



MAPPING SYSTEMS

mitsuelisa

MY STORY



**TECNOLÓGICO
DE MONTERREY®**



Diseño
Industrial





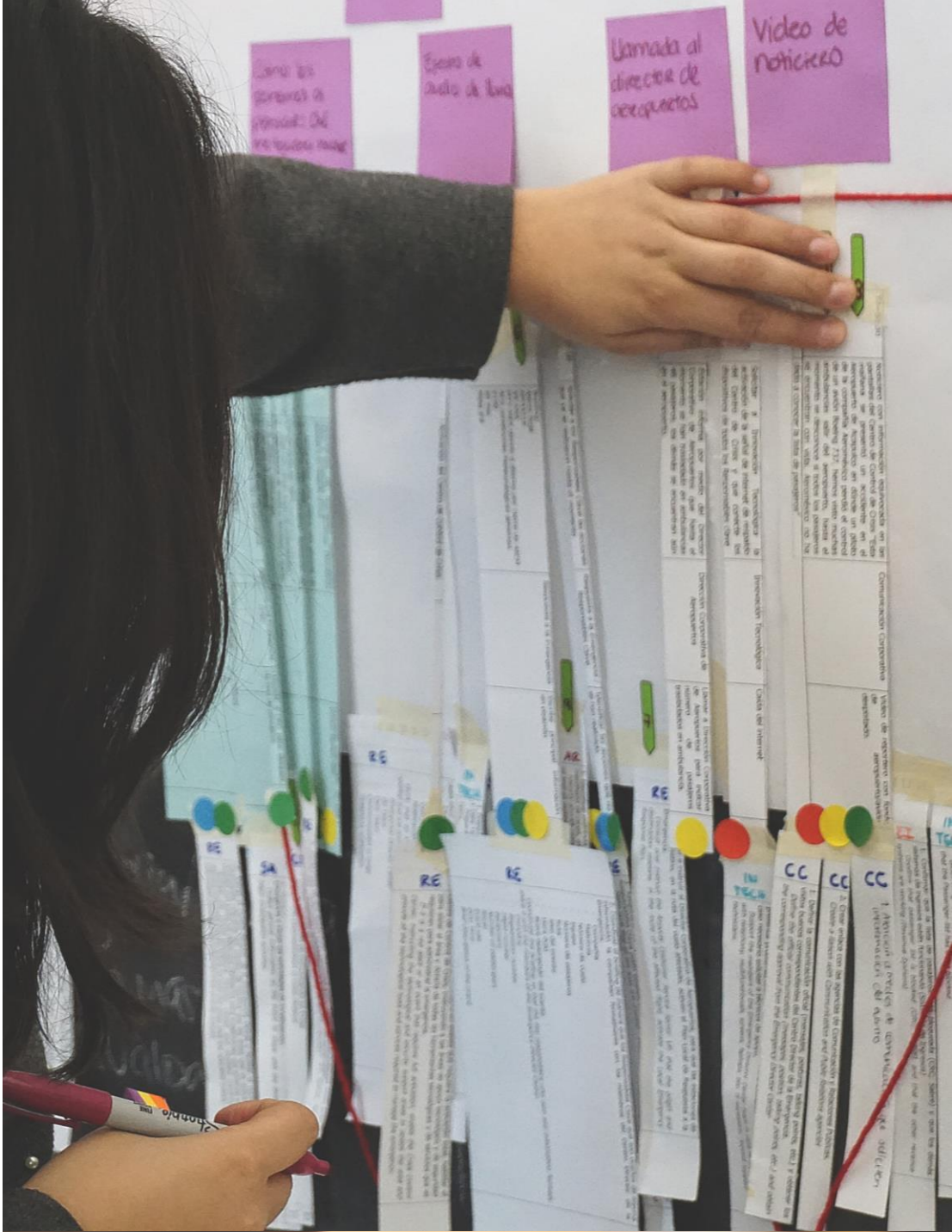
ELISAVA

Barcelona School of
Design and Engineering



howest
/ we develop people

