Unboxing Tech Toolkit:
The Materiality of the Smartphone

Built by The Pranava Institute
Supported by Konrad Adenauer Stiftung

Welcome to the Unboxing Tech Toolkit!

1

This toolkit belongs to

- - - - - - - - - - - - - - - - - - -

Things you'll need

A printer (optional)	
Your smartphone	
A pen/pencil	
Friends, if you feel like sharing!	

About the Unboxing Tech Toolkit

Hey there!

The Unboxing Tech Toolkit is your guide to better understanding your smartphone and making technology work for you and our planet. The activities in the toolkit will help you unbox what's inside your device, map the global journey your smartphone takes before meeting you and understand its afterlife once you say goodbye. By the end of this toolkit, you will have the power/ability to make better technology decisions and contribute to building the sustainable digital future we all dream of. ↗

2 Let's get started!

- When did you buy your current smartphone?

DD	MM	YY

- When you bought this smartphone, how long did you think it would last?

  - - - - - - - - - - - - - - -

- How many smartphones do you own?

  - - - - - - - -

- Is this your first smartphone?

YES

- What were the criteria which you considered while buying this smartphone?
  - ☐ Cost
  - ☐ Recycling
  - ☐ Battery life
  - ☐ Brand
  - ☐ Social proof
  - ☐ New release
  - ☐ - - - - - - - - - - -
  - ☐ - - - - - - - - - - -
  - ☐ - - - - - - - - - - -

NO

How many smartphones have you used before?

- - - - - - - - - - - - -

How long did you use your previous phone?

- - - - - - - - - - - - -

When did you buy your previous phone?

- - - - - - - - - - - - -

Where did it go after you were done using it?

- - - - - - - - - - - - -
- - - - - - - - - - - - -

3 Where does your smartphone come from?

- Where did you buy your smartphone?
  - ☐ Online ◦———● Where was your phone shipped from?
  - ☐ At a store ◦———● How did your phone reach that shelf you picked up from?
  - ☐ Local
  - ☐ From another country

- How far back can you trace the journey of your smartphone before you got it home?

  -
  -
  -

INFO BYTES!

In 2021, China manufactured **30.5%** of global smartphones. While mobile phones are the most commonly used device in the United States, none of the big tech companies manufacture phones in the US. **China, India, Japan, South Korea, and Taiwan** are some of the major manufacturing hubs in the world.

↘ From the above mentioned list, where do you think your smartphone was manufactured ?

- - - - - - - - - - - -
- - - - - - - - - - - -

↘ Do you think your smartphone was made from scratch (from raw materials) in the same location?

Let's find out! >

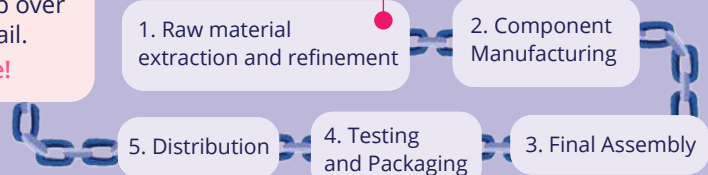# It takes the **entire world** to make your smartphone!

While buying a smartphone is easy, building it is not! Let's unpack the global journey of your smartphone. ↘

Part 1

Supply chains and how to find them!

How many countries were part of the process in making your smartphone?

a. 1-3
b. 5-10
c. > 10

Activity 1: Let's trace an iPhone's journey across the globe. Flip over to the map and follow the trail. **Come back here when done!**

Your phone was not manufactured in your country or any one specific country. The production of your smartphone occurs through a complex chain of steps performed by different players across the globe.

That's called a **supply chain.**

1. Raw material extraction and refinement
2. Component Manufacturing
3. Final Assembly
4. Testing and Packaging
5. Distribution

Part 2

Your Smartphone has bling!

Your smartphone is **just as snazzy as you.**

Gold and silver are used in your phone for their excellent conductive properties. For every 1 million smartphones recycled, you can recover 350 kg of silver and 34 kg of gold. **That's quite a bit of precious in there!**

Rare earths light up your display!

Rare earths, which occur **rarely** worldwide, bring vivid colours to your display and power your phone's vibrate feature. But they have worryingly low recycling rates.

