courses of action for their own actions in upcycling, with another positive impact on their promotion of upcycling activities.

Findings

【Verification against objectives】

Since the series of work sessions were held at the headquarters and in small groups, the participants were seemingly more relaxed, without any sense of tension. Therefore, the ideation process was an efficient yet active exchange of ideas. The time for discussion lasted for about two hours or less.

The purpose of this workshop was to support upcycling activities through the creation of new upcycling ideas for companies to use waste materials from other companies. As the survey results demonstrated the effectiveness of this event. Most of the participants consented that it was well-designed with great fluency. In fact, the work aroused a wide variety of ideas. The fact that introduction of a variety of materials with the relevant yet applicable processing methods proved to be effective. Each participant was interested in different materials and proposed different ideas.

The engagement implies new possibilities for more upcycling activities. The president of the company showed his remarkable interest in lab work, thus motivating him to actually experiment on his own by teaching him how to process the materials.

【Opportunities】

Participants expressed the need for a community-based platform to recover such materials, they had never been aware of the issues owing to the fact that there were little-to-no occasions to actually understand other companies' waste materials, nevertheless, learning about local waste materials through the workshop seemed to have expanded their imaginations.

In addition, their comments about seeking extra companies' attention on our workshops or activities confirmed that the concept we propose is valid and it resonates among companies. We have also received requests to use participants' waste materials in other companies' ideation processes and Re-Fabrication-Lab's experiments.

Cycle Project has collected materials with low transportation costs by mail to cooperate with the project. The company's waste material is a single sheet of architectural glass, which is expensive to transport and requires special skills to process. It poses a challenge for students and designers to operate in lab work. Therefore, transportation, professional techniques and practical application still remain as issues to be resolved in the future.

【Awareness】

In this particular case, there did not seem to be much difference regarding awareness of the issues between the president and the administrative staff. The president was young and of the same generation as the clerical staff, which made it easier for them to communicate opinions. When all participants had a positive view on upcycling, it vitalized the discussions, as a result, precise ideas were more likely to be generated.

【Summary of findings】

In summary, we found that lab work and other processed samples were effective in generating ideas to support complex upcycling of waste, and that actually examining and viewing the waste of participating companies stimulated idea generation and discussion. As a next step, we need to think about discussions about platforms to share information about local waste more easily, to provide ongoing support, and to expand connections with local companies, in addition to realistic venues such as workshops.

Test 3			
Objective	Target	Evaluation Methods	Work contents
<ul style="list-style-type: none"> • Increase interest in local industrial waste materials • Acceleration the creation of new upcycling ideas that incorporate local industrial waste materials. • Effectiveness of an online platform 	<ul style="list-style-type: none"> • An SME engaging in the business of sheet molding of acrylic materials • 1 employee 	<ul style="list-style-type: none"> • Survey • Interviews • Observation • Video Shooting • Photography 	<ul style="list-style-type: none"> STEP1: Introducing the concept of cycle project STEP2: Introducing Re-Fabriation-Lab STEP3: Ideation work Work thema "Upcycle idea by combining other industrial waste" STEP4: Validating the concept of online platform STEP5: Surveys and Interviews

Figure 4.23 Overview of Test 3

4.4. Test 3

4.4.1 Overview

The subject of this workshop is a SME in Nagoya engaging in the business of sheet molding of acrylic materials. This workshop was held at FabCafe Nagoya and lasted about two hours.

Participants comprised an employee who had decision-making authority within the company and could take action regarding internal upcycling activities and waste processing, and two members of the Cycle Project.(Figure 4.23)

4.4.2 Preliminary survey

In the questionnaire that was filled out in advance, similarly, the six-point measure was applied in this questionnaire.(Figure 4.24)

It is clear that the participant had a strong awareness of the issues related to his industrial waste and his own upcycling activities. As specific issues, the respondents felt that there were limitations in creating ideas for new products, it grew difficult for companies to test the combination of their own industrial waste materials with other materials as well as processing methods, besides, there was a shortage of finding solutions to issues and information about industrial waste materials remained unclear.

The participant also addressed a lack of opportunities to learn about other companies' waste materials.

Preliminary Survey	Participant
Q1: Does your company feel that industrial waste is a challenge?	6
Q2: Do you feel that upcycling activities within your company is a challenge?	6
Q3: There are insufficient opportunities to learn about industrial waste.	6

Figure 4.24 Preliminary survey of Test 3

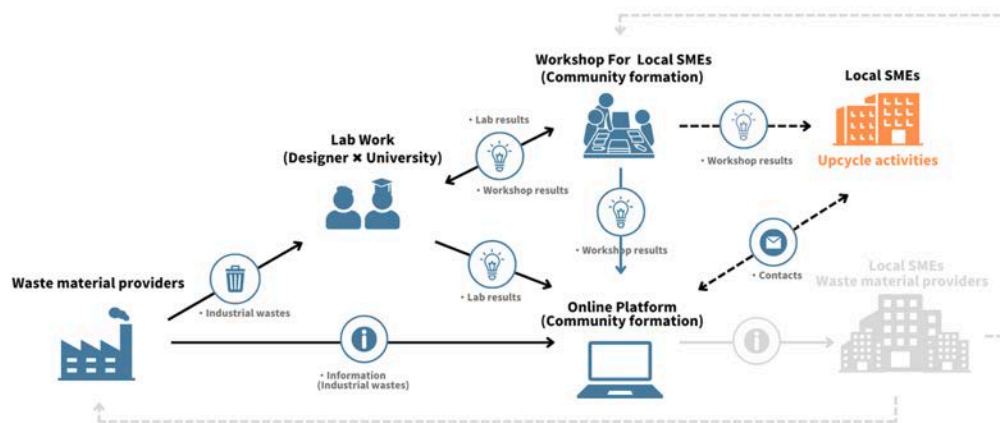


Figure 4.25 Verification flow for Test 3

4.4.3 Objective

The purpose is to test the effectiveness in raising awareness of industrial waste in the community, furthermore, to test the effectiveness as an inspiration for idea acquisition regarding their own upcycling activities. Finally, to test the effectiveness of an online platform.(Figure 4.25)

4.4.4 Workshop process

Step 1: Introducing the concept of cycle project

As mentioned above, it begins with an introduction of project concepts and activities.

Step 2: Introducing Re-Fabrication-Lab

Same as mentioned above, the collected waste materials were categorized by labels, participants were requested to observe them one after another, it then explained where the waste materials came from and what kind of manufacturing process they were generated in. Afterwards, visitors were able to hold and look at Re-Fabrication-Lab's lab work that made use of those materials.

An instruction manual was available for each of the processing methods, in this case, visitors could learn not only about the works but also about the processing methods. Items and local industrial waste samples used throughout this lab work were the same as in 4.3.4.

Step 3: Ideation process

As in the previous session, this time, the participants conducted ideation while having discussions on lab work, processing methods and upcycled products that can be created by applying waste materials from other companies to their own upcycling activities(Figure 4.26).

The representative presented his acrylic waste materials from his company. Therefore, all participants were able to actually look at them and brainstorm how the materials could be combined with each other.

The process consisted of the following:

- 1 Which piece of work in lab work are they most interested in.
- 2 Ideas and processing methods in the lab work that apply to own upcycling work.
- 3 Waste material samples from other companies that combine with their own waste materials.



Figure 4.26 A photograph of ideation process

	(1)	(2)	(3)	(4)
Participant	⑥	⑥	Japanese Paper	<ul style="list-style-type: none"> • I think paper and acrylic work well together. • I think it would be possible to create a single board by combining Japanese paper between acrylics. • If acrylic is mixed with other plastic waste materials and hardened, it would turn into a beautiful piece of work, as acrylic can also be dyed.

Figure 4.27 Results of ideation process

4 Specific upcycled products and design thoughts.

This figure below demonstrates the results of the ideation process(Figure 4.27).

Step 4: Validating the concept of online platform

After the workshop, the participants were also asked to conduct prototyping of the ideas generated in the workshop and share the prototyping results through the form on the platform to validate the platform.

The platform we offer consists of the following contents;

- Sharing of information on industrial waste in the region

- Archive of Re-Fabrication-Lab activity reports/results
- Archive of previous workshops
- Contact form for ongoing post-workshop support (Encompassing prototype progression, consultation on waste materials, meeting requests, workshop planning consultation, etc.)