**INDUSTRIAL
DESIGN
CENTER**



S B
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Climate Leaders Program

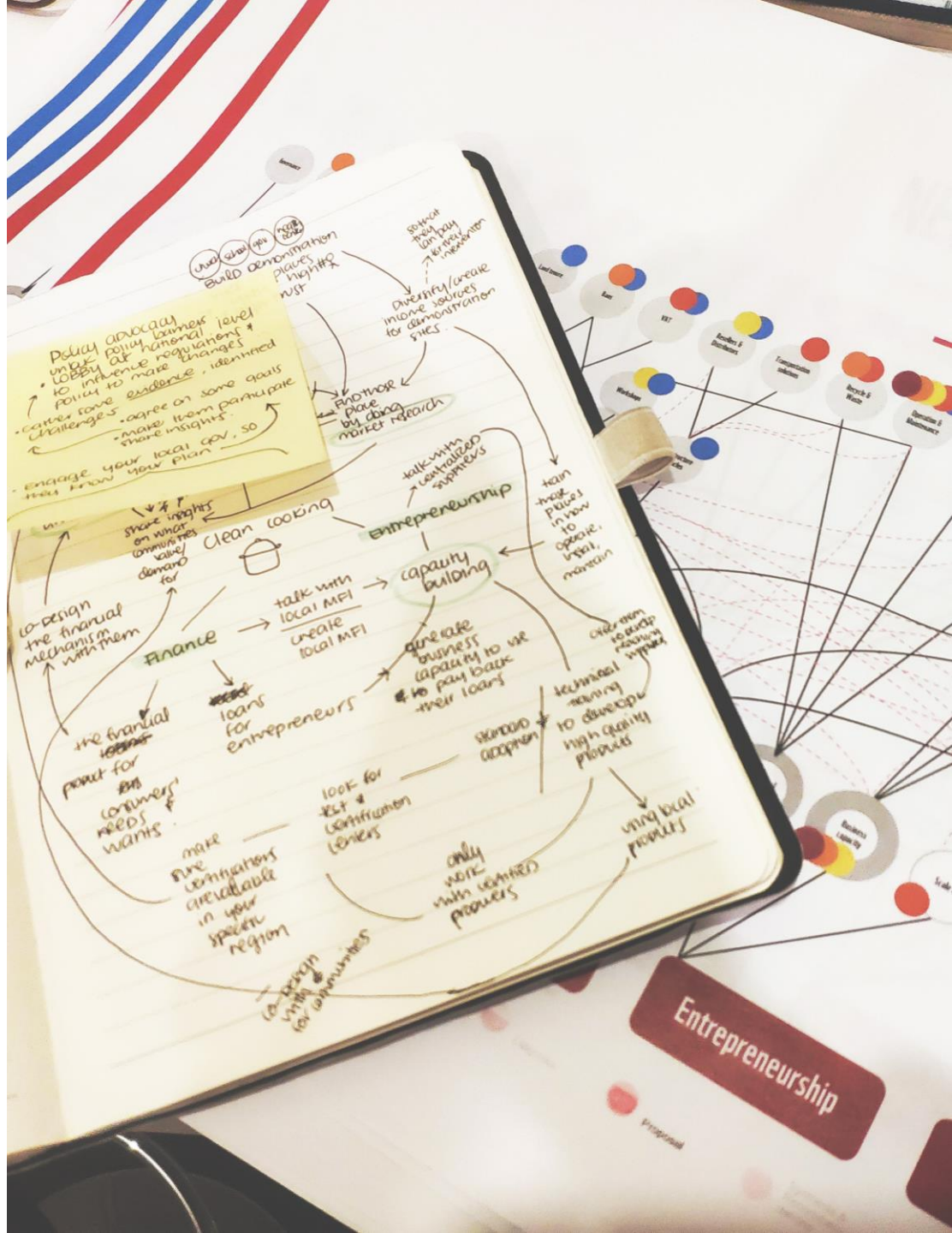
for Professional Students at Harvard

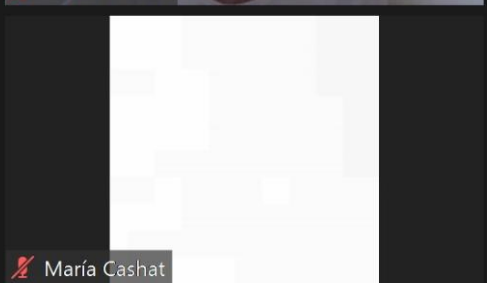
