

The background of the page is a close-up photograph of a wooden structure composed of interlocking hexagonal blocks. The wood has a natural, light brown tone with visible grain patterns. The blocks are arranged in a way that creates a central hexagonal opening, which is filled with a bright, white light, creating a strong contrast with the surrounding wood. The lighting is soft, highlighting the texture and depth of the wood.

CHOP X ALUE

Urban Impact Assessment

Issue 05 | December 2022



About this report



We lead by example with sustainable practices while being accurate and transparent about our environmental footprint.

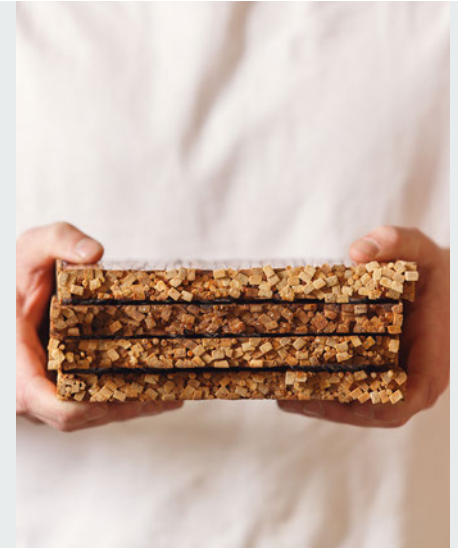
Motivation

At ChopValue, we believe that a desire to make a social and environmental impact does not hinder business profitability, and we hope to demonstrate that by our example. If environmental initiatives are well-understood and integrated into the business plans, then a business can remain both economically viable and environmentally conscious at the same time. We aim to be a leader in sustainable practices while being accurate and transparent about our environmental footprint and hope to inspire others to do the same. In the spirit of transparency, we will strive to quantify and report our environmental performance on an annual basis. This Urban Impact Assessment 5.0 marks the fifth report published by our company on this matter. To the best of our knowledge, the technical content in this report is accurate and has been

obtained from valid sources. In the absence of valid data, conservative assumptions have been made and are acknowledged throughout this report. The purpose of this assessment is to first evaluate the company's environmental impact for the current year and then to compare these findings to the Urban Impact Assessment 1.0 to determine our progress over the past past few years.

This Urban Impact Assessment 5.0 investigates the environmental performance of ChopValue by evaluating the impact of the current operations including the process of sourcing raw materials, manufacturing of the raw material and products, and distributing the final product using the life-cycle assessment approach and the GHG Protocol.

Raising awareness to educate our communities about the importance of the circular economy, together.



As we outgrow our current operations, there is a need for expansion of the company's manufacturing operations. Motivated by a desire to reduce our environmental footprint, we have made a conscious decision to expand our operations through the establishment of global Microfactories. This manufacturing system, known as distributed manufacturing, has several advantages over conventional centralized manufacturing processes including a reduced environmental footprint coupled with increased profitability and simpler logistics. In this impact assessment, the environmental impact of a distributed manufacturing process will also be compared to that of a hypothetical centralized manufacturing system in order to be transparent of our decision-making process. We hope to show, by our own example, that a desire to reduce

environmental impact can be a motivation rather than a hindrance to good business and profitability.

One of our core values at ChopValue is to make an impact, which includes a desire to maintain a positive environmental impact but also to make a social impact. We hope that with the creation of local microfactories at various locations globally, ChopValue can create new opportunities for the employment of young professionals in trades, which we believe is an important appreciation of hands-on work in the modern urban society. Additionally, the collection of chopsticks from local restaurants and partners leads to the creation of a local community that is well-engaged in a recycling program. Through these microfactories, we hope to raise awareness and educate our local ChopValue communities about the importance of circular economy.

Prioritizing education

Next Generation
Manufacturing & Design

2022 Urban Impact Assessment

Index

Urban Impact Assessment

About This Report	002
Founder's Note	0010
Circular Economy: From Waste to Resource	0012
ChopValue: A Model of Circular Economy	0016
Emission Sources	0020
Impact Calculation	0023
Overall Environmental Impact	0026
Expansion Plans	0030
Environmental Impact of Manufacturing Approaches	0034
Expansion Philosophy	0040
Social Impact	0042
Impact Summary	0048
Conclusion	0053

Strive

Our company-wide environmental and social initiatives are motivated by the United Nations 17 Sustainable Development Goals (SDGs).



Setting an example of a viable and successful business that revolves around under-utilized resources, one chopstick at a time.



Responsible Consumption & Production

01

ChopValue aims to tackle this goal by reintroducing chopsticks to the economy as a value-added product thereby reducing the utilization of new raw materials.



Decent Work & Economic Growth

08

As a new business, ChopValue contributes to this goal by creating additional employment opportunities to support its operation, and in turn contributing to the economic growth of the local community.



Sustainable Cities & Communities

11

Our corporate office and our global microfactories provide a platform to engage the local community in sustainable environmental practices by reutilizing their waste. Collecting used chopsticks from local vendors creates a platform by which ChopValue can educate the community on the circular economy.



Life on Land

15

By reutilizing waste, ChopValue promotes the sustainable management of forests by not extracting raw virgin materials from the environment.



Gender Equality

05

ChopValue is an equal opportunity employer, and our hiring practices are free of discrimination due to age, gender or other preferences.



Climate Action

13

ChopValue extends the life of bamboo chopsticks by utilizing them into products, and thus, extends the duration over which carbon dioxide is retained in the bamboo. ChopValue also ensures that its production process maintains a low contribution to greenhouse gas emissions and aims to maintain its current carbon negative status.



Innovation & Infrastructure

09

ChopValue's main contribution to this goal is to demonstrate the economic viability and increased environmental sustainability of our unique distributed manufacturing concept.



Partnerships for the Goals

17

Through our franchising model, ChopValue aims to share environmentally sustainable innovation surrounding science and technology to other countries, creating a positive impact locally through the sharing of knowledge, increased access to technology, and job creation.



Reduced Inequalities

10

ChopValue aims to create a unique work environment composed of woodworkers, production workers, and office staff in an urban area. Traditionally, such woodworking jobs are not found in dense urban areas, so the creation of these jobs prevents woodworkers from having to move away from such desirable locations, therefore, reducing these inequalities.

Looking forward, responsibly.

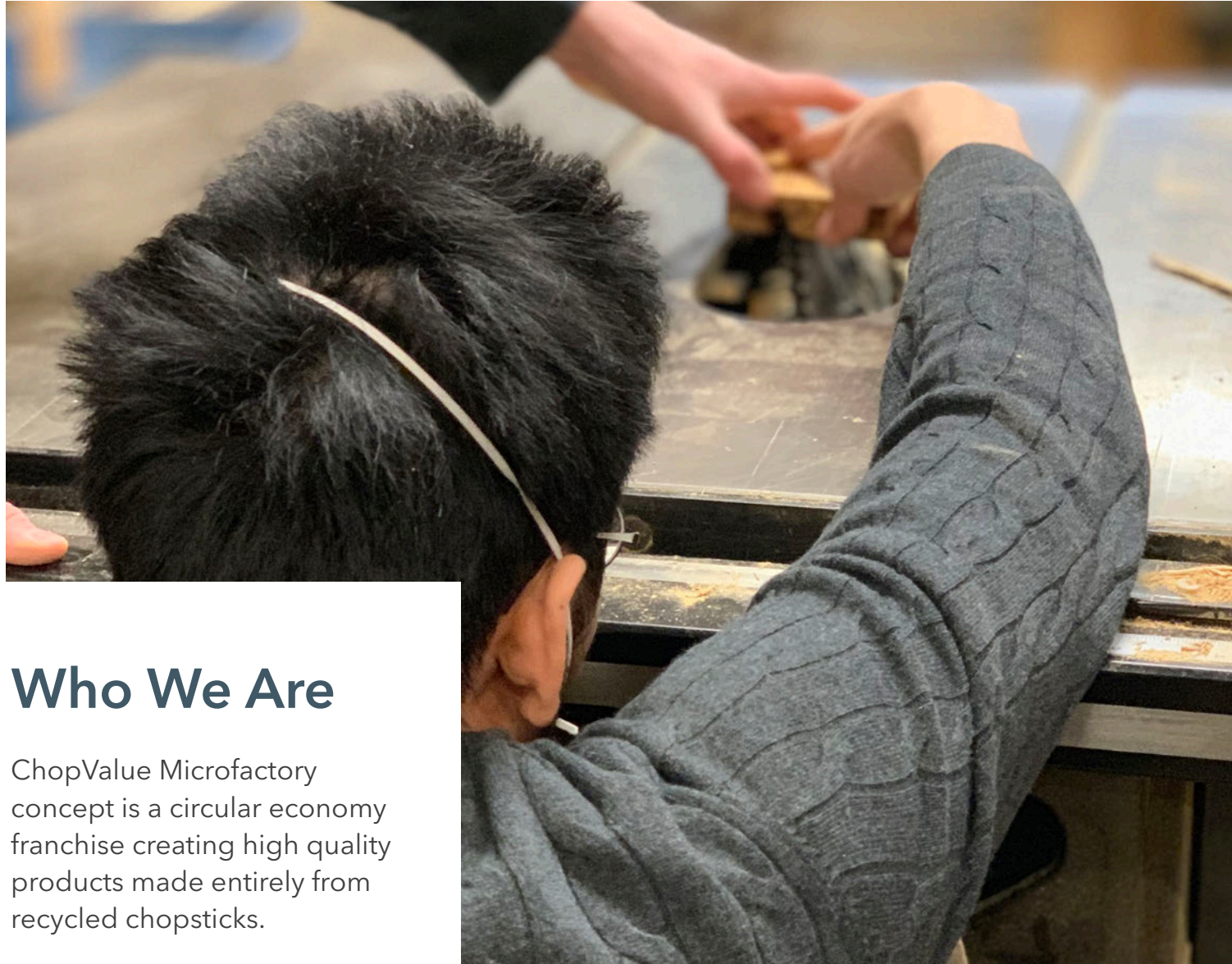
We believe that our expansion plans must incorporate the alignment of our values with the Sustainable Development Goals outlined here.