Prototyping was made feasible as the featured company had its own manufacturing studio, with the equipment and ideal location for immediate prototyping when it comes to processing their own waste acrylics.

Participants were eager to experiment with Japanese paper and thread sandwiched between acrylics and worked with in-house craftsmen. Simultaneously, they came up with the idea of applying this technique to make designs by blending small parts of Japanese paper, thread, and other scrap materials with acrylic. The outcome was positive, participants were motivated to engage actively in prototyping in the future(Figure 4.28).

Afterwards, participants reflected on each part of the platform(Figure 4.29).

We found that the participant was constantly seeking to obtain information about other companies' waste materials, while at the same time discovering opportunities to make his own waste materials known to others. There seems to be a desire for a wide range of ideas from the community and a desire to create things together.

Furthermore, he stated that he is not buying or selling his own waste materials. As there is no guarantee on the amount of scrap wood produced, as well as troubles in financial management. However, he was interested in the Re-Fabrication-Lab and would like to launch workshops within his own company and gather upcycling ideas for the future. This originated from a desire to learn more about the various waste materials in the region, the possibility of new manufacturing through collaboration and the value of expanding their network.

4.4.5 Survey and evaluation

Afterwards, we reviewed the work and conducted a questionnaire and interviews.

今回の連絡内容について以下からご回答ください*

プロトタイプ進捗報告

廃材に関する相談

ミーティングの希望

ワークショップ企画相談

その他

具体的な内容をお書きください

こんにちは！
早速やってみたので写真送りますね。
このまま壁に飾れるくらいいい感じです。
2~4枚目の写真は、くっつけた後に周りを切ってみました！
最後の写真は、糊の作業の後、一緒にやってくれた作業者が作ってくれたものです。
中に入っているのは、樹脂の切りカスです。これも廃棄物になる物です。製品をカットした時に切りカスが大量に出ます。

画像はこちらをお願いします



Figure 4.28 Prototyping report through online platform

Contents		Comments
Information of own waste materials	○	I need more ideas for upcycling, it would be inspiring if other companies are sharing their ideas.
Information of other waste materials	○	There is no opportunities related to learning about other companies, neither materials nor the methodologies, those information should be made available.
Buying and Selling of Waste Materials	×	Our waste materials varies depending on different period, which makes it difficult to guarantee or keep the output consistent.
Re-Fab-Lab work	○	Lab work is interesting and inspirational, new ideas are always welcomed.
Information of workshop	○	If there is another opportunity for ideation, I would like to participate and make contributions.

Figure 4.29 Feedback on platform contents

Quantitative approaches

A six-point rating scale was applied for measurements, ranging from Strongly Disagree to Strongly Agree.(Figure 4.30)

The survey results presented an optimistic outlook on upcycling. The experience of the workshop led to their actions for upcycling practices, which were then communicated through the online platform, the platform had started to bridge the gap between companies and industries.

We were able to provide an opportunity for them to grow their interest in local waste materials and incorporate them into their own upcycling efforts, which facilitated their upcycling activities. Our proposed concept was effective in supporting them regarding upcycling activities.

Qualitative approaches

In response to Q1(Figure 4.31), a participant raised the issue of well-established SMEs in the Nagoya suburbs. He specified that many of those SMEs had started since the 1970s or so, where business owners and individuals from that period of time are reluctant to engage in upcycling or any innovative manufacturing activities.

Quantitative Survey	Participant
Q1: Through the ideation process, I was able to gain new insights and ideas on how to combine and process waste materials for the development of upcycled products.	6
Q2: Rather than just looking at the waste materials itself, it would be more helpful to look at the product or combined samples to generate new ideas.	6
Q3: I would like to experiment and prototype by incorporating the introduced processing methods for my company's upcycling.	6
Q4: I would like more opportunities to learn about industrial waste materials from other companies and other industries.	4
Q5: We want to create upcycled products that transcend industry boundaries, combining other companies' waste materials with our own waste materials.	6
Q6: We want our own waste materials to be used for upcycling ideas for other companies and for ideation in the Re-Fabrication-Lab.	6
Q7: Online platforms are effective for their own upcycling activities.	6
Q8: I would like to check the website for information on local industrial waste materials and Re-Fabrication-Lab's lab work for my company's upcycling activities in the future.	6

Figure 4.30 Quantitative survey of Test 3

Qualitative Survey
Q1: What motivates you to engage in upcycling activities?
Q2: Please feel free to share your thoughts on today's event.
Q3: Due to time constraints, you were the sole participant this time, is there a common awareness within the company relating to upcycling own waste materials?
Q4: How would you like to apply the insight and ideas you gained today in the future?

Figure 4.31 Qualitative survey of Test 3

The participant argued that well-established companies tend to underestimate the value of such activities since those activities are unprofitable. He also suggested that middle-aged individuals with proficient expertise should devote greater effort to engage in activities and initiate change in the industry on behalf of older generations. This is necessary for the survival of society, the participant manifested an interest in inspiring the current generation to be proactive in pioneering activities and connection with the outside world, instead of being driven by profits.

Furthermore, the participant extended his attention on the importance of decision-making within the company, he stated that people with empowerment should intensively contact with the outside world, broaden the scope of their activities and create products from scrap wood, etc., in order to change the consciousness of the older generation and the industry as a whole.

In Q2, the participant gave his honest impression in the course of ideating with students who were Cycle Project members, he expressed his satisfaction and interest in connecting with outsiders through waste materials from his company, as well as the uplifting Q&As and discussions that ensued. The session was not for business purposes only. Therefore, there was no bias and restrictions. Despite having the expertise and knowledge in acrylic materials, it was an enlightening session for gaining knowledge of other materials, encompassing processing methods with designers' perspectives. The feedback gathered from the session confirms the validity of our proposed concept.

Q3 revealed that while the participant noticed and acknowledged upcycling and waste issues, the company as a whole had low awareness or interest.

In addition, he realized the fact that owning a factory can accelerate the process of prototyping his ideas. He believed that a promotion of proactive activities will lead to greater interest among other employees as well. Thus, when there is a disparity in awareness within a company, external support is requisite.

In Q4, he expressed an interest in broadening perspectives through students and designers to practice idea generation and commercialization. Throughout the workshop session, he was able to explore other waste materials from other companies, which helped him foresee new possibilities regarding their upcycling activities. Since the participant has their own platform for sales, once upcycling commercialization is delivered, they are thinking of selling products there on a

trial basis.

For that reason, he would first like to promote upcycling by incorporating waste materials from other companies, this would presage a rise in prototyping and idea generations. This presents a constructive outcome of the series of sessions mentioned above, our concepts were helping to promote upcycling, which ultimately resulted in a solid vision for his own upcycling activities.

Findings

【Verification against objectives】

We have found that sharing lab work outcomes and learning about local industrial waste materials have been the key factors contributing to a positive attitude toward upcycling, regardless of industry.

Another finding was that prototyping can be exceptionally quick when one has certain decision-making authority and initiative, as the participant in this workshop did. Additionally, it was confirmed that the platform would be effective for sharing local industrial waste, companies would like to analyse information about their own waste materials.

We were also able to verify the effectiveness and necessity of post-workshop connections and support through the platform. It was evidenced that there is a need for an online platform, a collective space for diverse voices and opinions.

The proposed platform was utilized effectively after the workshop as the participant was continuously seeking to share ideas and information about other companies' scrap materials, as well as information about his own prototyping. He responded that he wanted to continue to use the platform to stay connected and informed. Moreover, he indicated an interest in face-to-face connections for exchanging ideas and developing ideas collaboratively.

【Awareness】

We also found that having a strong problem-solving awareness of the industry drove the participant's actions in making use of things as well as pursuit of achievement rather than profit.

Before participating in the sessions, the participant showed his interest and curiosity in upcycling, yet could not relate to his own business. However, through the work, he had the access to new local materials, processing methods and de-

signer works at the Re-Fabrication Lab, as well as discussions with us, he began to genuinely enjoy prototyping items and started to share a variety of ideas.

Upcycling ideas are not necessarily limited to the final product, even little crafting processes such as mixing, pasting, cutting, and heating materials can suffice.

Nevertheless, we have also asked questions about the acrylic material, for instance, we proposed questions on dyeing acrylic, grinding acrylic to pieces, combining acrylic with other fabrics and blending plastic into acrylic. The participant said that the questions were surprisingly new and he suggested carrying out tests to comprehend. He then gradually began to give opinions on different material combinations, such as to try putting Japanese paper between acrylics and sticking them together. This entails his creativity and imagination blossoming. He also wanted to experiment with ideas in practice. “I will try it in my studio when I get back.” He told us.