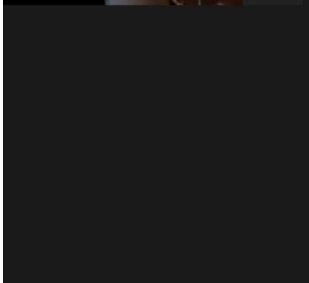
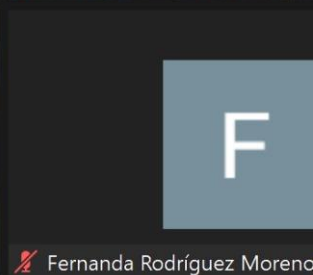
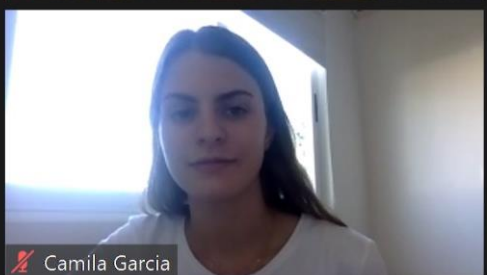
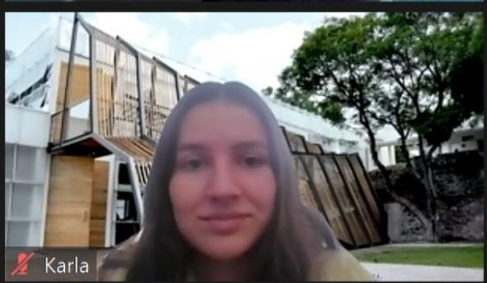
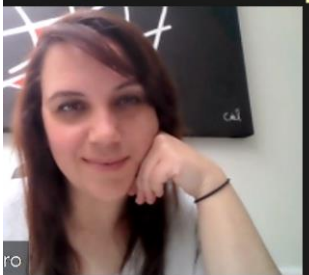