Reference Framework:

The Urban Impact Assessment 2022 is ChopValue's fifth annual reporting on important developments of the company's expansion strategies, covering the time period between September 1, 2017 - December 31, 2022.

Editorial/Remarks

Author: Sabrina Kon
 Visuals: Sueun Jung
 Acknowledgements: Maja Kuder, Atiya Livingston, Andrea Otamendi, Cheralyn Chok
 Auditors: Felix Böck/ Founder & CEO - ChopValue
 Arjan van der Vegte - MOSO Bamboo International BV
 Hans Friedrich/ Director - INBAR
 Brendan Seale/ Head of Sustainability - IKEA
 Christoph Schilling - FP Innovations



Who We Are

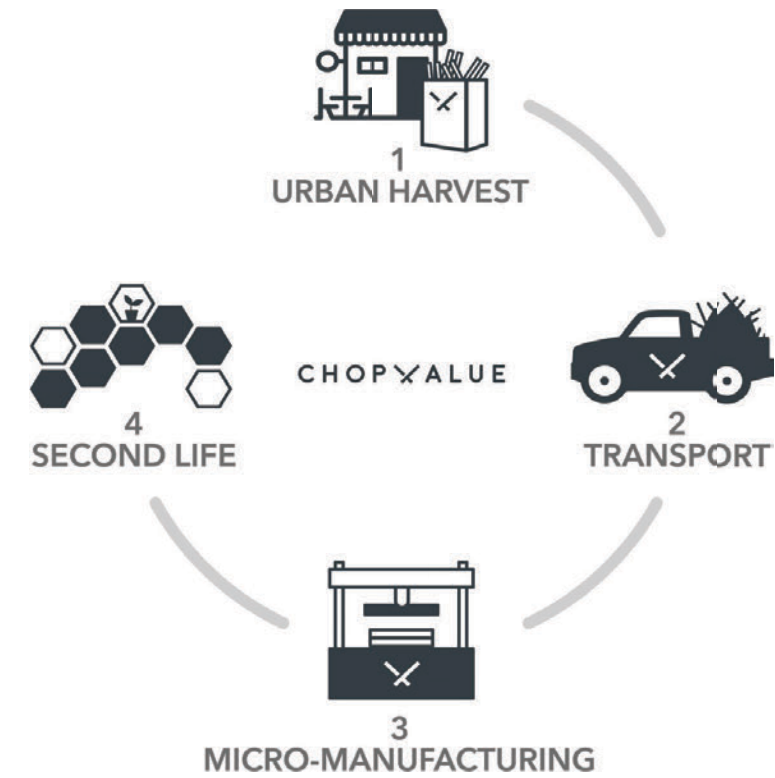
ChopValue Microfactory concept is a circular economy franchise creating high quality products made entirely from recycled chopsticks.

Together, we are redefining the term *waste to resource*, one chopstick at a time.

- Focus** we relentlessly pursue our vision with clarity, efficiency, and quality.
- Community** we create connections and collaborate locally and globally.
- Balance** we strive for a healthy balance between work and home.
- Accountability** we are reliable, and take responsibility for the outcome.
- Authenticity** we are sincere, approaching every situation with empathy and honesty.

“size doesn’t matter if you want to lead a change”
-a single-use chopstick

The ChopValue circular economy



Our vision

Inspire others to utilize any waste resource in a similar fashion.

Educate consumers on precisely why the circular economy is the future.

To actively guide more conscious, sustainable actions and resource efficiency through urban harvesting - by setting an example of a viable and successful business that revolves around under-utilized resources, one chopstick at a time.

Our mission

Transform & elevate waste resources into new materials and valuable products.

Make decentralized manufacturing and circular economy thinking standard.

We will become a “best-in-class” distributed manufacturing concept, using local resources for the local market by developing locations globally, and by working with like-minded partners.

Founder's note



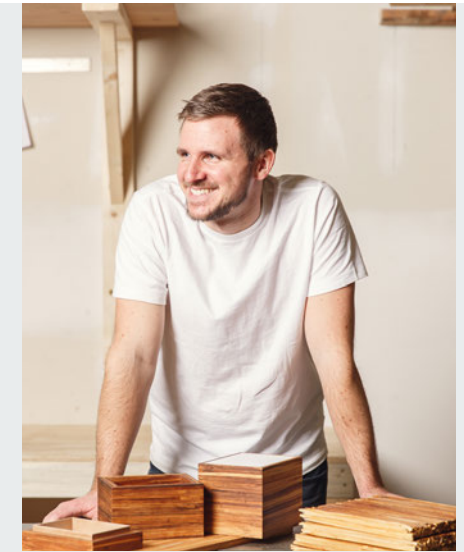
Why I dream about chopsticks.

I am fortunate to live in one of the most beautiful cities in the world, surrounded by mountains, the ocean, and forests. I am truly grateful to work on something so fulfilling by looking at our city as urban forest full of resources (and sushi restaurants). People often say that there are no "firsts" out there anymore, and that most ideas have been done, discovered, or tested before; but I think we all underestimated and neglected these little chopsticks right in front of us. As background, not too long ago, I tried to apply my wood engineering and stereotypical "German efficiency thinking" (not my quote) to tackle the wood and construction waste in Vancouver. A seminar that presented the research results and potential industry know-how for value added materials unfortunately did not resonate much with industry leaders. It was frustrating, but at the same time eye-opening. I realized that in order to prove sustainable business concepts that rely on under-utilized resource supply, there must be thought leaders who show its viability. It had to be interesting, something easy to comprehend, and something that elicits emotions towards

the problem of linear economy and our vast amount of waste. I would need to develop a process that creates innovative, highly value added and appealing products from a relatable resource. And that is how ChopValue was born.

More than 10 years in the bamboo composite manufacturing industry have not fulfilled me as much as being surrounded by young professionals who work with me on chopsticks. Having now a team of more than 25 makes us realize that 88 million chopsticks recycled to date can in fact create change. We presented the Microfactory concept in more than 10 countries so far, the media covered ChopValue's concept in more than 35 countries, and INBAR presented ChopValue as business opportunity as a mandate to its 44 member countries. It is not about proving that we have built a viable, carbon negative manufacturing business out of discarded chopsticks anymore... it is now truly about following up to expand this concept globally.

"Our story resonates with people so we believe we have a responsibility to inspire, set an example, and educate that resource efficiency thinking should simply be the norm."



Felix Böck
Founder & CEO

We work hard to create a unique experience with a story worth sharing. In all honesty, I am not sick of sushi yet knowing that I am working with a team that shares the vision of expanding our concept through franchising, that will directly and indirectly employ 1000 people in the next 3 years, and that will expand our "made local - wherever you are" products to 75 to 100 locations.

Thanks to impact investment funds, investors with vision, and institutions who support our innovation in manufacturing and resource efficiency, who invested with trust to move from our single city concept to a multi-level manufacturing cluster. Your financial commitment helps us to expand our brand globally and secure the right strategic development partners for growth. Welcome to the team - Welcome to this adventure.

We call it the "1.5 billion chopsticks expansion plan."

I am feeling the pressure, I am feeling the strong responsibility to lead by example, and while it's challenging to grow from proving ChopValue's viability to now expanding ChopValue as microfactory franchise rapidly to impact as many communities as possible, we remain convinced that it is important to tackle our environmental issues with a team that doesn't take themselves too seriously. But we know that if everyone understands this tangible example of how a chopstick fits into the circular economy thinking, we can motivate others to think the same.

Yes. I love what I do.

1.0 Circular economy from waste to resource

The modernization of society has resulted in material and product consumption at an unprecedented rate. This however, has had adverse environmental impacts including the exploitation of natural resources, accumulation of waste, and production of greenhouse gases.

Companies have previously relied on the approach of “Take-Make-Dispose”, where new natural resources are extracted, converted into products, and then disposed of in landfills. This business model, known as the “linear economy”, has resulted in significant accumulation of end products in landfills, and *has led to the obvious realization that this model is not sustainable and cannot be the path forward.*

Increased social awareness and the need for environmental accountability has prompted a paradigm shift away from the linear economy model. One viable solution to reduce the exploitation of new natural resources is the idea of a “circular economy”, where wasted resources are reintroduced into the economy. By extracting raw materials from waste of existing product or production streams, one can reduce the environmental impact of their processes by reducing the excavation of new natural resources.

Social awareness and the need for environmental accountability has prompted a paradigm shift away from the linear economy model.