Through a series of such efforts, we found that opportunities such as a brief lab space for ideation, similarly to DIY, were effective in promoting upcycling activities, either as a catalyst for innovative thoughts or as a pursuit of enjoyment.

【Summary】

In summary, this series of project concepts, workshops and platforms contributed to supporting and facilitating participants’ upcycling activities. Future steps are to expand the scope of activities, engage with individuals from a wider range of regional industries and businesses and continue on supporting companies with upcycling challenges.

For the purpose of promoting upcycling within the region, more options of combination should be offered to companies when combining waste materials or practicing upcycling. This will help to boost the local economy owing to greater occupancy of upcycling.

Test 4			
Objective	Target	Evaluation Methods	Work contents
<ul style="list-style-type: none"> • Connect with companies that have challenges with waste materials and upcycling • Examine the need for activities from diverse industries 	<ul style="list-style-type: none"> • 20 people from various industries or businesses in Nagoya, 	<ul style="list-style-type: none"> • Survey • Interviews • Observation • Video Shooting • Photography 	<ul style="list-style-type: none"> STEP1: Talk session and Q&A STEP2: Free Discussion STEP3: Surveys and Interviews

Figure 4.32 Overview of Test 4

4.5. Test 4

4.5.1 Overview

The talk session at FabCafe Nagoya was held with 20 people from various industries or businesses in Nagoya, who were also interested in the circular economy, circular design and the Cycle Project.

Participants included representatives from manufacturing, finance, government, designers, and independent creators. FabCafe Nagoya cooperated with us to promote the event, as well as gathering visitors and providing the space. Two Cycle Project members participated as presenters.(Figure 4.32)

4.5.2 Objective

The results of workshop 1 to 3 confirmed that the introduction of industrial waste in the region, the sharing of a series of lab work activities and an online platform are accelerating upcycling practices among SMEs, this further extends to incorporate other companies' industrial waste into their own upcycling activities. Therefore, the online platform is exceptionally practical for promoting such concepts.

In order to develop a community-based lab and expand the scope of our activities, we held this talk session to share our project concept with a wide range of industries in Nagoya in order to obtain their feedback.

This talk session was primarily a survey of issues on industrial waste materials

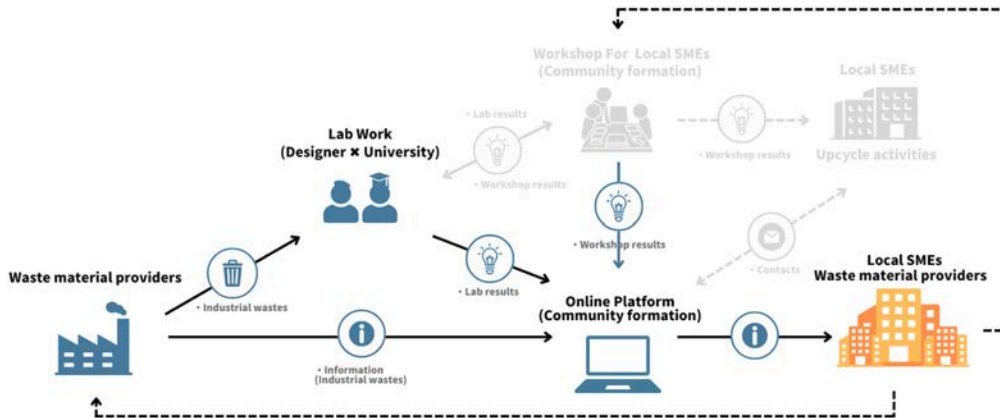


Figure 4.33 Verification flow for Test 4

and whether they could be provided as materials for lab work, the survey simultaneously served as an examination of the level of interest in the Re-Fabrication-Lab and participants' hopes for the Cycle Project as a future development.(Figure 4.33)

4.5.3 Session flow

Part 1: Talk session and Q&A

A presentation was made to enable the local community to understand the Cycle Project's activities. We introduced our concept, our activities, the fieldwork we have implemented, the industrial waste we have collected, our lab work, our online platform for local industry, and our vision for an upcycling community in the area(Figure 4.34).

After the series of presentations, a twenty minute Q&A session was held. Here, participants were free to propose questions and engage in open discussion(Figure 4.35).

Several participants were not familiar with the meaning of upcycling. In addition, most of the participants were interested in upcycling yet had not practiced it. Therefore, many asked questions about how they collaborate with designers, how they experiment, and how they collect waste materials. Hence, we sensed



Figure 4.34 Talk session

that upcycling industrial waste materials within the manufacturing industry in this region does not yet seem to be widespread.

Part 2: Open discussion

This session was dedicated as an opportunity for us to have face-to-face discussions with participants, gather their feedback, and further explore their needs.

We displayed design samples and ideas generated from our lab work at Re-Fabrication-Lab on tables where participants were allowed to touch and manipulate as we discussed them.

Below are excerpts from the participants throughout the talk session.

【Theme 1: Industrial wastes】

- Participant A (Plastic-based manufacturing): *“Our company manufactures plastic tags, and we have a large amount of waste from the manufacturing process. Could you use those for lab work?”*
- Participant B (Composite materials manufacturing): *“My company has a large amount of waste. It is a composite material of Japanese paper and plastic, so it is not recyclable. Can you find some new use or idea for this kind of material in your lab work?”*



Figure 4.35 Q&A session

- Participant C (Automobile manufacturing): *“I am in the automotive manufacturing industry and have a large amount of fine metallic waste material that has to be landfilled. Metals are difficult to process, if you give us an idea, we can do some actual processing. Can we do something together in that way?”*
- Participant D (Aluminum-based product manufacturing): *“Our company manufactures aluminum-based decorative products. We have a lot of aluminum scrap and I would like to provide a sample.”*
- Participant F (Nagoya city council): *“Since I am not a manufacturer, I do not have my own waste material. However, I am very aware of the issues as I get to see waste materials from diverse companies. In particular, I know many materials that are difficult to recycle, such as composite materials and metals, so I thought it would make sense if you could suggest interesting designs and possibilities and work on them.”*

【Theme2: Re-Fabrication-Lab】

- Participant C (Automobile manufacturing): *“I would like to see suggestions on how to mix metal wastes with other materials, or how to utilize it in*

new designs. When I saw this piece of plastic lab work, I thought that if I could devise a way to melt it like this, I might be able to create interesting presentations with metal as well.”

- Participant D (Aluminum-based product manufacturing): *“When I was looking at the lab work, I thought that if we can create beautiful designs with plastic waste, we can combine this with our own waste material to create interior designs. For example, by sandwiching the lab work between our scrap aluminum pieces, we could create a beautiful wall hanging.”*
- Participant B (Composite materials manufacturing): *“If you can show us lab work (the exhibition) like this, we can broaden the range of ideas. It made me realize that even with a single material, various designs can be created under different processing methods.”*
- Participant E (Finance industry): *“I think that there is no clear goal in this activity. I know there are many industries in this area and many different types of waste materials, but if we don’t have a more specific goal, nothing will be profitable.”*
- Participant G (Independent designer): *“I think it would be very beneficial for designers to be involved with companies in this way, the impact of such involvements would be strong. Nagoya is an area with a dominant manufacturing industry background, it comes with substantial industrial waste in the area. I think there is a high demand for the kind of regional lab you are trying to do, but if you want to do something like this on the level of waste reduction, I think you need to take dramatic action to get the Japanese government involved.”*
- Participant H (Independent designer): *“Let’s do it together soon! I am interested in various scrap materials and would like to make things with students. I’m interested in upcycling too, and I’m actually making a lot of things. I have never done upcycling of industrial products, but I am interested in materials.”*

Quantitative Survey
Q1: The Re-Fabrication-Lab's lab work was inspiring and helpful for developments of upcycling
Q2: Greater interest in Cycle Project activities and willingness to donate materials
Q3: Rising willingness to learn and share online through the Cycle Project's online platform
Q4: Greater willingness to work across industries and upcycle incorporating other companies' waste materials
Q5: Greater willingness to obtain information on upcycling activities for my own company, as well as lab works by designers and students.
Q6: Greater willingness to prototype or commercialize if applicable lab works or materials are found on the platform
Q7: Greater willingness to participate in a hands-on workshop with designers, students or other companies

Figure 4.36 Quantitative survey of Test 4

Summary of session

During the discussion, those in the manufacturing industry were highly sympathetic to the industrial waste issue. Since we are collecting and experimenting without specific material requirements, the entry barriers were set low initially, this would motivate individuals and corporations to provide samples. All participants seemed to genuinely enjoy making use of things and wanted to explore the undiscovered possibilities, rather than commercialization or profit. This phenomenon was also evidenced among designers.