Activity 2: Spot that rare mineral!

Most rare earth elements are extracted from an element called **Monazite**. Flip over to find the country where the mineral **M** is majorly sourced from.

Part 3

But smartphone manufacturing can be, um, problematic.

Rare Earths, which light up your display, are often extracted using open pit mining.

But this method can cause serious soil, water and air pollution. China's Bayan Obo mine is the world's largest rare earth mine. However, mining causes harmful chemicals to leach into the Yellow River and pollute the drinking water supply for millions.

Mined in War

Some extremely rare smartphone metals are only found in war-torn regions worldwide.

Tungsten, tantalum, tin and gold(aka 3TG) are mined and traded by armed groups in Eastern Congo who are notorious for human rights violations and abuses. Mining profits fund their activities. The US and the EU now have laws to ensure responsible sourcing to end exploitation and support local development.

Ans: On average, more than ten countries are involved in different stages of manufacturing a phone!

Part 4

Are some phones fairer than others?

Responsible!

Fairphone has succeeded in responsibly sourcing for all four conflict minerals. It has also created ways for customers to track the entire smartphone supply chain, unlike most companies.

And repairable!

Fairphone also tries to manufacture sustainable smartphones that are 100% repairable. They sell spare parts which allows users to repair their smartphones instead of throwing them away.

Activity 3: Flip over to the map to trace Fairphone's supply chain for tungsten across different stages of production.

Where does your smartphone come from?

↘ Use this map to do the **3 activities** outlined on the previous page.
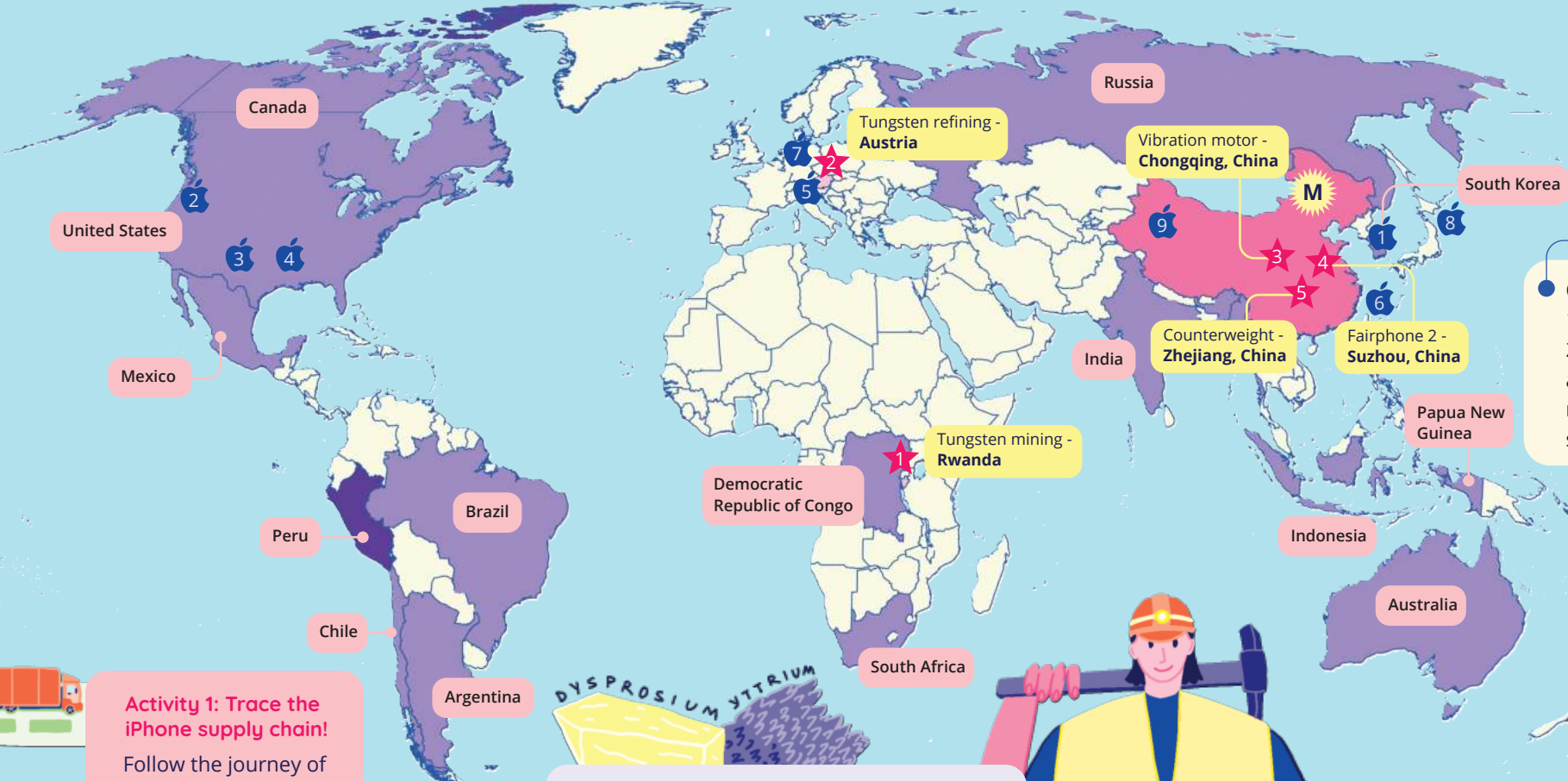
Activity 4:
Did you notice?