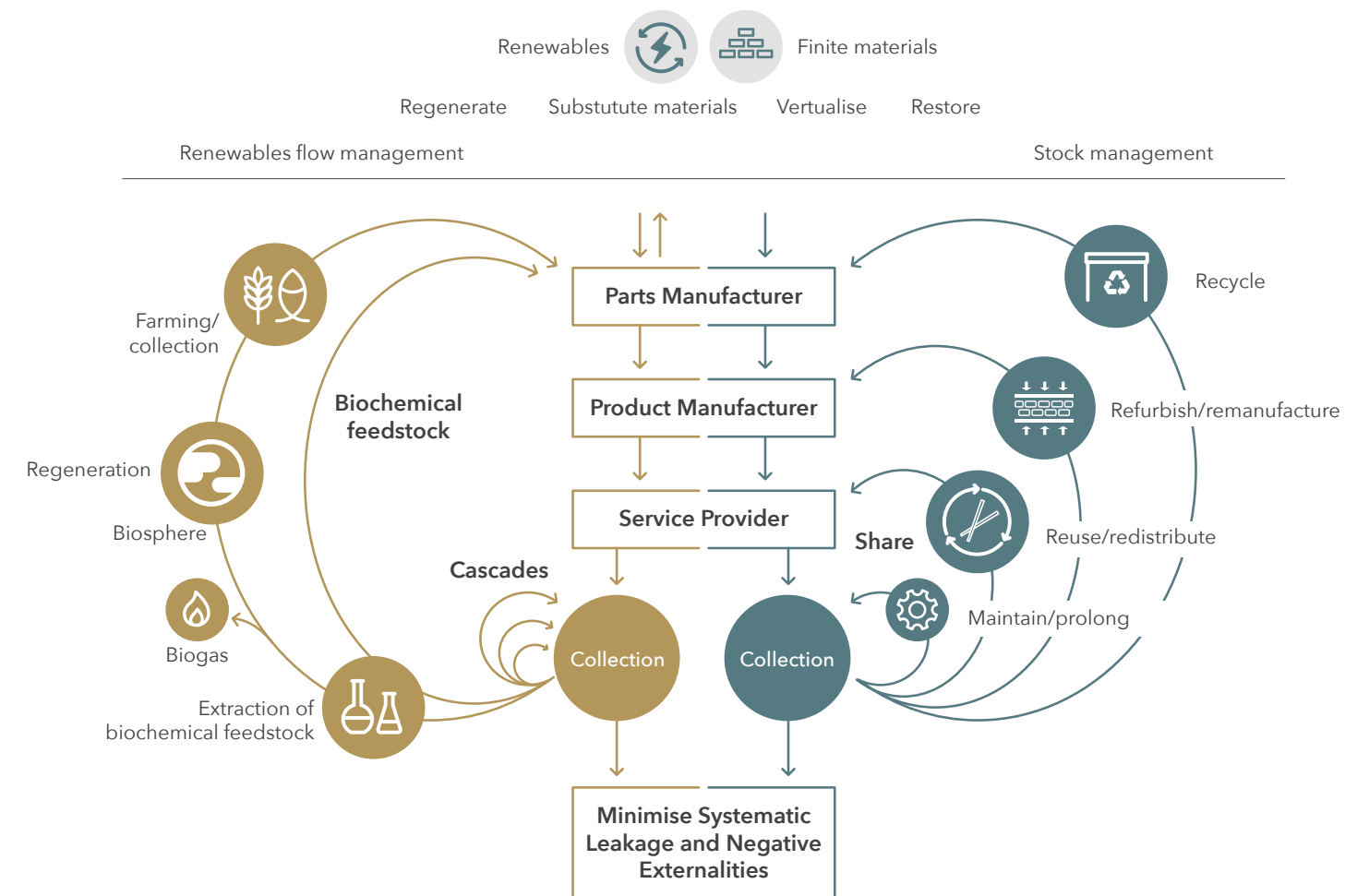
The busy urban centers in cities are hubs of modernization which are sources for waste, e.g. new resources, such as demolition and construction waste, post consumer waste, single-use utensils and plastics, all of which can be scavenged as resources under the circular economy approach. **The process of identifying and extracting these wasted resources is known as urban harvesting.**

Environmental innovations are often viewed by manufacturers as hinderance to their current processes; however, the concept of circular economy was not presented by environmentalists at all – it was presented as a viable model by several economists. In fact, the World Economic Forum (WEF) suggests that the transition towards a circular economy could provide financial opportunities of \$4.5 trillion due to the elimination of waste, increased production efficiencies, improved business productivity, and increased employment opportunities by 2030 (Gerholdt, 2017).

The reduction of waste creates additional steps in a manufacturing process where this waste would otherwise be discarded. This creates new jobs, increased social awareness about environmental sustainability, and an increased accountability of process waste.

Increasing impact

The concept of circular economy has prompted a wave of new advances in business models, policies, and technological innovations, making it simpler and easier to address the issue of waste in the manufacturing industry.



2.0 ChopValue a model of circular economy

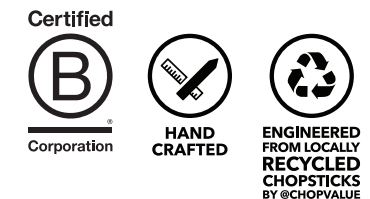


The production of our novel material required significant technological innovation and ingenuity.

ChopValue's business model is based on a circular economy approach. According to the market research conducted by a firm called Euromonitor, Asian fast food in the United States has increased by 135% between 1999 and 2015, increasing the popularity of Asian cuisine at an unparalleled rate. This repeated desire to eat sushi on a random weeknight leads to significant increase in the consumption of chopsticks worldwide.

It is estimated that in Metro Vancouver alone, approximately 100,000 chopsticks are discarded each day.

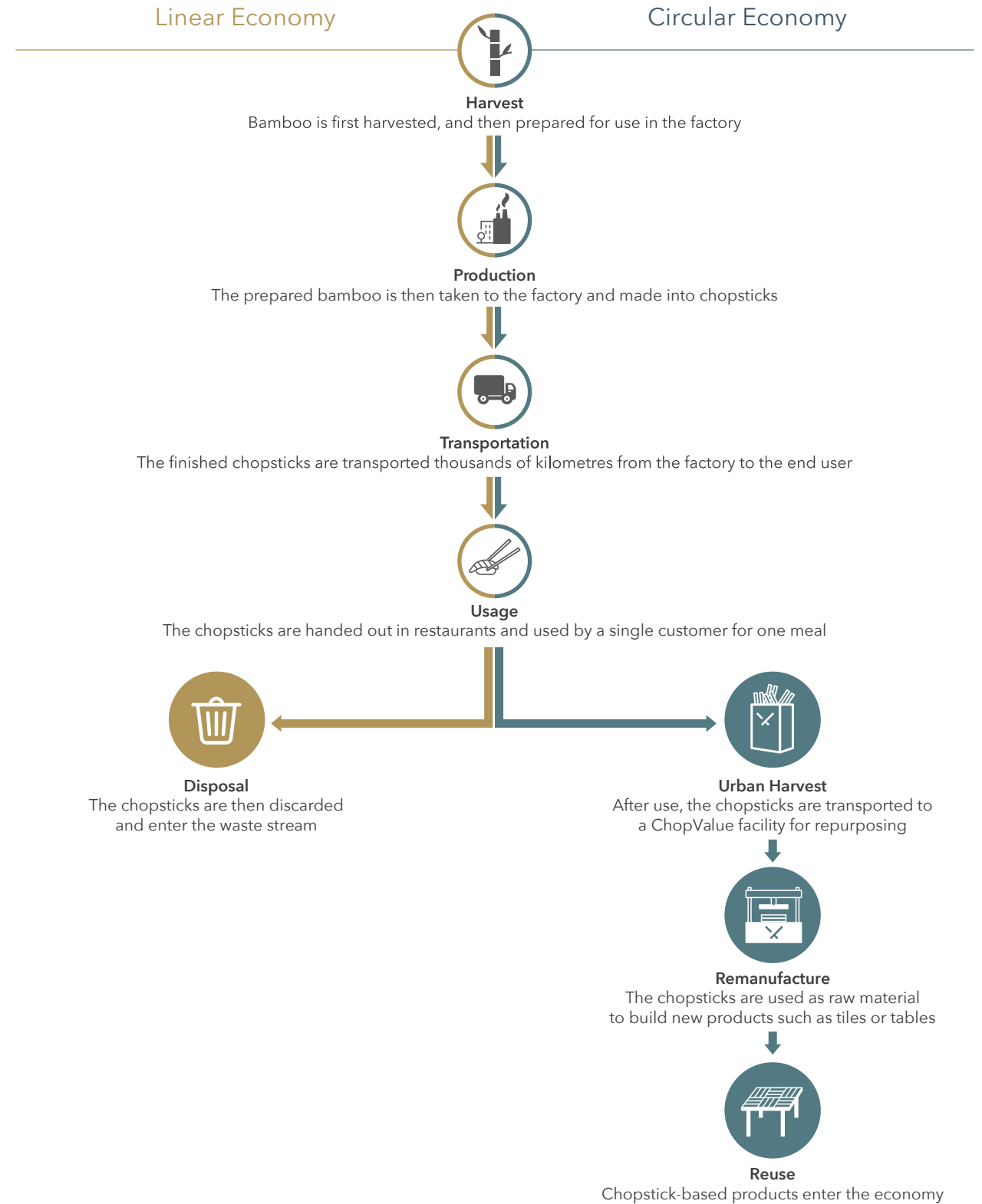
Little consideration is given to this single-use utensil that has travelled approximately 9,000 km and served its purpose for only 20 minutes of a meal.



ChopValue recognizes that

These perfect, slender, defect-free chopsticks can be reutilized as a resource to develop novel engineered materials.

Circular Economy at ChopValue



Environmental stewardship.

Our company recognizes that these perfect, slender, defect-free chopsticks can be reutilized as a resource to develop novel engineered materials, which can then be converted into products. Previously discarded as waste in such high quantities are given a new life at ChopValue, where we collect approximately 350,000 chopsticks per week and reintroduce them into society in the form of value-added products.

The production of this novel material required significant technological innovation due to the lack of existing machinery that could be utilized to process this new resource. Technological and material innovation allowed us the opportunity to ensure that our processes were designed by prioritizing environmental sustainability.

Circular economy and environmental stewardship are a priority in all facets of ChopValue’s business. Some of our environmental initiatives include:

Zero Waste

The waste and off-cuts generated from the manufacturing of our larger products is saved and later reused in the production of other smaller products such as keychains.

Repurposing

The sawdust that is generated from sanding our products is collected and reused as wood filler.

Resin

The resin used in the manufacturing of our chopsticks is free of toxic chemicals such as phenol and formaldehyde.

Packaging

Our products are packaged using biodegradable, starch-based peanuts and are wrapped in recycled paper; all packaging cards and labels are printed on recycled paper.

Oils

The oil used to finish our final products is vegetable-based and environmentally friendly.



Setting a new norm by changing the way you think about wasted resources and manufacturing.

At ChopValue, we consistently prioritize and highlight environmental sustainability in all stages of our business model including innovation, waste reduction and utilization, and our expansion plans.

By creating a viable business in Canada solely based on previously discarded chopsticks, ChopValue has demonstrated that it is feasible to incorporate the circular economy approach into business, and that valuing environmental sustainability does not hinder one from success. We hope to replicate this prioritization of environmental stewardship in the decision to expand from a national to a global scale.

Environmental sustainability is a global issue and more companies should incorporate the principles of circular economy into their business models.

We hope that by remaining transparent about our manufacturing processes and business practices, and measuring the environmental impact of our production chain, we can inspire others to incorporate environmental impact into their businesses as well.