Correspondingly, feedback from the perspective of profitability and economic growth, such as the financial industry suggested, did not seem to perceive the value of upcycling. Thus, the standpoints regarding industrial waste materials still vary dramatically across industries.

4.5.4 Survey and evaluation

Afterwards, we reviewed the session and conducted a questionnaire and interviews.

Quantitative approaches

A six-point rating scale was applied for measurements, ranging from Strongly Disagree to Strongly Agree.(Figure 4.36)

In Q1, over 87 percent of participants (7 participants answered “6”, 1 participant answered “4”) agreed that the session was helpful for developing their own upcycling activities, who were inspired after being involved in Le-Fabrication-Lab’s lab work(Figure 4.37). The shared ideas and processing methods also made contributions. The lively discussion sessions generated valuable ideas, having a touch of design samples from designer and student proved to stimulate creativity across industries.

In Q2, it demonstrated the participants’ interest in Cycle Project activities and their willingness to donate waste materials for the lab work. The results are as follows: 11 participants agreed on a greater interest in such activities, while 1 participant was conservative(Figure 4.38). During the discussion, most participants expressed a desire to have their own waste materials used for lab work as well, and to provide them as samples free of charge. In fact, this phenomenon was recurred in the survey. Waste materials were collected through personal exchanges for verification purposes so far. However, as expanding the project, an automated service such as a collection box should be set up at the FabCafe to collect materials efficiently and cost-effectively.

In Q3, it tested participants’ engagement regarding the Cycle Project’s online platform and the consciousness of sharing information about their own industrial waste, as well as challenges encountered(Figure 4.39). Responses to this question were categorized, participants on one hand would like to be publicly available, to attract individuals from other industries to know about their waste and to explore possibilities for collaboration. On the other hand, those who were reluctant to share expressed a concern that they did not want to be known by an unspecified number of people, it posed a challenge of large numbers of contact where companies would be unable to handle. They then commented: “I am open to being personally involved with the Cycle Project and participating in the project.” From the survey result, it demonstrated the need for holding discussions on posting information about waste materials online and the purpose of it. Among those who would like the information to be posted, we asked them to what extent they

would like the information to be shared, many responded that they did not want to actually sell the information. They then added, “First, to let people know that there is this kind of scrap wood in the community. And if they feel there is potential, it would be most desirable to have them contact us through the cycle project.” This was an opinion expressed in the survey for the concept design of the cycle project. Nevertheless, when companies communicate with each other, it is strenuous to pursue pure craftsmanship as most businesses are essentially driven by profits. A university project would be desirable as an intermediary of connections.

In Q4, it explored participants’ desire to work with different industries and upcycle incorporating other companies’ waste materials(Figure 4.40). Throughout the session, it was clear that our proposal was well-conveyed through the sharing of concepts, the display of samples and the processing of different materials etc. In particular, since most of the participants were from the manufacturing industry, many of them noticed the challenges of industrial waste and were interested in upcycling, yet have not taken actions. The results below indicate the great impact and significance of this project.

In Q5, it examined participants’ attentiveness of learning information and lab works by designers and students through the online platform, thus making contributions to their own company. Survey results indicated that even those who were reluctant to post their own waste materials were eager to study other companies’ waste materials, and to be informed about industrial waste materials in the area, which often leads to ideas and innovations(Figure 4.41). With the majority of respondents agreeing, it clearly highlights the importance of the platform. In the future, it will be necessary to proceed with the design for the proliferation of the platform and focus on public relations activities under the cooperation with FabCafe Nagoya.

In Q6, it examined participants’ willingness to prototype and commercialize with the Cycle Project members if they have successfully gained inspirations from lab works or applicable waste materials on the platform(Figure 4.42). When we explored whether participants wanted to be involved only in providing scrap wood or whether they were willing to perform wholeheartedly throughout ideation and workshops, most were motivated to work together collaboratively and had shown a

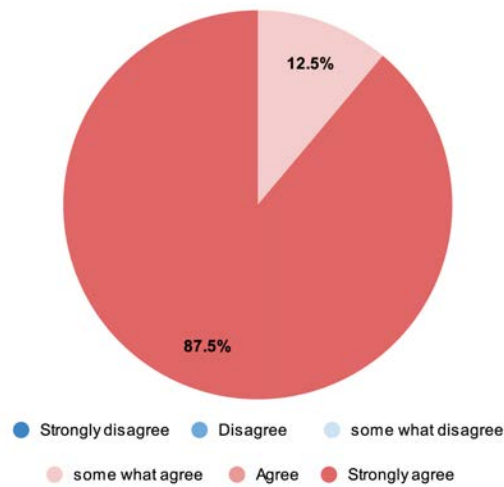


Figure 4.37 Q1: The Re-Fabrication-Lab's lab work was inspiring and helpful for developments of upcycling

willingness to commercialize their products. While not mainly seeking immediate profit, it is evident that the companies were motivated to actually produce results. Specific workshop designs are needed, such as reaching an objective by organizing multiple sessions instead of a single session.

In Q7, the survey questioned participants on willingness to participate in a hands-on workshop with designers, students or other companies to discuss the possibility of upcycling industrial waste materials internally or within Nagoya (Figure 4.43). The chart below illustrates that most respondents were highly motivated to participate in workshops and ideations for upcycling, this is not limited to their own companies but also other companies in the region. In order to promote regional upcycling, it would be desirable to gather such highly interested participants and collectively conduct ideation work and manufacturing using collected waste materials in a co-creation process.

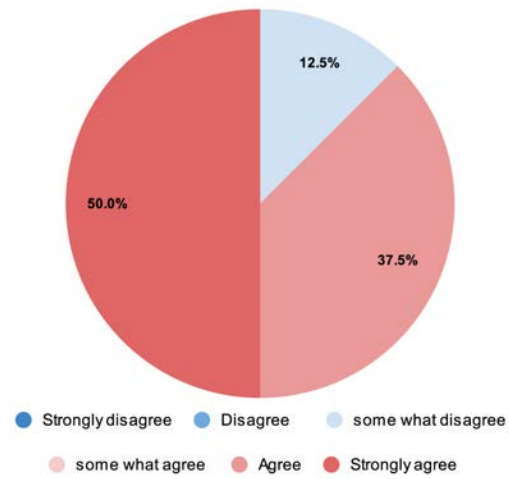


Figure 4.38 Q2: Greater interest in Cycle Project activities and willingness to donate materials

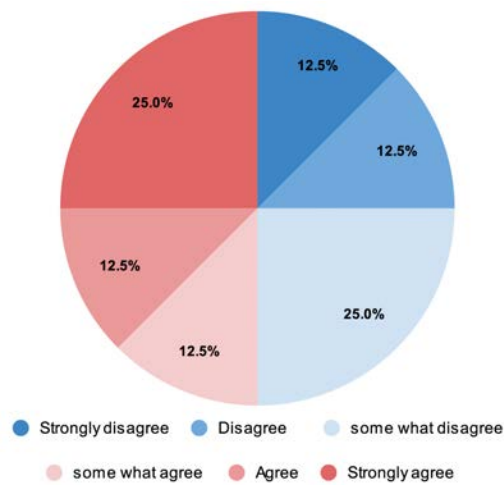


Figure 4.39 Q3: Rising willingness to learn and share online through the Cycle Project's online platform

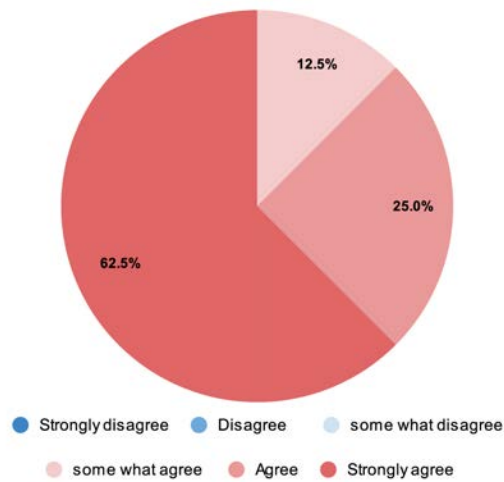


Figure 4.40 Q4: Greater willingness to work across industries and upcycle incorporating other companies' waste materials

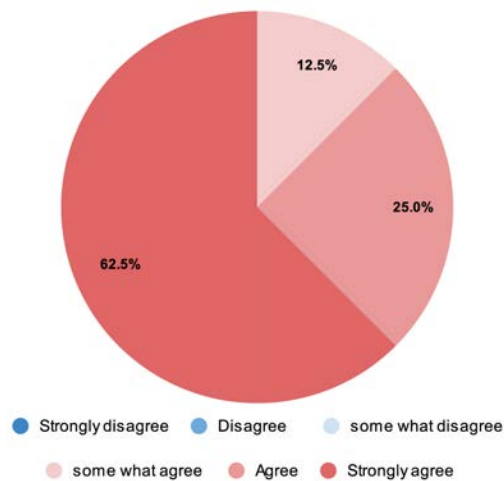


Figure 4.41 Q5: Greater willingness to obtain information on upcycling activities for my own company, as well as lab works by designers and students.