Can you spot which regions are mined to a larger extent to source minerals for your smartphone?

Countries which produce
1,
2-3
and >3
minerals which are used in smartphone production.

Canada

Russia

Tungsten refining -
Austria

Vibration motor -
Chongqing, China

7

2

M

South Korea

United States

5

9

1

8

3

4

3

4

Mexico

5

India

Counterweight -
Zhejiang, China

6

Fairphone 2 -
Suzhou, China

Papua New Guinea

Tungsten mining -
Rwanda

Peru

Brazil

1

Democratic Republic of Congo

Indonesia

Chile

Australia

South Africa

Argentina

DYSPROSIUM YTTRIUM

Activity 1: Trace the iPhone supply chain!

Follow the journey of the iPhone supply chain across the world. See carefully to find the hidden cues and connect the numbers from 1 to 9 !

Activity 2: Spot that rare mineral!

There are **5 Rare Earths** in your phone! - neodymium, praseodymium, dysprosium, terbium and yttrium. They come from a mineral called Monazite!
Find the (M) symbol on the map!

Activity 3: Track Fairphone's fair Tungsten supply chain

Trace the journey of the tungsten (any 3TG element) sourced by Fairphone ★ in the map.

Q: Which country controls the major part of the global supply of rare earth elements?

- - - - - - - - - - - - - - - -

Answer: China

It's time to...unbox your smartphone!

Smartphone BTS! 💥

We seamlessly slide, scroll and flash our phones in seconds to text, click pictures and post on social media. While this feels easy, multiple cutting-edge components are at work behind the screens to enable these functions.

Follow the action trails on this page to discover what components come into play when you use your smartphone. **Pick your responses from the options tray at the bottom!** ↘

1 Attend a phone call

You hear the phone ring or vibrate and swipe to pick the call.

i Your phone's speakers, microphones and the vibrate feature are powered by magnets made from which rare earth?
- - - - - - - - - - - - - - - - - - - -

iii Speakers and microphones help you hear and speak. But which component helps your smartphone transmit and receive call data?
- - - - - - - - - - - - - - - - - - - -

ii Where is your contact information stored?
- - - - - - - - - - - - - -

iv Finally, noticed how smoothly your screen switches off when you bring your phone near your ears. What component powers this magic?
- - - - - - - - - - - - - - - - -

2 Take a picture and upload it on social media

You pull out your phone and snap away.

i Which awesome element powers your camera flash and helps keep your phone cool simultaneously?
- - - - - - - - - - - - - - - - - - -

ii What component powers your photo filters?
- - - - - - - - - - - - - - - - - -

iii Where is your picture stored?
- - - - - - - - - - - - - - - - - -

iv You can tag your location because of _ _ _ _ _ _ _ _ _

💥 Behind The Screen

3 Your phone is so sensitive!

Your smartphone is a phenomenal engineering achievement that does the work of many devices. Its coolest features are powered by sensors, specialised devices that help your smartphone detect and respond to the environment around you. **Match each function with the right sensor!**

i Used to detect the orientation of your device to enable features like shaking the phone to change music. Shows your current speed in driving apps and powers your fitness devices.

ii Used when you tilt your screen to steer your car in a racing game or create a 360-degree photo/video. Means "look around" in ancient Greek.

iii This device helps your phone find North and navigate maps. Can also serve as a metal detector.

iv This sensor connects to satellites in space to figure out where you are on earth, even without the internet.

v Helps your phone automatically set screen brightness based on surrounding light to conserve battery life and reduce eye strain.