ELLEN
MACARTHUR
FOUNDATION



Circular
Economy
Symposium
at Harvard





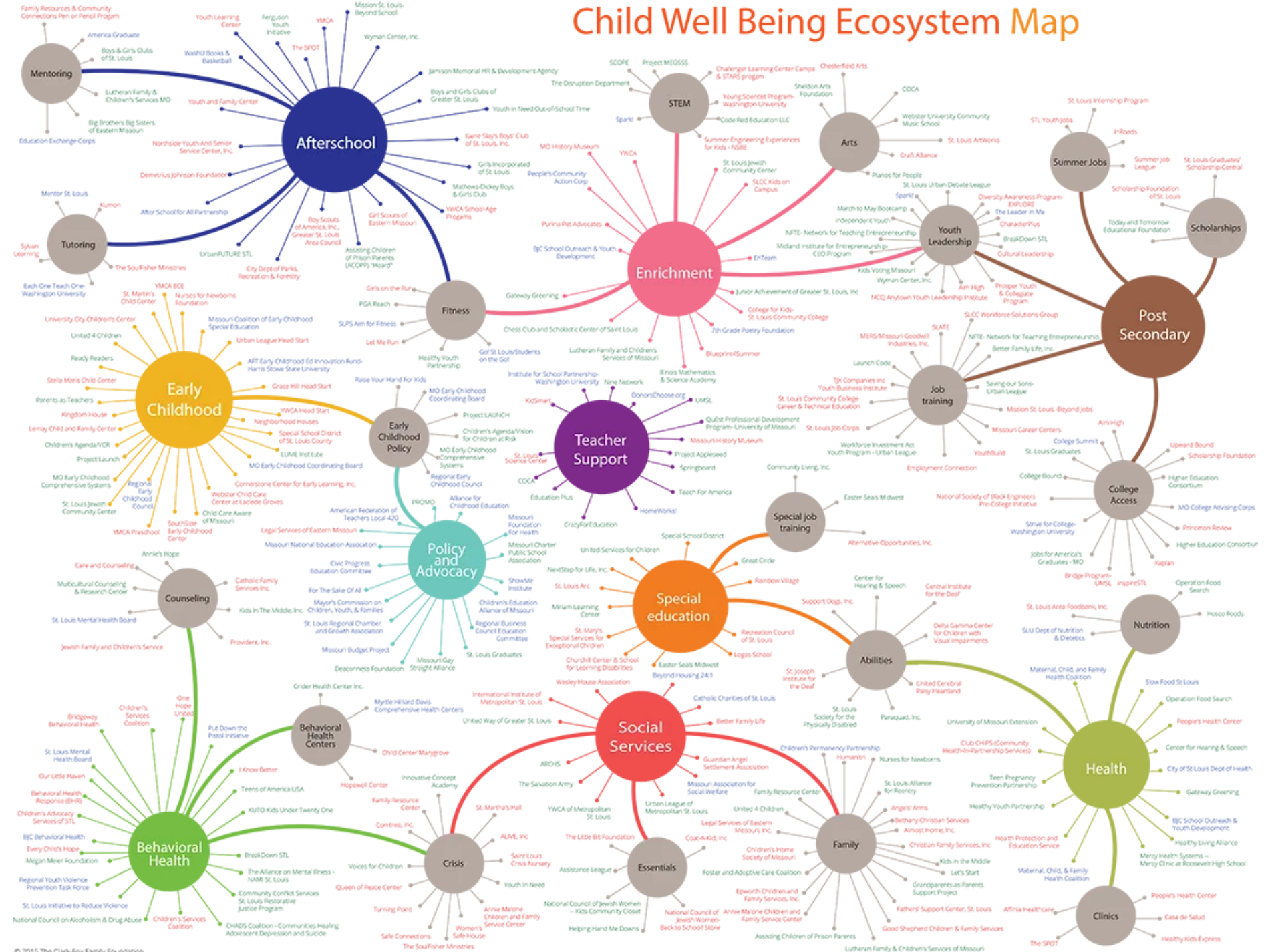
TECNOLÓGICO DE MONTERREY®



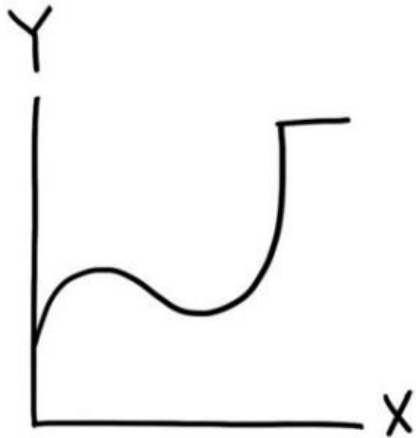
United Nations Climate Change

MAPPING FOR DIFFERENT PURPOSES

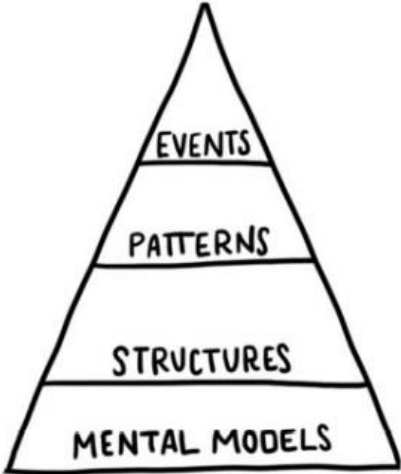
Child Well Being Ecosystem Map



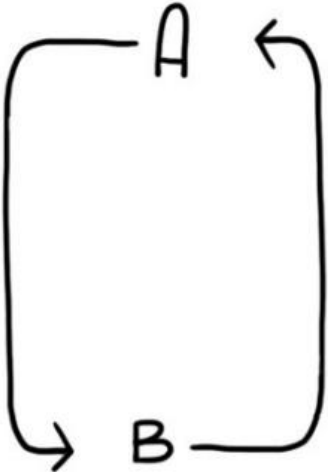