3.0 Emission sources

Within the ChopValue Process

01

Chopstick Collection

ChopValue partners with various restaurants, malls, and office cafeterias to collect used chopsticks. The collection program is free of cost to the recycling partner. When signing up a new partner, the ChopValue collection team provides a training session to educate employees about the circular economy and our mission.

Chopstick collection is conducted between 2-6 days a week (depending on the location and Microfactory) using ChopValue's pick-up truck. The route travelled on these days is generated via software to ensure that the distance travelled, and thus the corresponding emission, is minimized. The routes travelled by the collection driver are recorded and used to calculate the emissions from this step in the process.

Emission Sources: Distance travelled by the ChopValue truck.

02

Chopstick Sorting

Once the chopsticks are collected, the chopsticks are sorted at the facility. The sorting table is used to align the chopsticks in a single orientation for easier processing in the later stages. The sorting table is electric-powered; however, the design and size of the machine has been optimized to sort approximately 30 kg of chopsticks within 2 minutes of operation.

Emission Sources: Electricity consumed by the sorting table

03

Adhesive

The sorted chopsticks are dipped into a water-based, formaldehyde-free resin. The excess resin from chopstick dipping is recycled and used to coat subsequent batches of chopsticks. Since the resin used in the process is free of the toxins found in other conventional resins, such as formaldehyde, the process of applying adhesive to the chopsticks has no adverse environmental impact.

Emission Sources: None

04

Drying

The resin-coated chopsticks are placed into a convective dryer. Research was conducted to determine the minimum drying time required for the chopsticks to reach the target moisture level required for pressing to ensure that the emissions from this process are minimized.

Emission Sources: Electricity consumed by the dryer.

05

Densification

The dried chopsticks are densified into tiles using a heated hydraulic press. This hot press was designed by the ChopValue Engineering team and is customized to meet their needs in terms of production volume, efficiency, and sizing. The high heat and pressure results in chopstick compaction and resin curing, forming a raw, high-density material ready for product manufacturing.

Emission Sources: Electricity consumed by the press.

06

Product Manufacturing:

The raw tile is planed and cut into standard dimensions before being used to manufacture a product, and this standard tile is then processed based on the product being manufactured. There are several measures taken to reduce material waste during this step. Different products require different tile thicknesses and therefore, to minimize the energy consumed and waste generated by planing and sanding down tiles, ChopValue instead presses tiles into three different thicknesses. By doing this, products with thinner dimensions are made using the thinnest tile produced by the press. Additionally, the offcuts and tile scraps resulting from product manufacturing are used in the production of smaller products such as keychains.

Emission Sources: Electricity consumed by the woodworking machinery.

07

Finishing:

After the products are manufactured, they are coated in a vegetable-based and environmentally friendly oil, which emphasizes the material's natural colour. This is the standard finish applied to most products at ChopValue; however, different product applications may require different surface finishes that may result in different environmental impact.

Emission Sources: None.

08

Packaging:

All ChopValue products are packaged using starch-based sustainable packing peanuts, and all labels and cards are printed on 100% recycled paper.

Emission Sources: None.

09

Product Delivery

We encourage customers to pick up their orders from our production facilities to minimize our emissions; however, under special circumstances, the ChopValue truck is used in the delivery of larger products. The mileage associated with such deliveries is tracked and used in the calculation of process emissions.

Emission Sources: Truck mileage during delivery.

4.0 Impact calculation

01

Scope

This impact assessment is conducted based on the Greenhouse Gas Protocol for the operational period between January 1, 2021 to December 31, 2021. The calculation includes all Scope 1 and Scope 2 emissions according to the standard including: electricity consumption by the leased facility, electricity consumption during production of the material and final product, and all travel by the company-owned vehicle including the collection of chopsticks, purchase of other raw material, and the infrequent delivery of the final product.

02

Methodology

Chopsticks, which are mainly made of bamboo, have a carbon dioxide retention of 46%, by weight. The collection of these chopsticks prevents their biodegradation and the subsequent release of this stored carbon dioxide into the environment. By diverting them from landfills and converting chopsticks into products, ChopValue extends their life and allows them to continue to retain this carbon dioxide for a longer duration.

The basis of the impact calculation is to determine if the emissions required to process these chopsticks results in a net benefit to the environment, or if it would be more beneficial for these chopsticks to release the retained carbon dioxide back into the environment.

A key assumption in this report is that there is minimal waste generated from the operation. This was determined to be a valid assumption due to the high fraction of reuse of offcuts that are generated from the production process.

Equations for calculation

The How

Number of Chopsticks	$\frac{\textit{weight of chopstick collected}}{\textit{average weight of single chopstick}}$
Emmissions per Chopstick	$\frac{\textit{Total operational emissions}}{\textit{number of chopsticks collected}}$
Retention Capacity per Chopstick	$\textit{Average Weight Single Chopstick} \times \textit{Carbon Stored by Bamboo}$
Overall Emmissions	$\textit{Average Weight Single Chopstick} \times \textit{Carbon Stored by Bamboo}$

Activity data sources

The What

- The average weight of a single chopstick was determined by measuring the mass of several chopsticks using a high-precision scale. This number is used consistently for all calculation at ChopValue.
- Chopsticks that are collected during each trip are weighed, and this weight is recorded by date and by restaurant.
- The route driven during each collection trip is recorded and available to estimate mileage.
- The total mileage of the truck due to other purchases and delivery of the final product is recorded and available.
- The electricity consumed by the facility (including the office and production facility) were obtained from the bi-monthly electricity bills.

Key assumptions

The Assumed

- In the absence of reliable production data, it was assumed that all chopsticks collected during an operational year were converted into products during that year.
- It was assumed that negligible waste was generated during the production process. This assumption was deemed valid as our process involves utilizing our offcuts and waste to create smaller products such as keychains.
- The carbon retention percentage (46%) used was based on the calculated average of biomass and carbon storage from the Zhang et al (2014).

5.0 Overall environmental impact



Leading with transparency.

ChopValue’s business decisions are motivated by our desire to be an inspiring leader in environmental impact and transparency. As the business expands, it is vital to us to ensure that expansion decisions, including the addition of new chopstick collection partners, incorporate our core aim of sustainability.

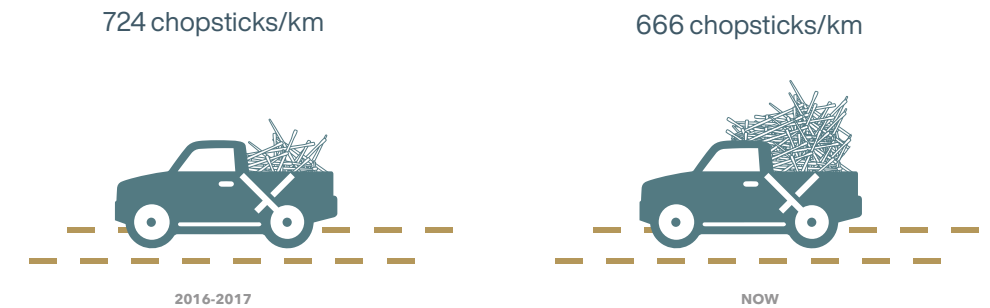
This section features a comparison between when we first started operations in 2016/2017 to our current performance as outlined in this report.

With the expansion of our business and increase in the number of production facilities, it is trivial that the total emissions from the production process would increase, which makes

it difficult to critically compare the environmental performance of the business between years. In order to make an accurate comparison of the emissions between the two years, the total emissions must be scaled down to the growth of the company. As a result, we have decided to calculate our impact in the units of per kilogram of chopsticks collected.

This was selected because if there are no changes made to a process, the emissions per kilogram of chopsticks will remain the same. An increase or decrease in this value would clearly indicate deterioration or improvement in the overall environmental performance of the company.

Travel emissions during chopstick collection



Stats.

1,000 kg

Chopsticks collected per week

In the operational year 2016-2017, the total distance traveled on a weekly basis during the collection route was 46 km, resulting in a weekly collection of 100 kg of chopsticks. In 2022, the weekly collection route had an average travel distance of 500 km with 1,000 kg of chopsticks collected per week.

In 2022, we expanded our collections program quite significantly to areas outside of Vancouver, covering a

larger distance during the year than previous years. This enabled us to substantially increase the number of chopsticks collected, giving them a second life.

During this year, 666 chopsticks were collected per kilometer of distance travelled by our truck.

Energy consumption during processing

In the operational year 2016/2017 (when we first began operations), the monthly energy consumption at ChopValue was 1,420 kWh, which was used to process 433 kg of chopsticks. Fast forward to 2022, this was 10,922 kWh/month, while 4,000 kg of chopsticks were processed. As mentioned earlier, the comparison is more evident by understanding the energy consumption per kilogram of chopstick.

The process energy requirements in 2016/2017 were 3.28 kWh/kg of chopsticks, which decreased to 2.73 kWh/kg of chopsticks processed

in the current year - this is a decrease of 17%. This change may stem from several factors including updates to the hydraulic press used to produce the tiles. However, it is more likely attributed to the increase in the number of chopsticks being collected and processed at the facility (we had a greater demand in our products compared to previous years). This is important to note, since the equipment at the ChopValue facility, which was consuming energy but not being fully utilized, is now utilized more efficiently due to increased chopstick processing.

Comparison of 2016 and 2017

- 17 %

Reduced energy consumption per kg chopstick

THEN
2016 & 2017

3.28 KG KWH / KG



NOW
2022

2.73 KG KWH / KG



The path forward More than work. It's good business.

We are continually evaluating our processes to decrease our environmental footprint.

One upcoming initiative is the redesign of the resination process. When coating the chopsticks in resin, additional water is absorbed by the chopsticks, resulting in adverse environmental impacts such as increased water usage and additional drying time required to evaporate the absorbed water.

The new resination process has been designed to decrease the contact time between the water-based resin and the chopsticks from 20 minutes to 2 minutes, decreasing the amount of water absorbed in the chopsticks. This results in less water usage and subsequently, decreases the drying time required to evaporate the additional water.



6.0 Expansion plans

Change the way you think about manufacturing.

ChopValue recently evaluated between various options to expand our business; however, we believe that the decision between these options must incorporate an assessment of our environmental implications. The purpose of this section is to describe the various expansion strategies available to a manufacturing operation such as ChopValue, and the environmental implications of each option.