A Magnetometer

B Gyroscope

C Ambient Light Sensor

D GPS sensor

E Accelerometer
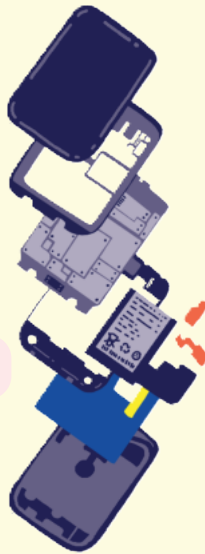
Options tray

1
- A. Modems
- B. Neodymium
- C. Proximity Sensor
- D. RAM or Internal Storage

2
- B. Gallium
- D. The Graphical Processor Unit (GPU)
- C. RAM or Hard Disc
- A. GPS

The life of our smartphone as we use it

We are constant consumers of the smartphone in various ways in our daily lives.
Let's see how ↘

You are **ALWAYS** on your phone!

1 Your phone economics

It costs you money to make the best use of your phone. What are the accessories which you buy along with your smartphone to get a **complete experience?**

Accessories	Cost
◯ Earpods	- - - - -
◯ Data plan	- - - - -
◯ Selfie sticks	- - - - -
◯ Holders & covers	- - - - -
◯ Power bank	- - - - -
◯ Headphones	- - - - -

How many of the aformentioned accessories have you bought for your current phone?

- - - - - - - - - -

Can you try and remember the cost of each item and add it up? What's your phone-economics?

- - - - - - - - - - - - - - - - - -

The cost of our phones are much more than the price we paid to buy the device, but also includes costs we consistently pay to use various functions of the device.

2 How much energy do we use to power our devices?

How often do you charge your phone? For how long in a day?

- - - - - - - - - - - - - - - - - -

3 Time and attention cost

What activities do you mostly do on your phone? Check the app and fill out the time you spend on it below:

- Surf social media
- Play video games
- Chat with friends
- Learn through apps
- Watch videos
- Learn through videos

Are you sure your smartphone time is useful, or meaningful to you?

Does it add **joy** to your life?

Scan for a toolkit which explores how your phone is designed to be addictive!

4 What do your phone and a skillet have in common?

Some elements you saw in the previous sheets are quite common and can be found in day-to-day objects.

INFO BYTES!

Your phones require communication networks and data centres which consume huge amounts of energy around 764 megatons of CO_2

Guess what these things and your phone have in common?

1. 💡 2. ⏰ 3. 🔧 4. 💉
5. 🧭 6. 🔍 7. 📦 8. 💡

Answers: 1. Tungsten 2. Silica 3. Iron 4. Nickle 5. Carbon 6. Copper 7. Aluminium 8. Gold

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Where does your phone go once you say goodbye?

1. Use to dis-use

How do you dispose off your smartphone?

- - - - - - - - - - - - - - - - - - - -
- - - - - - - - - - - - - - - - - - - -

What are the reasons or criteria for getting rid of your smartphone? Add your reasons to this list!

Reduced battery life	Broken/ malfunction	Offers	Better upgrade
Social pressure	New release	Switch brands	Habit
- - - - -	- - - - -	- - - - -	- - - - -
- - - - -	- - - - -	- - - - -	- - - - -

Smartphones are made as single compound units which are glued shut and impossible to dismantle these days. As a result, if one component is damaged, we end up throwing away the whole phone.

How repairable is your phone? Do you know the repairability score? Find out how repairable your smartphone is using the **iFixit Smartphone Repairability score.**

2. Designed to discard?

Most of the problems you identified are a result of:

☐ Planned Obsolescence   ☐ Perceived Obsolescence

Planned obsolescence describes a strategy of deliberately ensuring that the current version of a given product will become out of date or useless within a known time period.