TYPES OF SYSTEM MAPS



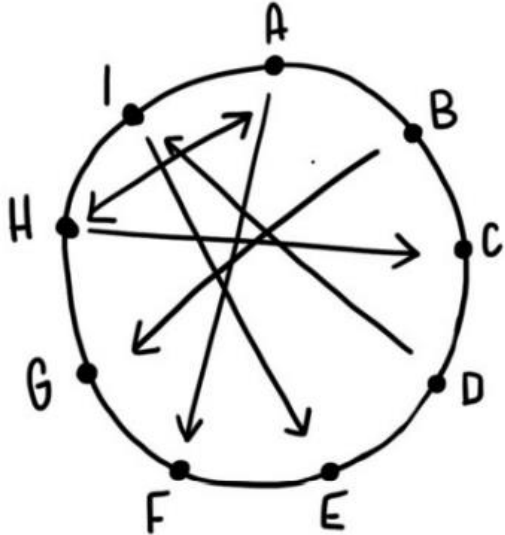
BEHAVIOUR OVER
TIME GRAPHS



ICEBERG
MODEL



CAUSAL LOOP
DIAGRAMS



CONNECTED
CIRCLES

OPEN STANDARDS

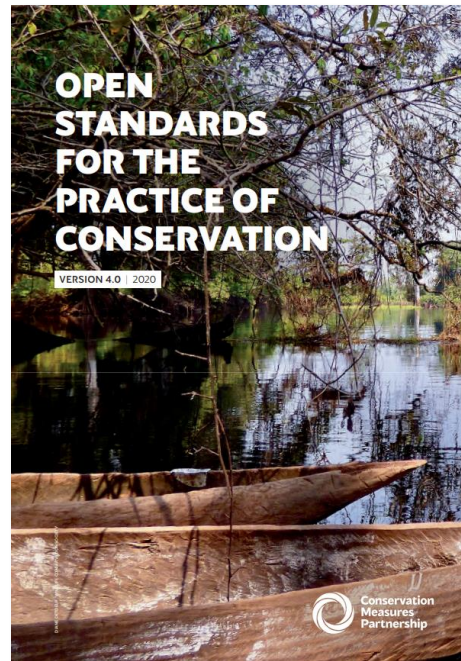


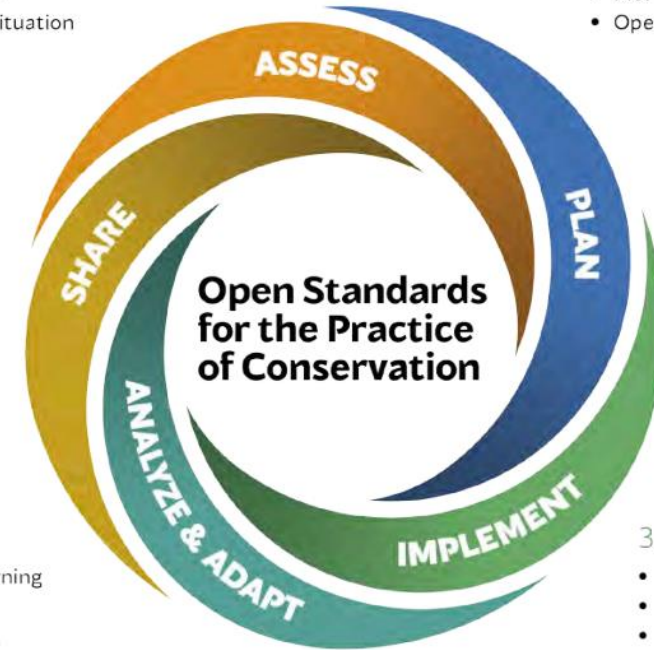
Figure 1.
Open Standards for the Practice of Conservation Project Cycle