6.1 Approaches to manufacturing

Centralized Manufacturing

Centralized manufacturing is the classical approach to producing goods. This dates to the industrial revolution when long-distance transportation and high-energy intensive process became feasible. It can be defined as a manufacturing system where all required raw materials are transported to a central location where they are used to manufacture goods or products. This was and still is one of the most prevalent manufacturing options, particularly in traditional industries such as forestry, steel or oil and gas.

The benefits of centralized manufacturing come from the economy of scale and high grade of automation. The manufacturing of products at larger volumes decreases the cost of single-unit production – a concept known as the economy of scale. Additionally, the production of larger volumes drives an increase in automation, reducing the need for highly qualified individuals to operate the machinery.

A major downside; however, is the inflexibility of such systems to react to short-term market needs. Large factories can only react slowly to a change of product and require major retooling or modification to do so. Transportation of goods becomes the highest factor affecting production costs unless factories can be placed close to the required resources. However, with increasing globalization, the distances of raw materials being shipped to central location have increased drastically and so has the associated environmental footprint. Additionally, the depletion of resources worldwide has made it more challenging to source large quantities of raw materials from a single location, making it difficult to decrease costs by large bulk shipments.

Due to these challenges, many industries have moved to a decentralized manufacturing model, which allows for more flexibility and shipping of intermediate products.



Decentralized manufacturing

Decentralized manufacturing describes the manufacturing of goods and products at various locations closer to the available raw materials needed to manufacture those goods. These manufactured products then get transported to a central location for final assembly or manufacturing. The automotive industry is a classic example of this, where various mechanical parts are produced in different locations where either raw materials or labour is available at reduced costs, for example, some automotive parts are manufactured in Mexico.

Decentralized manufacturing has several advantages regarding market and product flexibility. Smaller factories can react more spontaneously to changes in market needs, and additional products can be quickly sourced from other locations, when necessary. The required logistics and organizational challenges;

however, become more complex. This manufacturing requires more sophisticated enterprise resource planning (ERP) solutions, which tend to have a larger overhead due to increased requirement of management positions. Additionally, a shortfall in the supply chain can cause the entire system to come to a standstill – impacting all stakeholders involved from the supply chain, to transportation, and the end consumer.

The environmental impact of such manufacturing systems is complex since each manufactured part must be first transported to a single location for assembly, after which the products are then transported to distributors or customers. The several intermediate steps of transportation have a significant impact on the environmental impact of such manufacturing systems.

Distributed manufacturing

ChopValue's novel expansion approach



Distributed manufacturing can be defined as the local manufacturing of products based on locally available resources, at multiple locations, under a single company or brand. The major difference of this option compared to decentralized manufacturing is that these facilities can operate with increased flexibility, and independently of each other, while serving different markets.

Although all locations operate under one brand, individual factories can benefit from local partnerships with other large manufacturers to decrease the costs of outside services and materials. By sourcing raw materials, goods, and supplies locally, the net environmental footprint of distributed manufacturing is significantly lower when compared to traditional manufacturing concepts such as centralized or decentralized manufacturing.

Factories can operate on smaller volumes of raw materials while remaining profitable due to decreased costs of automation and required labour qualifications.

The disadvantages include quality control and standardization of products between individual locations. Despite the separation of production, a

relatively large degree of ERP and quality control systems are required to ensure uniform production of the same product. While the goal is to utilize resources as locally as possible, distributed manufacturing can have elements of decentralized manufacturing that source components from other manufacturers.

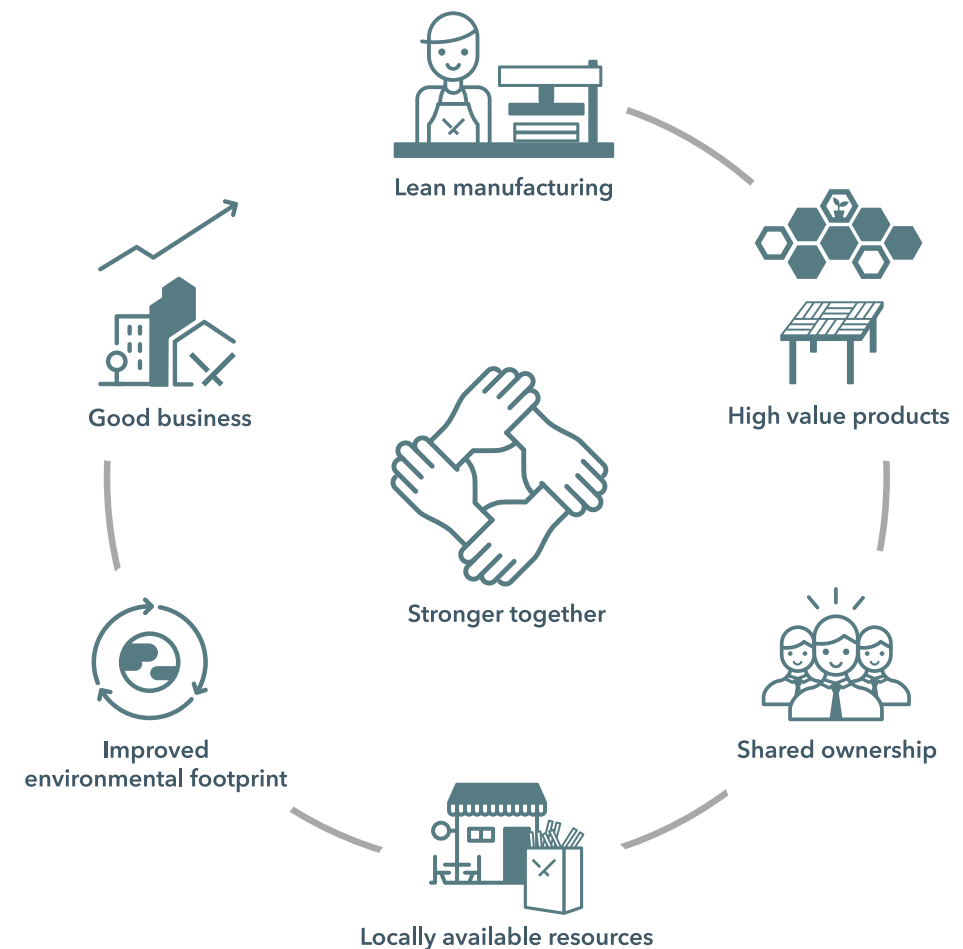
Distributed manufacturing systems obtain raw materials locally, process them locally, and distribute them to local consumers. Decreased transportation and the leveraging of local services allows these manufacturing systems to have a significantly lower environmental footprint and a more global social impact.

After thorough evaluation of these manufacturing approaches, ChopValue aims to expand its operations globally via a distributed manufacturing concept through franchising. ChopValue aims to establish microfactories which source all materials and services locally, thus having a larger social impact through job creation and increase social outreach. By implementing the franchise concept, ChopValue empowers local owners while also cutting overhead costs.

Made local has a whole new meaning

Lean manufacturing of high-value products under *shared ownership*, using locally available resources to minimize the environmental footprint.

ChopValue's distributed manufacturing concept can be defined as the lean manufacturing of high-value products under shared ownership, using locally available resources in an effort to minimize the environmental footprint and maximize business opportunities from local resources that are otherwise not profitable to use.





Environmental Impact of Manufacturing Approaches

Approach

To evaluate the environmental performance of our distributed manufacturing approach, an environmental impact assessment was conducted to compare a hypothetical distributed manufacturing approach to a centralized manufacturing approach.

01

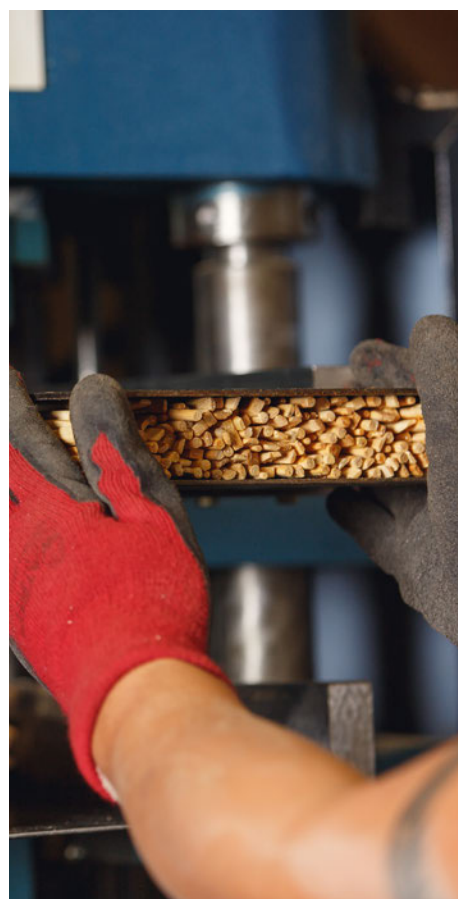
Scope

This assessment includes chopsticks collected from Vancouver during the operational year specified earlier in this report. The emissions included in this study are the electricity consumed during the production of the material and products, and the transportation of chopsticks to their processing location.

02

Methodology

The assessment will first evaluate a hypothetical, centralized manufacturing approach. This is where all the chopsticks are collected and transported to ChopValue Vancouver where they are processed.. The second part of this assessment will evaluate a distributed manufacturing approach where the chopsticks collected from each city are processed at a facility located in the same city.



Key assumptions

For the centralized approach

it was assumed that the chopsticks from various locations were shipped to ChopValue Vancouver on a monthly basis.

For the centralized approach, it was assumed that chopsticks from Montreal and Los Angeles were transported to Vancouver via truck (LTL Dry Van), with an emission factor of 1.01 kgCO₂e/km. It was assumed that transportation from Victoria to Vancouver required the use of a ferry, specifically, a car passenger ferry with an emission factor of 0.136 kgCO₂e/km.

