

Project name: **Paper to Infinity π (Pi)**

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Problem

HKUST has a well-developed paper recycling system that 3 million pieces of A4 paper were recycled on campus in 20/21. While the recycling work of A4 paper has been impressive, wouldn't the impact be more significant if we start developing innovative recycled paper products? Moreover, there is low transparency in how recycled paper is processed and utilized in HKUST as students are rarely involved in the paper recycling manufacturing process. These problems would in turn restrict students' imagination and interest in paper recycling and sustainability in general, which eventually lead to difficulty in reducing paper and other waste in HKUST in the long run.

Our Sustainable Solution

We wish to provide students opportunities to experience the comprehensive cycle of recycling paper waste into products and impact the lifestyles of students and even the global community.

1. Paper product innovation and manufacturing workshop (team workshop)

In the team workshops, we will focus on developing innovative pulp products. Our goal is to work with different organizations of HKUST and provide practical HKUST-made paper products. We believe, by applying innovative paper products to different campus settings, our project could influence students to live more sustainably, and promote a more innovation-friendly environment on campus.

2. Paper recycling and product development experience workshop (experience workshop)

Our experience workshops will provide opportunities for students to recycle paper into pulp, design, and create paper products to take home. We aim to educate students about how paper waste is recycled and applied in daily life so that they can be more familiar with sustainable products and make smarter decisions as citizens, consumers, and entrepreneurs in the future.

Process of Creating Pulp Products

This is the general process of how our paper products will be developed:

1. Paper waste collection

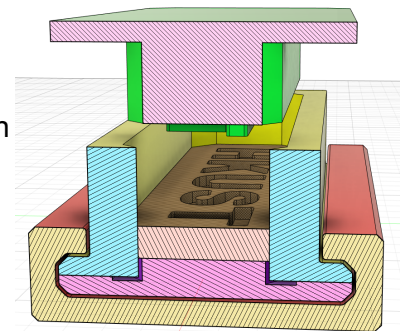
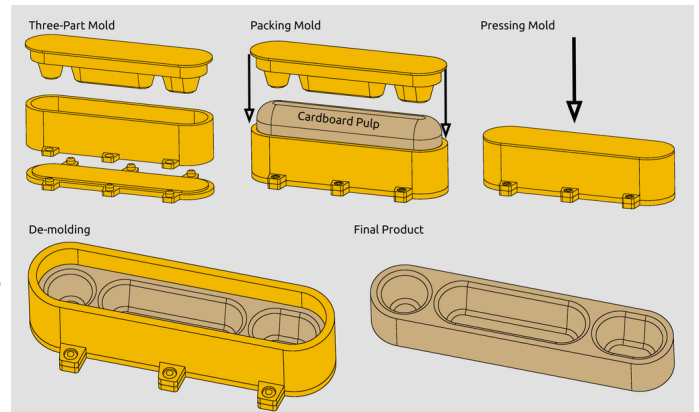
Type of material and collection method: Pulp is made of cellulose fiber, which can be obtained from a wide variety of paper waste. This includes writing paper, newspapers, egg cartons, and cardboard boxes. However, only paper without coating will be used. All paper waste will be collected from the recycling bins on campus.

Material pre-treatment: Any nonpaper material on the paper like labels or tapes should be removed in advance.

2. Shred paper: Use a shredding machine to shred paper into pieces. Different types of paper material can be mixed together, and it doesn't affect the quality.

3. **Making paper pulp:** (1) Put the shredded paper into a blender. (2) Add hot water to half the amount of paper. (3) Add fiber binder (glue). We can use PVA glue and also organic rice paste, which is an eco-friendly choice. (4) Blend it until it is a uniform paste. (5) Add dye to give pulp color (if needed)

4. **Mold pressing pulp:** The fundamental principle of mold pressing paper pulp into shaped products is shown on the right. We will design the mold based on the shape, size, and characteristics of the product. To be systematic, we will use this basic principle for all of our manufacturing methods. Our molds can be either 3D printed or CNC machined. More of our technical considerations are in the “Extra” section. Below are the procedures:



1. Remove excess water from the pulp with a squeezing machine
 2. Insert pulp into pressing mold. The input volume should be around 150% of the final size of the product.
 3. Press the mold with a pressing machine. It would be better to use a hydraulic machine, but it is not required. Other cheap or free methods can be used compromising quality.
5. **Drying:** For highly compressed pulp, remove the compressed pulp from the mold. Leave it to dry for a few days or put it in an oven to dry faster. For Less compressed pulp, If we would like a less dense product or if the product is pressed with insufficient force, then the pressed product will be wetter. It is better to leave it in the mold for one day, and then take it out to dry.