1. ASSESS

- Purpose & project
- Scope, vision, & targets
- Critical threats
- Conservation situation

2. PLAN

- Goals, strategies, assumptions, & objectives
- Monitoring plan
- Operational plan



5. SHARE

- Document learning
- Share learning
- Foster learning

3. IMPLEMENT

- Work plan & timetable
- Budget
- Implement plan

4. ANALYZE & ADAPT

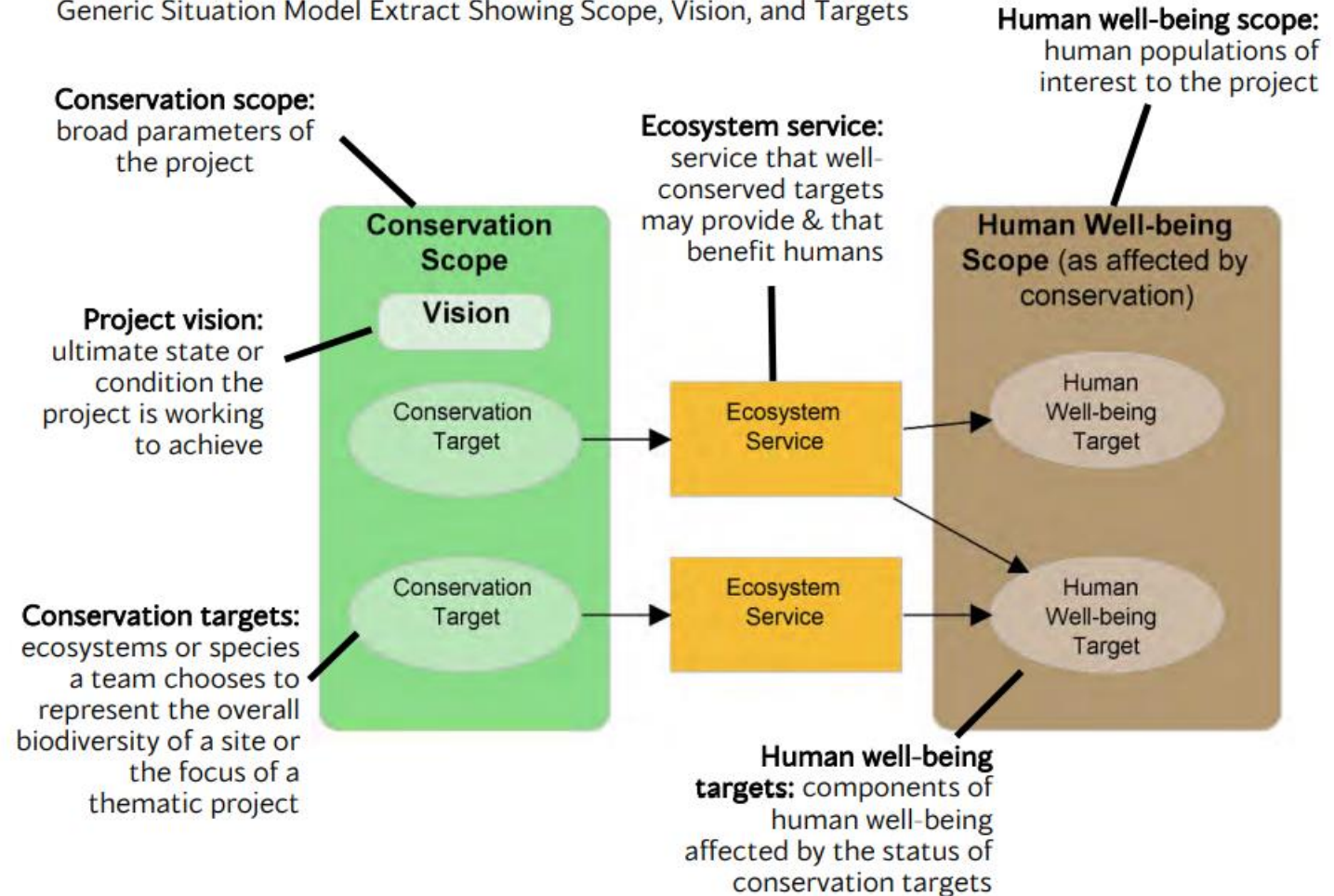
- Prepare data
- Analyze results
- Adapt plans

CONCEPTUAL MODEL



Figure 3.