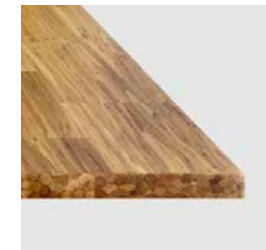
For the distributed manufacturing approach,

some locations do not contain a Microfactory at the moment, and therefore, their production emissions are unknown. For these locations, it was assumed that since the process of producing tiles from chopsticks would be the same at each Microfactory, the electricity required in the process would scale with the number of chopsticks being processed, and therefore, the kWh/chopstick ratio was used to estimate the hypothetical electricity that would be consumed at a location without a current Microfactory.

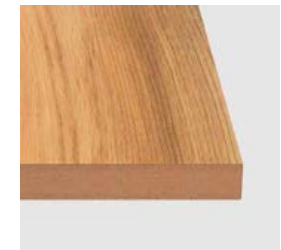
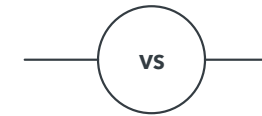
CV Material vs. Fibreboard: A Comparative Analysis

This shows a comparative analysis of the carbon footprint of a tile produced from ChopValue Material vs. Melamine Fibreboard. On logistics, our approach in collecting chopsticks from restaurants locally, transporting them to the closest microfactory and then to local consumers shows a 58% decrease in CO2 emissions in comparison to the process of sourcing, producing and shipping fibreboard products.

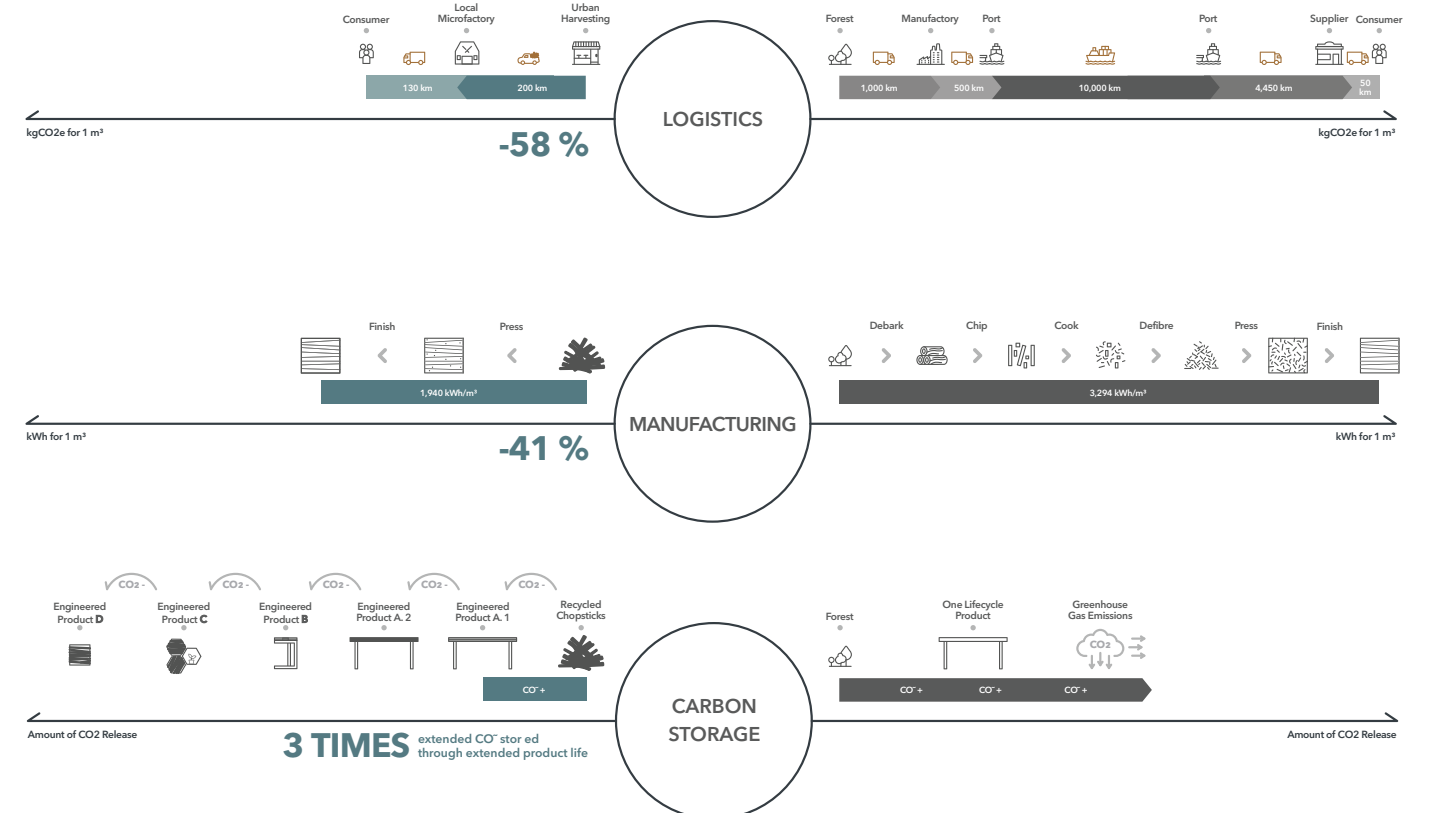
On manufacturing, our simple process (press and finish) represents a 41% decrease in CO2 emissions compared to a 6-step process to manufacture fibreboard. In addition, by engineering our products into other products, we are able to maintain the CO2 emissions stored through the extended product life.



ChopValue Tile



Fibreboard



CIORCLAN

Centralized manufacturing

If ChopValue were to follow a centralized manufacturing approach, the supply chain would start with urban harvesting chopsticks from global collection locations, and would include the shipment of these chopsticks back to the production facility in Vancouver to be processed and manufactured into viable products. In this case, the shipping distances by each facility would be:

If we used this approach

the shipping distances would have made us carbon positive.

+2.79
kgCO₂e

per kg chopsticks

Victoria	Los Angeles	Montreal
108.2 km	2,055.5 km	4,556.8 km
61.8 truck, 46.4 ferry	by truck.	by truck.

If this were the case, the emissions from such an operation would be +2.79 kgCO₂e per kg chopsticks, causing ChopValue to become a carbon-positive company.

Such an operation would not be environmentally sustainable, making it less beneficial for chopsticks to be diverted from landfills.

Distributed manufacturing

In the case of our distributed manufacturing approach, emissions are calculated for each individual location.

This includes a local route to collect chopsticks which are then processed at a hypothetical microfactory located in the same city. The results showed that this manufacturing approach would result in a net carbon-negative impact. In this case, each location would remain carbon negative except ChopValue Montreal. Currently, Montreal's operational emissions exceed the retention amount in the chopsticks collected and would either require a change in the production process or an increase the number of chopsticks collected to make the process more efficient.

Our approach is

a better, more efficient process, and carbon negative.



7.0 Expansion philosophy

Driven by impact.

ChopValue's collaboration with the local restaurant community has allowed the business to demonstrate that waste can be effectively used as resources. The utilization of formerly neglected materials has allowed ChopValue to take its business model into new cities and establish itself in different communities.

After systematically establishing Vancouver's efficient and profitable production facility and the success of ChopValue in Calgary and Singapore, it has been demonstrated that ChopValue can start to make an impact at a larger scale.

Our choices are purpose driven.

Choosing our Microfactory Locations:

New ChopValue microfactories require an abundant supply of chopsticks, an existing demand for products, and a community that is receptive to greener lifestyle choices, as well as ChopValue's goals for a cohesive, socio-environmental community.

As additional collection and manufacturing facilities are expected to spike the company's carbon footprint, the extensions must be justified by ChopValue's ability to offset those emissions and create a positive impact on the community. With the rise of ChopValue microfactories around the world, the company will be able to establish multiple facilities for an optimal, local production and distribution that will reduce transportation emissions by fulfilling customer orders using the closest microfactory available.

Choosing our Suppliers:

As a business that aims to support the local community, it can be a challenge to find suppliers that also source their resources locally, so ChopValue does its best to purchase locally made goods wherever and whenever possible. It is important for ChopValue to have control over the emissions they produce because once it is out of their hands, the company and its customers are impacted by third-party prices, shipping, taxes, and trade agreements.

Choosing our Partners & Collaborators:

Community is important to ChopValue for making strong, lasting, mutual relationships filled with unity and participation. In order to make the biggest impact, ChopValue hopes to support and inspire local businesses to support local businesses, and therefore, invest back into the local economy.

The 1.5 billion chopstick vision

By 2022, ChopValue envisions to establish 75-100 Microfactories around the world, including cities like Sao Paulo, Mexico City, and Toronto. The microfactories will provide a framework for franchise partners to establish their own business based on converting waste to resource.