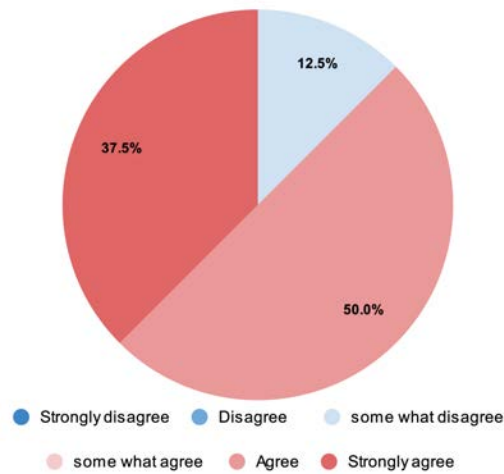


Figure 4.42 Q6: Greater willingness to prototype or commercialize if applicable lab works or materials are found on the platform

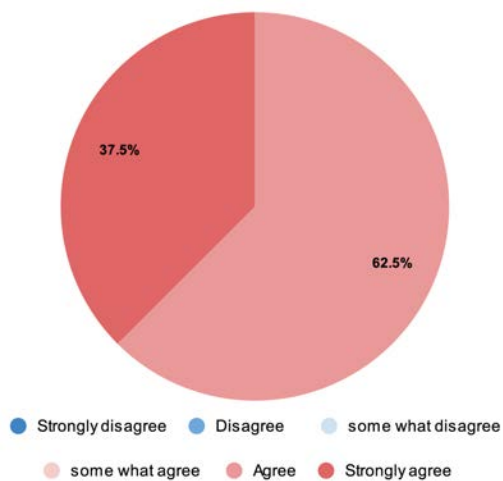


Figure 4.43 Q7: Greater willingness to participate in a hands-on workshop with designers, students or other companies

Findings

【Verification against objectives】

SMEs tend to encounter challenges in upcycling with industrial waste materials, yet they have not been able to take concrete steps to make use of those materials in their manufacturing activities. In this context, this project suggests that creating an open regional platform contributes to the upcycling of local SMEs, where companies can benefit from discovering new value in industrial waste materials, furthermore, our proposal aims to create a mechanism that facilitates entries into upcycle activity. The form of participation in the project differs between those who want to participate in the actual manufacturing and those who provided industrial waste materials. Since there are a number of individuals and corporations who are willing to actually work and produce collaboratively, it proposes a topic for further discussion as to what direction we should take as a regional open lab. It is desirable to operate both a space for discussion and ideas and an online platform for sharing information and spreading the outputs from activities.

【New additional interests from other sectors】

In this talk session, we had people from the financial and government sectors interested in our activities and discussions. By localizing our activities in the Nagoya area, we were able to attract participants through local connections, the response was beyond expectations. That indicates how highly aware we are of the issues related to industrial waste materials and the significance of practicing upcycling.

【Summary】

The project concept of collecting industrial waste materials, overcoming challenges confronted by local manufacturers and exploring the potential for upcycling with designers and students was well performed by the participants. As can be seen from the content of the discussion, many of the participants expressed their desire to provide their own scrap wood as material samples.

In order for us to localize this project concept to the community, more companies are required to be involved in the project and thus expanding connections and network. For this reason, we discussed with our external partner, FabCafe Nagoya, to install collection boxes with equipment at FabCafe Nagoya, which can efficiently collect materials in the future. The objective is enabling local compa-

nies to drop off their waste materials or samples at FabCafe Nagoya. This will serve as a practical action and optimism for future upcycling.

Chapter 5

Discussion

5.1. Overview

In Test 1, a session was held to provide companies with ideas for upcycling their own waste plastic materials, and to experience lab work with designers using plastic waste materials from other companies. The objective was to ignite an interest in learning other companies' waste materials and to find new directions for their own upcycling practices, while enabling them to understand various design expressions can be created by melting and processing plastics in different ways. It verifies the contribution of growing knowledge and interests. However, developing ideas for actual utilization of waste materials still remains challenging, with issues of disparities in awareness and internal conflicts.

In Test 2, it comprised a survey of waste materials from participating companies and materials used for collective ideation, this had helped participants to generate upcycling ideas and resulted in better lab work performance. The participants expressed a need for a platform to constantly obtain information on materials and lab work, and to share issues with a wider community of companies.

Test 3 verified the positive effects of the online platform as a tool for ongoing support after the ideation workshop and for obtaining information. However, some participants mentioned that the contents of scrap lumber was not for sales purposes, it posed a challenge where companies are unable to handle the deliveries of scrap lumber between individuals. It was necessary to bridge the gap between business-to-business exchanges of waste materials. Furthermore, while profit-related bias cannot be ignored in interactions between companies, having a university or carrying out a lab project as an intermediary can encourage collaboration and lower the entry barriers, it allows more companies to participate in upcycling.

In Test 4, in order to further explore the community-based concept and potential of waste materials from regional companies, the test offered more material options for companies to contrive new combinations, a talk session was held with a wide range of industries in the region to share firsthand opinions and discussions in the field.

The test results revealed challenges confronted by companies with their own industrial waste, while indicating a greater momentum for companies to be involved in upcycling activities, whether as waste providers or actors. In order to create a system with mass industry and region coverage, it is necessary to establish a collective platform and ongoing activities of the lab work, to regularly gather local companies to further develop through instructive events such as the ideation process mentioned.

5.2. Views from designers

Through an interview with Ryota Yokozeki, a designer who worked on the project with us, we asked him to convey the findings and insights he gained from those activities, as well as his visions and challenges for the future.

Findings and insights gained

- *“The manufacturing industry is perceived to have expertise on creating things, yet they do not know how to destroy things. I used to be a product designer for a large company, but I had no idea what kind of plastic was being broken down and how it was disposed of until I started this project. I learned a lot of new things by actually seeing factories and the recycling industry. On top of that, I felt that we should definitely consider mass production and the utilization of waste as two different things. I would like to find ways to utilize waste materials as “research” without getting caught up in mass production methods. It would not be interesting if everyone did the same thing. That is why I embrace the value of methods such as handcrafted arts and pieces, which are done with a pursuit of a designer’s point of view and sense.”* (Ryota Yokozeki)

Yokozeki was not looking to profit from this activity, yet he was deeply impressed by the insights and discoveries he gained from this series of activities, he emphasizes the importance of such activities in the future as a role of designer.

In this project, the activities might be a failure if we stress “sustainability” exceedingly. As project members, we sense that our activities maintain a fine balance between “hypocrisy” and “justice”. However, that is why it is essential to form a community of actors with a common understanding, such as companies and designers, to focus on “putting the spotlight on industrial waste materials that have not found any use”, and to cultivate a variety of discussions.

Vision and challenge for the future

- *“Now that we are in the transition period to the SDGs and a recycling-oriented society, SMEs are especially required to be proactive in their activities. However, they face various hurdles in engaging in such activities. Therefore, I strongly feel the need for designers to approach corporations, form proposals and be actively involved. We would like to involve many people in our Cycle Project in the future. There are many designers and architects around us who are interested in this project. However, I feel that it is important to be able to see profitability as a hurdle to getting them involved. At present, there are not many people like myself who can focus on experimentation without desires of profit. I would like to create a future in which it becomes commonplace for a variety of people to make things out of waste, and handmade crafts that can be cyclically used like natural things, just like the natural cycle.”*(Ryota Yokozeki)

The fact that designers find this activity meaningful and other creators are also interested proves that this campaign was exceptionally valuable.