Implementation

Workshop and Schedule

	Team workshops	Student Experiencing workshops
Participants	Team members only. We need around 10 team members	20-25 participants per session, and all students are welcome
Content	<p>Step 1: Get product orders from HKUST organizations.</p> <p>Step 2: R&D: (1) Experiment with the paper molding process, document problems, and successes, and refine the production method for specific products</p> <p>Step 3: Manufacture products</p>	<p>Session 1(online): Online classes teaching students to design their custom mold press + 3D print mold press on Campus</p> <p>Session 2(f2f): Making paper pulp and shaping the pulp with their own molds or our prepared molds</p> <p>Session 3(f2f): Embellish and color their own dried pulp product + Summary</p>
Schedule and Length	<p>Long-term team:</p> <p>The schedule will be adjusted according to product supply needs</p>	2-3 workshops/semester, 3 different sessions within 2 weeks. Flexibility for participants to join any 1 to 3 sessions. 2-3 hours per session.

Experience Workshop

Students will use Fusion 360 to CAD model their own designs. The structure of the mold press mechanism will be provided, so they only need to transfer the shape of their product onto the mold press mechanism. This will be a relatively simple task that students with no experience can achieve. For teaching, we will lead the workshops with professors. In the future, we can even collaborate with local external partners, such as Mill Mill, in organizing more diverse paper

recycling workshops to further raise students' and public awareness of paper recycling and its application.

Requirements and cost

We need **(1)** a room to execute workshops, **(2)** A hydraulic pressing machine/substitute: 10000HKD/free, **(3)** A paper shredding machine, **(4)** Blender, **(5)** 3D printers, **(6)** cheap miscellaneous materials. The school already has some of our required facilities or equipment, which can further bring down our costs.

Our Team Workshop Products

Paper Trophy

Currently, there are very few awards in HKUST that consist of recycled materials. Hence, we propose a paper trophy made of paper waste on campus for the HKUST sustainability departments, which can be used as a prize for students with sustainability achievements in the future. The recycled paper materials can also be combined into any other prizes in the long run for promoting sustainability.

The trophies can be made by assembling their recycled paper components together, while the text on the trophy can be spray painted, laser engraved, or sticker foil applied. For humidity concerns, we can apply eco-friendly epoxy resin to make it water-resistant.



Other product ideas

We wish to design a wide variety of products that bring convenience and sustainability to students and the campus. Our products range from different types of containers and decorations to others like souvenirs. We will come up with more creative ideas and discover more possibilities for paper-made products with other HKUST students in the future.

The picture shows some of our product ideas







(More product ideas and photos can be found in our extra session!)

Other applications of our products:

- Collaboration with Sustainability

Departments: They can also be served as gifts for students when they achieve certain targets in sustainability campaigns to encourage the use of sustainable products.

- Collaboration with other departments and societies: We can provide products such as paper-pencil boxes for departments or societies as their event giveaways (e.g. on orientation days). Content such as the logo and the name of the organization can also be customized and printed on our products. This helps promote the use of recycled products.

	Image	Application	Examples
Regular paper box		Can store anything as different sizes of paper boxes are available Can be used to organise items in hall rooms.	<ul style="list-style-type: none"> - Electronic components - Oversized textbooks - Daily necessities - Clothes for laundry
Paper bag		Acting as an alternative to shopping bags. Can be provided on the bag sharing shelf in Fusion for free to reduce the use of plastic bags, as it is more recyclable and biodegradable.	<ul style="list-style-type: none"> - Clothes - Packed food
Paper-made figure		For room decoration and promote recycling culture within HKUST	
Paper-made keychain		For decoration and promote recycling culture within HKUST	
Poker cards		We can print our sustainability messages on the package and the back of cards to let students learn more about our project and sustainability.	
Paper-made seedling pot		For the community garden and other planting activities in HKUST. They are biodegradable and can be put into the soil directly to grow plants, which helps protect delicate roots and reduce transplant shock while transplanting.	