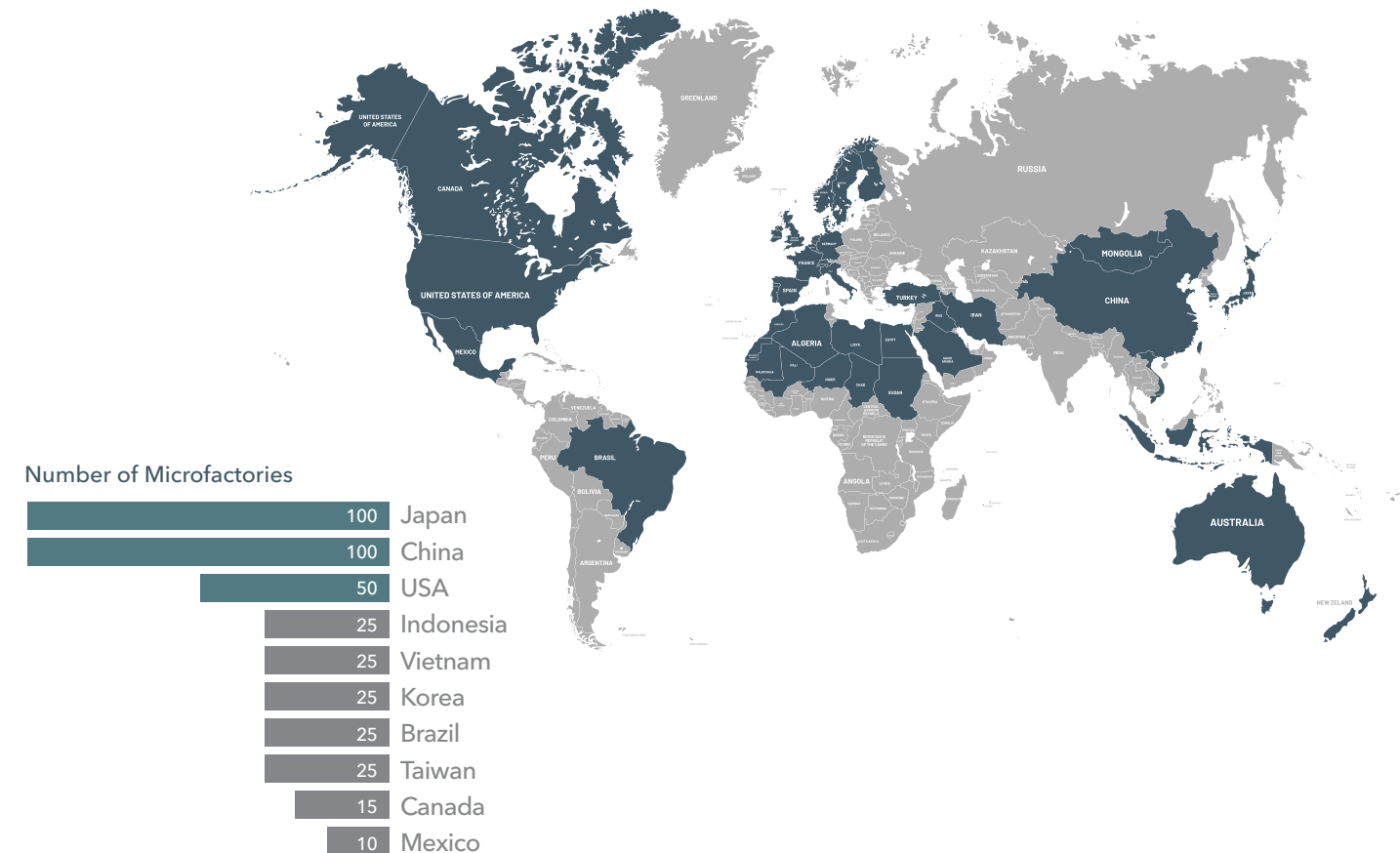
1.5+ billion chopsticks made into products

75+ Microfactories worldwide

1000+ locally employed trades, designers and engineers

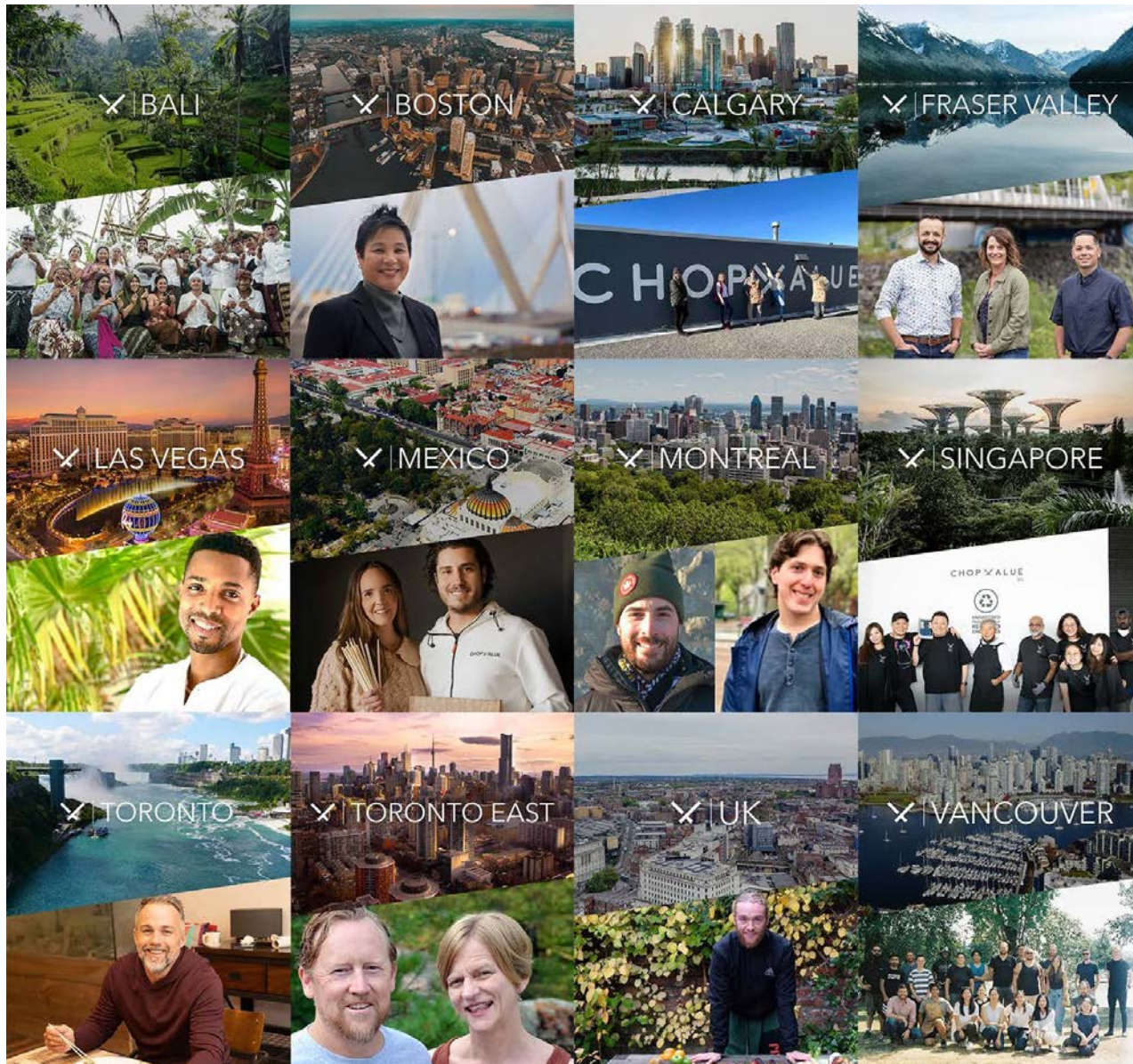
Global ChopValue Opportunity Map:

*10 year development plan presented to strategic partners



Made Local On a Global Scale

Lean manufacturing of high-value products under shared ownership, using locally available resources to minimize our society's environmental footprint: Our expansion philosophy ensures that ChopValue is manufacturing and delivering premium, circular products globally: carbon neutral or better.



Franchise Partners

Since the launch of our franchise expansion philosophy in 2020, our brand grew from our initial location in Vancouver to over 60 locations globally: creating impact location by location, one chopstick at a time.

8.0 Social Impact

Our relationship with others is the heart of our business.



ChopValue connects multiple industries through the common goal of increased environmental sustainability and awareness.

These relationships that form are the core of our business.

This network is not only relied on resource supply, but also on community involvement and the support for a change in how businesses are being structured. Industries involved with ChopValue range from restaurants and hospitality, developers and architects, interior designer and décor, and personal and corporate groups, and are emphasized based on design, manufacturing, and production. Products are acquired by consumers and businesses due to their high performance and the unique story visible in the aesthetic of the material.

A ChopValue Microfactory requires a strong network of local businesses, chopstick collection partners, employees, and end customers. In its own way, the presence of a ChopValue Microfactory creates a small local community that is engaged in the circular economy movement. Establishing each new collection partnership is an opportunity to educate and inspire others to reutilize their waste into resources. By collecting one chopstick at a time, ChopValue has had a significant impact on its local society and the impact continues to grow each year.



Key partnerships & collaborations

We are thankful to several collection partners and collaborators who have joined in our mission to raise awareness about the circular economy by either collecting with us or investing in our products.

We aim to highlight our key partnerships and how they have added to ChopValue's sustainability efforts.



Vancouver International Airport

1,137,755
CHOPSTICKS RECYCLED

1,563.3 kg
CO₂e
EMISSIONS RETAINED IN PRODUCTS

Collection partner since: December 2016

Reaching a million chopsticks collected at the end of June 2019, Vancouver International Airport was the first high-concentration collection partner in ChopValue's collection program.

With the airport's goal to achieve their target of 50% waste diversion by 2020, they emphasize the importance of waste management by running internal initiatives, such as the annual 'Waste Wars', to evaluate their tenants on their waste sorting habits and accuracy for YVR's four waste streams (organic waste in green bins, plastics, paper and metals in appropriate recycling bins, and the rest in garbage).

This initiative also acts as an education platform to inform staff on proper waste disposal and excite them with beautiful products that are made from the waste resources they divert.

To demonstrate their commitment to waste, YVR's expansion plans highlight ChopValue in their main building materials and products.



JLL

1,217,700
CHOPSTICKS RECYCLED

1,673.1 kg
CO₂e
EMISSIONS RETAINED IN PRODUCTS

JLL kickstarted their partnership with ChopValue through the chopstick collection program in June 2018 and soon grew to become one of ChopValue's most engaged recycling partners.

With the united belief that wasted resources should be utilized to accelerate the circular economy, ChopValue has worked with JLL to work on their sustainability targets across their real estate portfolio.

With all the chopsticks that have been collected, ChopValue is working with JLL to create an art piece to feature the partnership in Metrotown mall.



Cadillac Fairview (CF)

1,963,001
CHOPSTICKS RECYCLED

2,697.1 kg
CO₂e
EMISSIONS RETAINED IN PRODUCTS

Cadillac Fairview and ChopValue both pride themselves in transparency, holding their actions accountable to the decisions made in the operation of their company. Cadillac Fairview focuses on developing and operating their properties through collaboration with local community members to find ways to continuously reduce their environmental footprints when possible.

With such a broad network and reach, they run a 'Green at Work' program where they incentivise property teams - like our recycling partner, Richmond Centre, to engage their company and employees in integrating sustainability into their daily practices, especially in their building operations and maintenance.