Involving experts from the manufacturing industry in the lab work will foster new possibilities for industrial waste materials, this project also has the potential to serve as a foundation for connecting SMEs with experts. It is crucial to pursue such possibilities as the direction of this project has been consolidated.

Summary

It is clearly specified that participating in this project as a designer, conducting fieldwork at companies, lab-working with universities and workshops have broadened the sphere of activity and led to new insights and discoveries. Yokozeki also highlighted the significance of such activities for designers, suggesting that he would like to further expand the scope of his lab work activities in the future.

The purpose of lab work is not only to write proposals for corporate upcycling by experimenting with processing methods and exploring new design presentations by combining materials, but also to provide an opportunity for individuals to network as well as to serve as a place for own research and development.

Yokozeki also suggested launching exhibitions of those design works outside of Nagoya on a regular basis. In this respect, it enables people outside of Nagoya to know about the current circumstances in Nagoya and obtain new clients, who would like to utilize such materials and designs after seeing the lab work.

By establishing a guideline for such activities, there is a possibility that other designers and creators will grow their interest in the lab work to embrace waste materials, this project will become increasingly active. This entails the possibility of a new field of activity and a community for designers.

5.3. Findings

According to the surveys covered in this study, the lack of opportunities to learn about industrial waste materials from other companies and industries remains as the most critical challenge. In addition, companies engaged in upcycling stated that they encounter limitations and problems in defining new values of their own waste materials. Therefore, this study examined the support and mechanisms required to practice upcycling by combining waste materials from other companies.

Based on the results of the verification, the first step is to provide options in consideration of combining diverse local waste materials. When companies find it difficult to engage in upcycling using their own waste materials exclusively, one possible reason is that they are deficient in ideas on how to make the best use of the waste materials.

In this study, we provided companies with lectures on sharing other compa-

nies' industrial waste challenges, opportunities to observe other companies' waste materials in their hands and an online platform for posting information about industrial waste materials in the region. As a result, companies were able to apply the diverse waste materials as resources, which then inspired them to come up with ways to utilize their own waste materials for upcycling.

Secondly, the program provided ideas on processing methods when combining waste materials. SMEs do not have many opportunities to obtain such expertises, they are unable to devote time and budget to their own R&Ds. In this case, this study was conducted in collaboration with a university and a designer. The university and designers conducted laboratory work using collected waste materials and shared the results they generated with companies. Consequently, we were able to help companies to understand the potential of materials and by acting as a bridge to incorporate other companies' waste materials into their own upcycling efforts.

Although some of the waste materials were provided by local makers, it is necessary to design a platform for further provision. This entails a need for an online platform to share information on industrial waste materials held by companies, through the platform that was launched on a trial basis, many companies expressed a desire to take part in it. It brings up the potential for creating new connections through industrial waste materials.

In addition, workshops had helped companies to promote their upcycling activities by processing local waste wood together with designers, and had provided them with samples of these processed materials and ideas. Furthermore, we had connected with them after the workshop through an online platform and offered them opportunities to share information and issues. Such workshops require discussion and design as more companies enter the project, encompassing how to provide support to each company, how to construct the content of the workshops, and what the achievements of each workshop should be.

The significance of designers' participation in the lab work was also addressed. It is necessary to develop this experimental effort into a community where designers can be inspired to bring ideas out, which will lead to new connections and clients.

5.4. Limitation

Due to the limited duration of the study, it was not possible to validate long-term upcycling support in this study. In addition, the types of industrial waste materials procured for lab work were limited.

For further analysis in the future, it will be necessary to design and schedule a long-term collaboration with companies, which simultaneously operates with the lab work. This would cover greater swathes of companies in Nagoya and help to highlight the issues efficiently.

Nevertheless, it can be suggested that by integrating this concept into the community and sustaining the activities, local SMEs may incorporate local industrial waste materials into their upcycling activities, and collaboration among companies through industrial waste materials may be propelled.

In order to realize the win-win-win concept set forth in this study, it requires local waste providers, designers and local SMEs to be involved in long-term research activities, thereby pursuing collective interests and achievements in upcycling.

5.5. Launch of new service

The results of this series of verifications, as well as the results and feedback obtained from the Test 4 talk session were highly valued, the “Local leftover material drop-off and pick-up service” was launched at FabCafe Nagoya(Figure 5.1) [9]. The vision of this platform is to connect people to people, people to things and things to things through industrial waste. This is a service platform of collecting industrial waste materials from companies in the Nagoya area and it addresses consideration on new ways to utilize and the possibility of upcycling.(Figure 5.2)

With the launch of this service, companies that share our concept can offer us their industrial waste materials, we then utilize it to collaborate with designers, creators and universities to conduct processing experiments, exhibition and design workshops. Correspondingly, we offer waste materials as options of material combination to companies who are interested in upcycling.

The platform actively engages with companies and people who want to learn more about industrial waste materials and use them in their own creative activi-

ties. The establishment of a community-based lab platform within the region will have a significant impact on resolving industrial waste challenges.

のこりもの循環サービス / FabCafe Nagoya

愛知県名古屋市中区 FabCafe Nagoya / 企業さまの端材や廃材など“のこりもの”をFabを通して循環させるプロジェクト「のこりもの循環サービス」に関するご案内

のこりもの循環サービス

「余ったアクリルの端材を、何かに使ってくれない?」
「他の端材と合わせて、一緒に何かできないかな?」

新しいアイデアを生み出すため、気軽にものづくりに挑戦してもらうため、製作のため、研究のため、FabCafe Nagoyaは“のこりもの”を通して、クリエイターや企業間など異業種の人と人をつなげ、知恵・アイデアの循環を行い、新たな価値創造のタネをまくため、アクリルや木材などの端材を提供しております。

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1957年創業、プラスチック製の店舗什器、内装材等の製造から産業機械等のプラスチック部品を製造しています。
その中でも、プラスチックシートの大型成形、少量多品種を得意とし、コンビニ・自動車販売店のブランドサインや半導体製造装置部品、医療機器、自動車、鉄道、楽器、物流等の様々な分野へ製品の供給をしています。
その他、多くの分野で蓄積してきた技術を使い、アクリル樹脂を使用したインテリア雑貨の自社開発をし、「NI STYLE」として販売もしています。

Webサイト

「のこりもの」のご相談、お待ちしております!

新しいサービスや事業を生み出すきっかけは、無類なものだったり、意外な視点だったりします。そんなきっかけを探るためにも、端材や廃材の活用に興味がある企業のみならず、サーキュラーエコノミーに興味のあるみなさま、まずは“のこりもの”をFabCafe Nagoyaにお持ちしませんか?

ご相談・お問い合わせはこちら

このサービスは、循環型社会の実現のため、アップサイクルやリサイクルなどを考えてはいるものの、「一社で出る端材をそのまま活用しても、プロダクトやサービスの価値を感じる」という、企業さまやデザイナーさまの悩みから生まれました。

新しいものを生み出すためには、トライアンドエラーがとても重要です。そこで、様々な異分野を絡めさせ、クリエイティブと循環をつなげるサービスを通して、新たな価値創造の場を創設することにより、FabCafe Nagoyaを通じたコミュニティづくりにもつながっていく試みです。

イメージは、芸術系大学のアトリエの一角、好きな素材が使われなくなったパネルなどを活用してアイデア出しをしたり、練習に使ったりしていた、あの「想像を越えて」「自由に発想し」制作する場や「思考する」「創造する」発想の場を、“のこりもの”とともに提供いたします。

企業さまから募った“のこりもの”は、店舗のFabスペース内に設置しています。また、今後は“のこりもの”を使用したプロダクトの一部を展示したり、サービスとして実装予定です! 気になる方は、ぜひお声がけください。

お問い合わせ

Figure 5.1 Local leftover material drop-off and pick-up service [9]