Perceived obsolescence is when a customer is convinced that he / she needs an updated product, even though his /her existing product is working well.

Activity: Think about the reasons you listed before to dispose off your smartphone. Which of these were planned and perceived obsolescence? Circle the ones caused by planned obsolescence, and cross over those which are perceived obsolescence.

3. The afterlife of your smartphone

Do you know where your smartphone goes once you discard it?

- Dismantled and used for scraps and metals
- Repaired and components used to make other electronics
- Goes into landfills
- Recycled
- Burnt with other waste

INFO BYTES!

Less than **20%** of the world's e-waste is disposed properly. The rest partly goes into landfills which release toxic substances into air and water, destroy natural habitats and cause health hazards to nearby communities.

THINK!

Most of the metals used in manufacturing of a smartphone have **<1% recycle rate.** Where do you think these metals go?

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From you... to Planetary Futures

So far you have been thinking about what your relationship with your phone is like- you buying it, using it and discarding it.

You have been the centre of attention all this while. ↘

1 Often when we think of the world, about nature, trees, buildings around us, institutions, other people, animals, and the Earth at large, we seek to ask,

How does this work for me? What do I want for myself as a human being?

This is called anthropocentrism.

Thinking that humans are the central element of the universe.

What if we shifted focus and made the Earth the **center of attention?**

We would then think differently about technology, and what role it plays in the life of the Earth.

3 Show some 💗 to your smartphone!

Love your smartphone? Create a short story, video, or reels to share what you learnt about your smartphone (this could be repairability, metals and minerals, etc.) which you found interesting! Make your friends a part of your smartphone's life!

2 What can we do for the future of us and the planet?

We all work together to build the future we want. Imagine you play different roles in your future, and fill the blanks on what these different people can do to create a better digital future.

How would you want to create a better digital world?

- -
- -
- -

Innovators,
Can new inventions solve some problems we have discussed?

- -
- -
- -

Designers,
How can we all design sustainable technological futures?

- -
- -
- -

Researchers,
What should we study more closely?

- -

Political leaders,
What are some things political leaders can do?

- -
- -
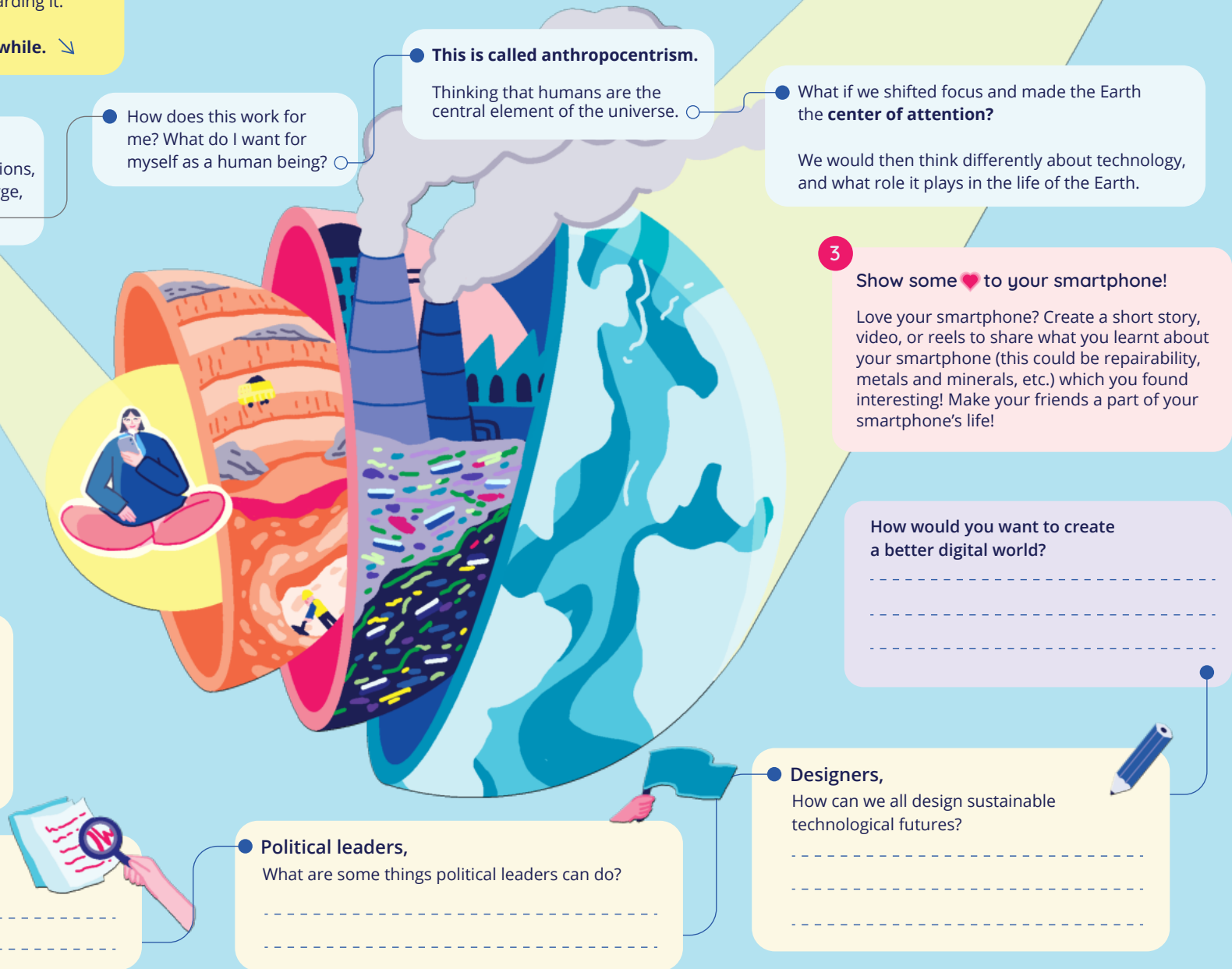
# Sketch your digital future!