Benefits for Students and HKUST

Smart and Innovative campus

Our project matches the “Living Lab” area in the HKUST 2028 Sustainability Challenge:

Skills and Experiences for Students: The workshops could provide students with technological skills and hands-on experiences in paper recycling, CAD designing, 3D printing, and CNC-machining

Boost Innovation: Our team could provide a long-term lab for students to engage in the R&D process of recycled product development. This facilitates students to develop a problem-solving mindset and also showcase their new ideas and approaches to creating recycled paper products.

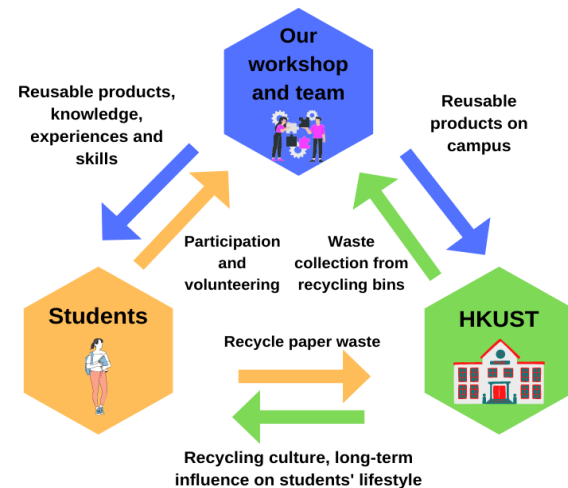
A More Sustainable HKUST

We have also addressed the “Sustainability Education”, “Building Our Community” as well as the “Progress and Performance” areas in the 2028 Challenge:

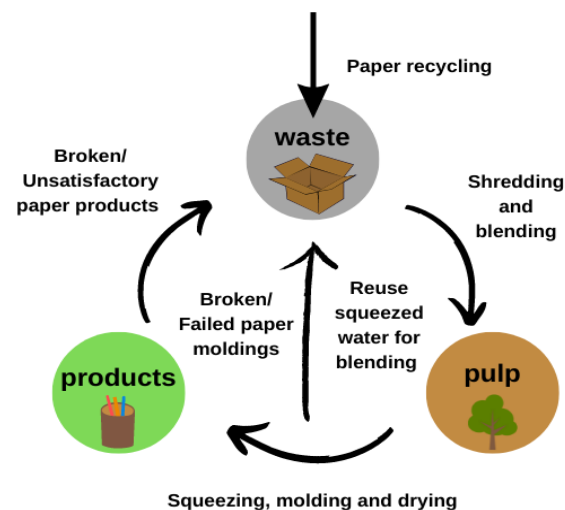
Influence our Lifestyle: our workshops allow students to experience paper recycling and create their own paper products, thereby, promoting a recycling culture and encouraging students to adopt more diverse recycled products in daily life.

Build a Recycling Community: We could create a community of faculty, staff, and students by offering students and staff the chance to cooperate in paper recycling and develop products for HKUST.

Save Resources: By developing a sustainable product cycle, our project could facilitate a long-term reduction of paper waste and its disposal bill in HKUST.



The Product Cycle



Summary

Paper to Infinity π (Pi) aims to solve the problems of having low transparency of paper recycling and its application, and the lack of a recycled product innovation platform in HKUST. We proposed a solution that includes workshops and a team for students to experience paper recycling and create products out of closed-loop recycling. We believe we could lead people into living sustainably and spread the infinite possibilities from paper products to students and the global community, just like π having infinite digits!

See our extra section!:

<https://docs.google.com/document/d/19eymalUVHU7P-L-lzZRIInVzSVIiKr2rZeXQqCRSKgY/edit?usp=sharing>