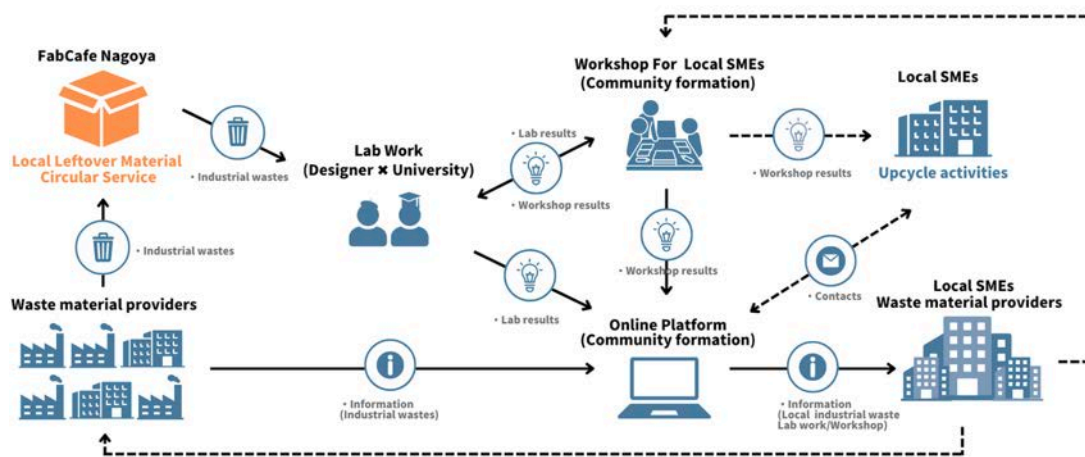


Figure 5.2 Center point to collect the local waste material

The screenshot shows the FabCafe website interface. At the top, there is a navigation bar with 'FabCafe' logo and links for 'Events', 'Open Labs', 'Project Cases', 'Magazine', and 'Branches'. Below this is a sub-header 'FabCafe Open Labs'. The main content area features a large title: '工業廃材を通して、素材の実験的・研究的アプローチやワークショップ手法を模索するコミュニティ' (A community exploring experimental and research approaches to industrial waste and workshop techniques). A photograph of a workshop with various materials and tools is displayed. To the right of the photo, the text 'CYCLE PJ' and a 'Community' button are visible. Below the photo, there is a paragraph of text describing the project's goals and a call to action. A 'Service' section follows, detailing the '循環サービス' (Circular Service) and providing more information. At the bottom, an 'Outline' section lists the project name, description, and organizers: RYOTA YOKOZEKI STUDIO, Future Crafts, and FabCafe Nagoya.

工業廃材を通して、素材の実験的・研究的アプローチやワークショップ手法を模索するコミュニティ

CYCLE PJ

Community

「CYCLE PJ (サイクル プロジェクト)」は、廃材の特性を活かした創造的なワークショップ手法の研究から実証実験、アート表現まで、様々な角度からアプローチを試みるプロジェクト&コミュニティ。

Re-cycle、Up-cycle、Second-cycle、Life-cycleなどの“CYCLE”の視点を持ちながら、どうしたら廃材の長所を活かすことができるか、廃材に新たな意味や意義を持たせられるか、テクノロジーやキットの開発、仕組みやワークショップの実証実験を行います。

一緒に試行錯誤していただける企業のみなさまを募集中です！お気軽にお声がけください。

Service

【のこりもの循環サービス】

新しいアイデアを生み出すため、気軽にものづくりに触れてもらうため、試作や研究のため、FabCafe Nagoyaでは、CYCLE PJにご協力いただいている企業の皆さまの“のこりもの”を通して、クリエイターや企業間など異業種の人と人をつなげ、知恵・アイデアの循環を行っています。

店頭では、アクリルや木材などの廃材を実際に見ることができます。ぜひお手にとってご覧ください。

[サービス詳細](#) →

Outline

名称	CYCLE PJ
概要	工業廃材を通して、素材の実験的・研究的アプローチやワークショップ手法を模索するコミュニティ
オーガナイザー	<ul style="list-style-type: none"> RYOTA YOKOZEKI STUDIO Future Crafts FabCafe Nagoya

Figure 5.3 The local community-based lab [10]

Chapter 6

Conclusion

6.1. Conclusion

Research on industrial waste materials has paid little attention to upcycling as a significant opportunity to contribute to the reduction of waste and pollution. This study aimed to address this knowledge gap by suggesting a concept that supports upcycling for SMEs in Nagoya.

The study employed surveys to analyze and explore the general willingness of business owners to engage in upcycling activities, the survey results presented an overall positive feedback from respondents, illuminating a tendency towards upcycling practices across levels, scales, and sectors. This is also evidenced by the degree of participation and diversity of participants. However, it requires a sort of authority and quick decision-making process within the company in order to carry out upcycling activities efficiently.

For companies who could not afford practicing upcycling, the proposed Cycle Project allowed companies to collect industrial waste materials from companies that cannot afford to engage in upcycling, enabling them to work with designers and other companies in the region to uncover new ways to utilize the materials. Second, the project supports the creation of new ideas and promotes their upcycling activities by introducing local waste materials and processing methods to companies. This has boosted companies' knowledge and engagement regarding upcycling, and has helped companies to define new value in their own waste materials. Finally, the study also established an online platform for sharing information on these series of activities, to inform local businesses and provide long-term support for their upcycling activities.

The Cycle Project reflected a need of long-term support, as upcycling operation is still at the incipient stage. Although we can see emerging efforts from well-

established companies such as Muji Japan [28] and Toyota Boshoku [3], owing to the high cost of operation and stringent entry barriers, support of government and volunteers such as universities or local councils are much needed to make the redesigning process cost effective and successful. To help resolve this issue, this paper suggested launching a community-based upcycling lab, which was led by universities and designers, it allows companies and individuals to brainstorm on industrial waste problem, while lowering the entry requirements for local SMEs, designers and scholars perform as the catalyst of upcycling practices, they also benefit from this research opportunity to gain ideas and clients. Therefore, it is evident that collaborative upcycling reduces entry costs and builds win-win relationships.

This study encountered several setbacks, predominantly regional restrictions and time constraints. Nevertheless, it is distinct that upcycling has various benefits, which encompasses environmental and monetary benefits for the individual. The current paper has also comprehended practice of upcycling done through face-to-face workshops and the series of user tests, accompanied with some pre-existing cases in the upcycling market. In future, this can be extended by empirical investigation of upcycling and redesigning processes by visiting various organizations with different backgrounds, as well as involving government's participation and expanding the scope of the activities mentioned in this paper.

6.1.1 Key to success

The following analysis discusses challenges confronting the Cycle Project throughout the process of launching a community-based service, which aims to promote upcycling of industrial waste materials among local companies as well as presenting the solutions for such issues.

RYOTA YOKOZEKI STUDIO and FabCafe Nagoya have contributed to the implementation of this project. The prerequisite to maximizing the effectiveness of this project is to execute in a non-profit context, as devoting time and event space to the lab work depletes resources. It was crucial to forge connections with local businesses throughout the project.

The process of gaining support from participants of the project had encountered obstacles. For instance, the benefits of participating in this project were not

immediately perceived. Several feedbacks showed that participants could not cognize the originality of the project, as there were plentiful pre-existing upcycling initiatives. Nonetheless, the project presented the fact that substantial industrial wastes in the Nagoya area were yet to be discovered, through discussions about the potential of those waste materials and the social responsibilities, the participants were able to gain sympathy and take action.

In order to prompt collaborations, several meetings were held to share, resonate and deepen understanding of the conceptual vision of this activity, which helped to bring potential local waste materials to the surface and promote new upcycling activities. The roles of each actor were then clarified. Specifically, the designers from RYOTA YOKOZEKI STUDIO will participate in regular lab work with students, and FabCafe Nagoya will expand the promotion of the concept to local businesses, as well as providing a venue for meetings and workshops.

Nevertheless, the concept of the upcycling lab community emphasizes the connectedness between people to people, people to waste materials, and materials to materials. In other words, this proposal does not necessarily lead to an actual completion of a product or commodity. One of the greatest outcomes of the proposed concept is that it provides an opportunity for waste materials that have never drawn attention to be discovered. In the course of the survey sessions, we found that there were differences in the way people of different age groups comprehend waste materials, as well as their awareness towards environmental concerns. In particular, the elders were less likely to understand concepts such as upcycling as they were less exposed to them, in addition, the elders were generally less persuaded when the middle-aged groups were promoting the idea. As the dissatisfaction of the middle-aged employees gradually increased, this phenomenon triggered a strong desire for external connections and upcycling activities. This situation demonstrates a communication challenge of involving the unsympathetic older generations, as well as those who actually value the final output of manufacturing, to understand the value of this upcycle lab.