They see growth and opportunity in urban spaces. ChopValue runs their business the same way, ensuring sustainability is at the forefront of company values. ChopValue has produced feature walls and tabletops for the Richmond Centre food court from the chopsticks recycled from their facility and participate in their hosted events to highlight their sustainability efforts.



Little Kitchen Academy (LKA)

Little Kitchen Academy and ChopValue both focus on inspiring locally and impacting globally. We are truly united in our core values of educating the new generation, one teaching about healthy food choices and the other teaching about reutilizing waste.

ChopValue is excited to provide LKA with the exclusively designed “Community Table” for all their current and future locations, as well as recipe tags and serving trays. In addition, ChopValue is provide 5 annual scholarships for LKA, offering kids with culinary classes once a week for a total of four weeks.

These kids will get an opportunity to experience proper handwashing, equipment safety and care, collecting, cleaning, prepping ingredients, and making recipes - “from scratch to consumption”. ChopValue’s partnership with LKA provides the perfect opportunity for these kids to learn about the entire cycle of a culinary journey including waste and its reutilization. #changinglivesfromscratch.



London Drugs

ChopValue formed a national partnership with London Drugs, a Canadian retailer and waste conversion leader. In addition to having chopstick collection bins available at every London Drugs location across Canada, ChopValue has designed custom interactive Closed Loop displays that enable consumers to drop off their used chopsticks and shop a variety of beautiful and sustainable products for the home and office.



Edo Japan

ChopValue has partnered with Edo Japan, a popular restaurant chain specializing in Japanese Teppan-style cooking. The partnership enables the repurposing of used chopsticks from 61 locations across Canada and transforming them into products. Edo Japan and ChopValue have worked on a number of campaigns and giveaways to help educate, inspire and advocate on the importance of upcycling.



Air Canada

ChopValue has been collaborating with Air Canada’s Waste Management and Environmental Affairs team as they explore circulatory options to address Canada’s ban on single use plastics. ChopValue has closed the loop through sustainable products for corporate giveaways, design elements for airport lounges and making ChopValue retail products a sustainable option for Aeroplan members to utilize their points.

The value of trades and craftsmanship

The ChopValue microfactory concept reminds local communities of the importance and value of handcrafted products. By creating a novel and sustainable material that can be used by woodworkers to create new products, ChopValue hopes to inspire both woodworkers and the end consumer alike.

Our material has a similar aesthetic to tropical woods, and we hope that the beauty in this chopstick-based material can inspire woodworkers to consider more sustainable alternatives for their projects rather than extracting new resources from the environment.



Impact Summary

Impact Stats.

As of December 2022, ChopValue's cumulative environmental impact is:

88,683,935

chopsticks diverted from landfill



The equivalent of 412 basketball courts

266,051.81 kg

of waste diverted from landfills.



The equivalent of 2,204 adult pandas

121,851.73 kg CO₂e

stored in functional products.



The equivalent of charging 14,822,367 cell phones

*these different figures are owed to the inconsistent measuring techniques used each year, and the different scaling systems and chopstick variations.



Bamboo as a renewable resource.

As a material, bamboo is similar in chemical composition to wood but is a part of the grass family, making it a valuable and non-wood forest product. Easily adaptable to changes and differences in climatic and soil conditions, its connection to the grass family ensures its fast growth and ability to spread from its dense-root rhizome systems and produce a higher production yield than timber products over a shorter time period.

As it reaches full maturity within 3-5 years, harvesting is possible every few years due to the bamboo's natural regeneration capability. If produced locally, bamboo has an even lower environmental impact than tropical hardwood and can grow on slopes deemed unsuitable for agriculture or agroforestry crops.

The ecological benefits of bamboo forests are its water conservation and prevention of soil erosion – both of which assist with land rehabilitation and carbon sequestration, mitigating forest floor degradation.

Bamboo sequesters 45.8% its total biomass as carbon.

The remanufacturing of bamboo chopsticks offers the opportunity to utilize this wasted resource and to treat it as a valuable raw material.

Therefore capitalizing on the potential to retain carbon within new products. Bamboo also has a denser composition than softwoods and is therefore more resistant to environmental changes (especially humidity) and is generally scratch resistant, both of which make utilizing bamboo advantageous compared to wood-based products. ChopValue's conversion of chopsticks into products extends their lifetime indefinitely, thereby extending the time that this carbon dioxide remains stored.

The environmental impact of renewable chopsticks

Regardless of the material, reusable objects are labelled as sustainable alternatives to single-use options. Recently, the term “single-use” has become a taboo that is automatically associated with environmental unsustainability. While these reusable products generate less overall waste, a Life Cycle Assessment (LCA) is necessary to determine the full extent of its impact throughout its entire production chain. For a reusable material to be deemed a truly sustainable alternative, all stages of the product preparation including raw material extraction, processing, manufacturing, logistics, maintenance, and its ultimate disposal should be considered.

The previous Urban Impact Assessment investigated the comparisons between plastic, wooden, and bamboo chopsticks to understand the advantages and disadvantages of each material choice. Though disposed of after one use, bamboo was the most sustainable choice in material for chopsticks due to its rapid regeneration rate.

Plastic chopsticks, which are generally believed to be better, aesthetically deteriorate over time or according to a number of restaurant owners, are thrown out either by mistake when restaurants sort their dishes or due to its reduced aesthetic, and sometimes even hygienic concerns. As a result, these chopsticks are disposed of by restaurants after an average of 3-6 months when they should be used for a significantly longer time to counteract the energy and resource-intensive processes required to produce them. In addition, the need to clean the utensils after each use requires ample amounts of energy and water, while introducing microplastics into the water system through material breakdown. Because these plastic chopsticks are made of thermoset polymers, they are non-recyclable (Hopewell et al, 2009), so restaurant owners are left with no other choice but to send these chopsticks to the landfill, where they do not decompose.

The resource-intensive process that goes into the production of plastic utensils is invisible to the end consumer, making it easy for restaurant owners and customers to omit the information when selecting a material for their restaurant.

Furthermore, through ChopValue’s process of giving bamboo chopsticks a second life, the value of this material increases, and the waste that would otherwise be generated is diverted into timeless products. The products created through ChopValue also retains the carbon sequestered during the growth phase of bamboo (see more in the previous issue of the Urban Impact Report).

Conclusion

Leading by Example

This report marks the fourth Urban Impact Assessment conducted by ChopValue to evaluate our social and environmental impact.

We hope to show that a desire to make a social and environmental impact should not hinder progress in business. Being a prime example of the circular economy approach, ChopValue shows that a viable business can be developed based on the principle of waste reutilization and that manufacturing does not require the extraction of new resources from the environment.



Our business also creates a strong local community of collection partners, suppliers, and customers, which can be leveraged to educate and raise awareness surrounding the circular economy.

The environmental impact assessment in this report includes Scope 1 and Scope 2 emissions in accordance with the Greenhouse Gas Protocol. After accounting for the emissions generated from the manufacturing process and comparing those to the amount retained in the chopsticks, ChopValue remains a carbon negative company. A comparison of this report to the previous assessment showed that the strategic collection of chopsticks from denser areas, such as malls, resulted in increased efficiency.

ChopValue is expanding our operations by establishing Microfactories in various locations across the world. These Microfactories are expected to develop a network of local vendors from which they would obtain chopsticks to be manufactured locally, and the products would be distributed to local consumers. This decision is expected to have a higher social impact by creating an engaged local platform for education about the circular economy and about the responsible utilization of resources. ChopValue conducted an environmental assessment to compare the impact of this distributed manufacturing approach to a traditional centralized manufacturing approach. This assessment concluded that expansion via centralized manufacturing would cause ChopValue to become carbon positive, resulting in no net benefit to the environment, while expansion via distributed manufacturing would allow ChopValue to remain carbon neutral.

This assessment also addresses the concerns around reusable chopsticks. The taboo of “single-use” utensils have caused many to believe that reusable alternatives are the only way to go. Though plastic chopsticks are generally believed to be better, the aesthetic deterioration and hygienic concerns result in an untimely disposal by restaurants. This decreased lifespan coupled with the energy and resource-intensive processes required to produce reusable chopsticks decreases their net benefit to the environment. Comparatively, using chopsticks made of bamboo have a net benefit to the environment owed to bamboo’s high carbon retention capabilities and fast growth. We believe that the solution to “single-use” chopsticks should not rely on the extraction of new resources from the environment, and that extending the lifespan of bamboo chopsticks can be a simple and effective solution with increased environmental impact.

Since ChopValue’s initial establishment, over 88 million chopsticks have been utilized into new products, each storing carbon dioxide that would otherwise be released back into the environment. We at ChopValue are committed to environmental leadership, showing, by our example, that a desire to have a social and environmental impact can align well with our business plans.

We hope to continue to encourage and inspire new businesses to find resources in our waste, making a difference just like us – one chopstick at a time.

References

- Gerholdt, J. (2017). These 4 companies are embracing, and finding value in, the circular economy.
- World Economic Forum. Retrieved from <https://www.weforum.org/agenda/2017/06/four-companies-embracing-the-circular-economy/>
- Hopewell, J., Dvorak, R., & Kosior, E. (2009). Plastics recycling: challenges and opportunities. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1526), 2115-2126.
- Ostadhashemi, R., Shahraji, T. R., Roehle, H., & Limaie, S. M. (2014). Estimation of biomass and carbon storage of tree plantations in northern Iran. *Journal of forest science*, 60(9), 363-371.
- United Nations Environment Programme - UNEP. (2017). With Resource Use Expected to Double by 2050, Better Natural Resource Use Essential for Pollution-Free Planet. Retrieved from <https://www.unenvironment.org/news-and-stories/press-release/resource-use-expected-double-2050-better-natural-resource-use>
- Zhang, H., Zhuang, S., Sun, B., Ji, H., Li, C., & Zhou, S. (2014). Estimation of biomass and carbon storage of moso bamboo (*Phyllostachys pubescens* Mazel ex Houz.) in southern China using a diameter–age bivariate distribution model. *Forestry: An International Journal of Forest Research*, 87(5), 674-682.



CHOP X ALUE

ONCE A CHOPSTICK - NOW A STATEMENT

chopvalue.com [f](#) [t](#) [@](#) @chopvalue