What is the technological future you want to live in?

What technological future do you imagine living in? What does it look like? What is a day like in this digital world? How does this future ensure a space for all and better health for the planet?

Draw a small sketch, write a poem, or use any form of expression to sketch your digital future!

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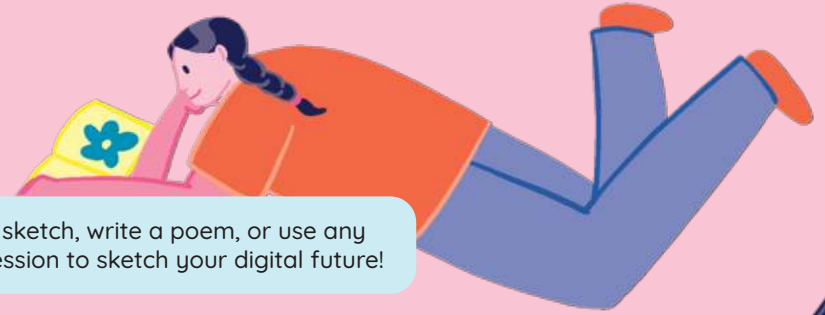
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The Pranava Institute
Center for Emerging Technology and Policy

The Pranava Institute works at the intersection of Emerging Technology, Public Policy, and Society from an India-first perspective. We help organisations stay ahead of the curve on tech policy issues through research, strategic foresight, and capacity-building. We believe in developing emic approaches to technology and creating sustainable digital futures. The Unboxing Tech Toolkit Series is a project aimed at creating research, multimedia resources, and workshop-based pedagogies which can help digital education become more holistic, as well as accessible for youth. Explore the project.

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Years of Political Dialogue Asia

The Konrad-Adenauer-Stiftung (KAS) is a political foundation of the Federal Republic of Germany, named after its first Chancellor Konrad Adenauer. KAS contributes substantially to international cooperation and understanding through its international activities and projects. Digitalisation and innovation are core topics of its regional programme Political Dialogue Asia in Singapore. Together with regional actors from politics, business, society and science, KAS promotes the exchange of knowledge between Germany, Europe and Asia to create economic and social value through the use of digital technologies.

The illustrations and layout in this toolkit were designed by Ladyfingers Co .