In order to gain recognition from all participants, a steady stream of fieldwork, surveys, discussions, and presentations were conducted for businesses to communicate on common issues, new possibilities and value discovery of upcycling versus recycling. Through those four sessions, it was verified that such concept of estab-

lishing community is expandable. In addition, since launching the service, seven new companies have applied to donate their waste materials to lab work, we have begun working with designers on lab work and posting material information on our online platform. This has entailed that our proposed concept had been validated and had gained early success.

Elements that keep the community alive

In order to sustain the creations of new manufacturing systems and the realization of the circular cycle model, it is crucial to keep this community-based concept alive.

In order to do so, it is necessary to categorize waste material providers and design a waste collection procedure, followed by establishing a communication platform for the entry of waste material donors and lab work participants into the community. Correspondingly, it is essential to consider the means of communication among participants and the clear division of roles along with increasing number of participants. These issues can be addressed through the design of Standard Operating Procedures (SOPs).

6.2. Future work

This study enlightens a potential for forming new communities in other areas, the community-based model could be adapted to other regions. It simultaneously emphasizes the potential as a long-term upcycling support.

6.2.1 Long-term upcycling community

This study highlights the challenges of industrial waste and upcycling activities confronted by the local manufacturing industry. As an approach to this issue, by surfacing local waste materials and offering them as an option to be incorporated into their own upcycling activities, it became clear that this approach has a positive effect on the circulation of local industrial waste materials, the creation of new ideas for upcycling, as well as ideology of exchange among companies.

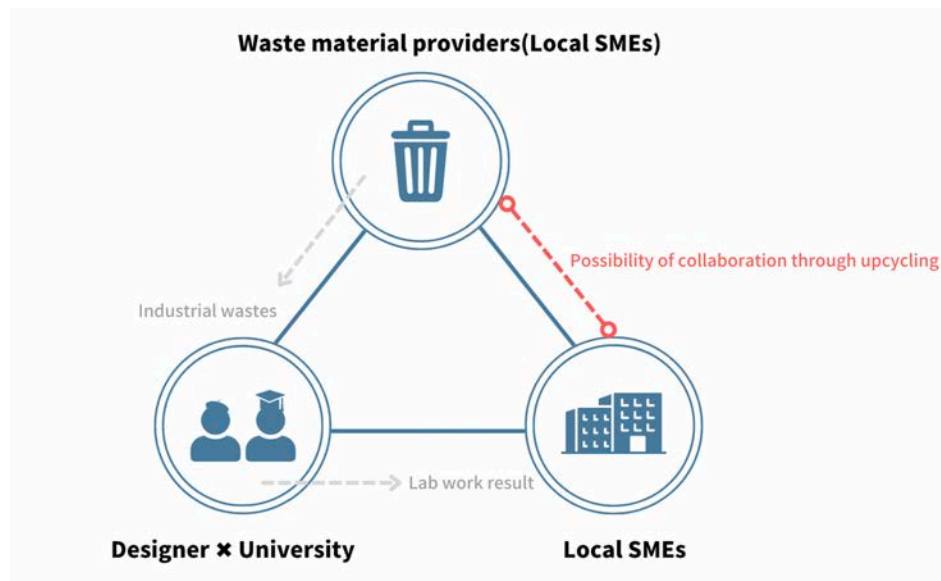


Figure 6.1 Possibility to collaborate with external designers

In order to involve more companies in the region in these activities, boost the impact and its contribution towards upcycling activities, the “Local leftover material drop-off and pick-up service” that we have started should be widespread to other central locations in the region. It is crucial to enroll more companies to utilize this service. After that, it is necessary for the Cycle Project members to conduct public activities using online platforms, etc., and to launch lab work and workshops to further explore combinations of waste materials and new design expressions, as a consequence, it proceeds toward the development of upcycled products.

The localized lab community proposed in this study, which focuses on local industrial waste, has the potential to be adopted in other regions. A platform for collecting local industrial waste materials, with universities and designers acting as intermediaries and performing lab work, and sharing the collected industrial waste materials and lab work outputs across companies with common interests, this helps to put upcycling into practice through the multiplication of knowledge, ideas, technologies and waste materials.(Figure 6.1)

6.2.2 Possible development of upcycled products

By bringing local industrial waste materials to the surface in this way, companies that want to engage in upcycling will have options, the sharing of lab work by cycle project members open the door to the development of upcycled products. However, the actual marketing of the product educating consumer on upcycling must be well-considered, whether it will sell and eventually become a profitable business.

As the test revealed, for companies that wanted to engage in upcycling, their motivation was not driven by profit, but rather the impact and awareness it would bring to the industry and people, as well as new connections, encouragements and enjoyments they would gain from this series of activities. Therefore, it needs to discuss the issue of stressing on sales, as this may dramatically limit the scope of our activities. Another area for discussion is how to distribute the profits to the companies that donated the waste materials after products are developed. As this community will be conducted only as a laboratory activity, when the potential for a product is seen, it comes with the potential in creating a sustainable economy environment that can supports the continuation of upcycling research and development activities. However, the significance of activities can be to generate discussions and draw attention to waste materials.

6.2.3 Collaboration between local companies and external parties

As can be seen from the designer's interview, there is space for many actors in this community. The three linkages of local companies, designers, and universities will assemble as the foundation of this lab community.

For local companies, having a platform for ideating with outside designers, creators and educational institutions on how to utilize their waste materials will further reveal their upcycling activities. Explanations are needed to expand this activity, hence, more designers embrace the value in entering this activity. For instance, by regularly exhibiting lab work in various regions, promoting the designers involved in the lab work and the companies that provide waste materials, the possibility of acquiring new clients enlarges.(Figure 6.2)

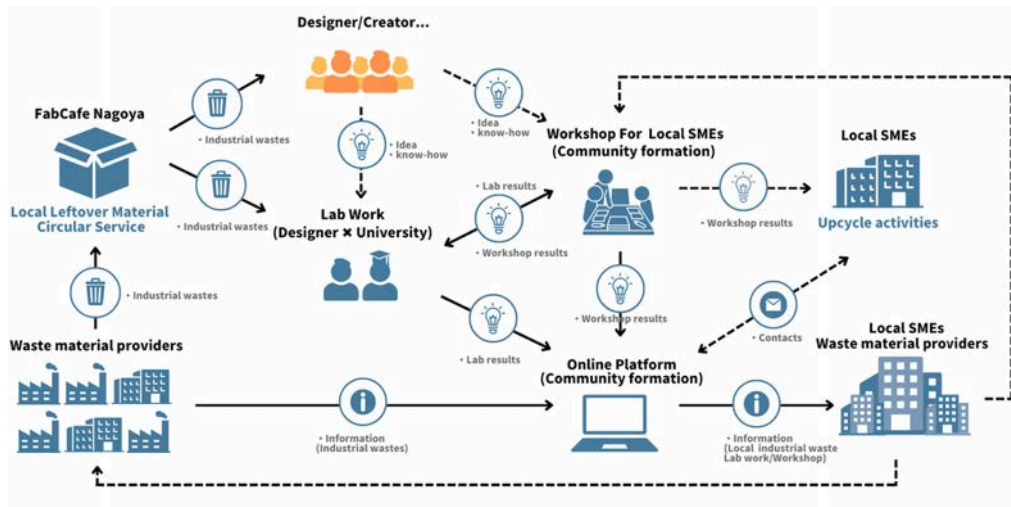


Figure 6.2 Future collaboration possibilities

6.2.4 Summary

As the localization of this community-based upcycling lab concept involves more participants from different fields, it enhances the positive impact on local upcycling activities, as well as provides a foundation for potential development that can be adapted to other regions.

Future work should explore the long-term validation of this community-based model, as well as its limitations, potentials and challenges in bringing other stakeholders together.

The study focused on validating the importance of addressing local industrial waste and how upcycling can be facilitated by companies that are collectively challenged by upcycling activities, it also encouraged institutions and companies to study and provide other industrial waste materials for oncoming laboratory events. It is obvious that this research approach only addresses a small portion of the challenges confronted by the region. Ongoing research activities are needed to further explore the significance and impact of this activity in the future.

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Appendices

A. Cycle Project Exhibition



Figure A.1 Cycle Project exhibition(2021.12)



Figure A.2 Cycle Project exhibition(2021.12)-2