Generic Situation Model Extract Showing Scope, Vision, and Targets



CONCEPTUAL MODEL



Figure 5.
Generic Situation Model Showing Project Context

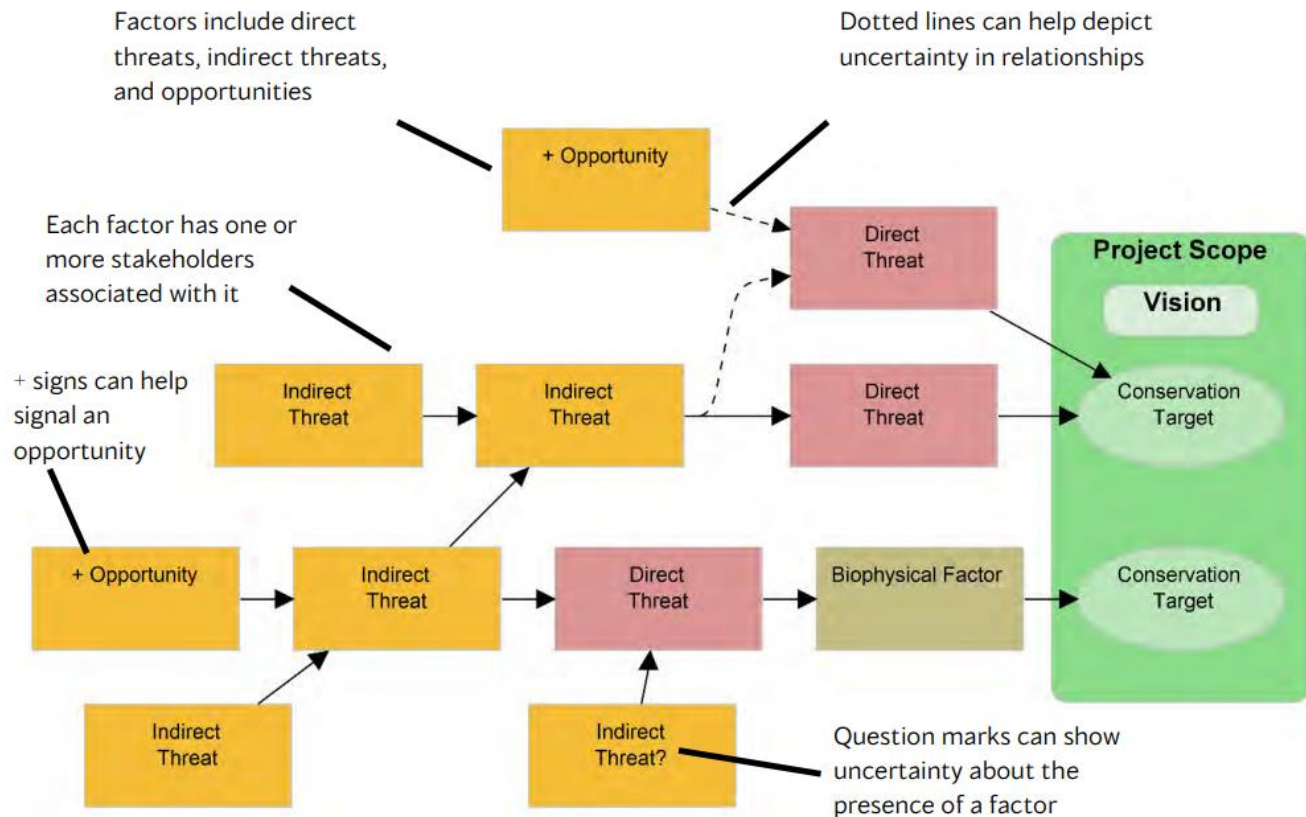
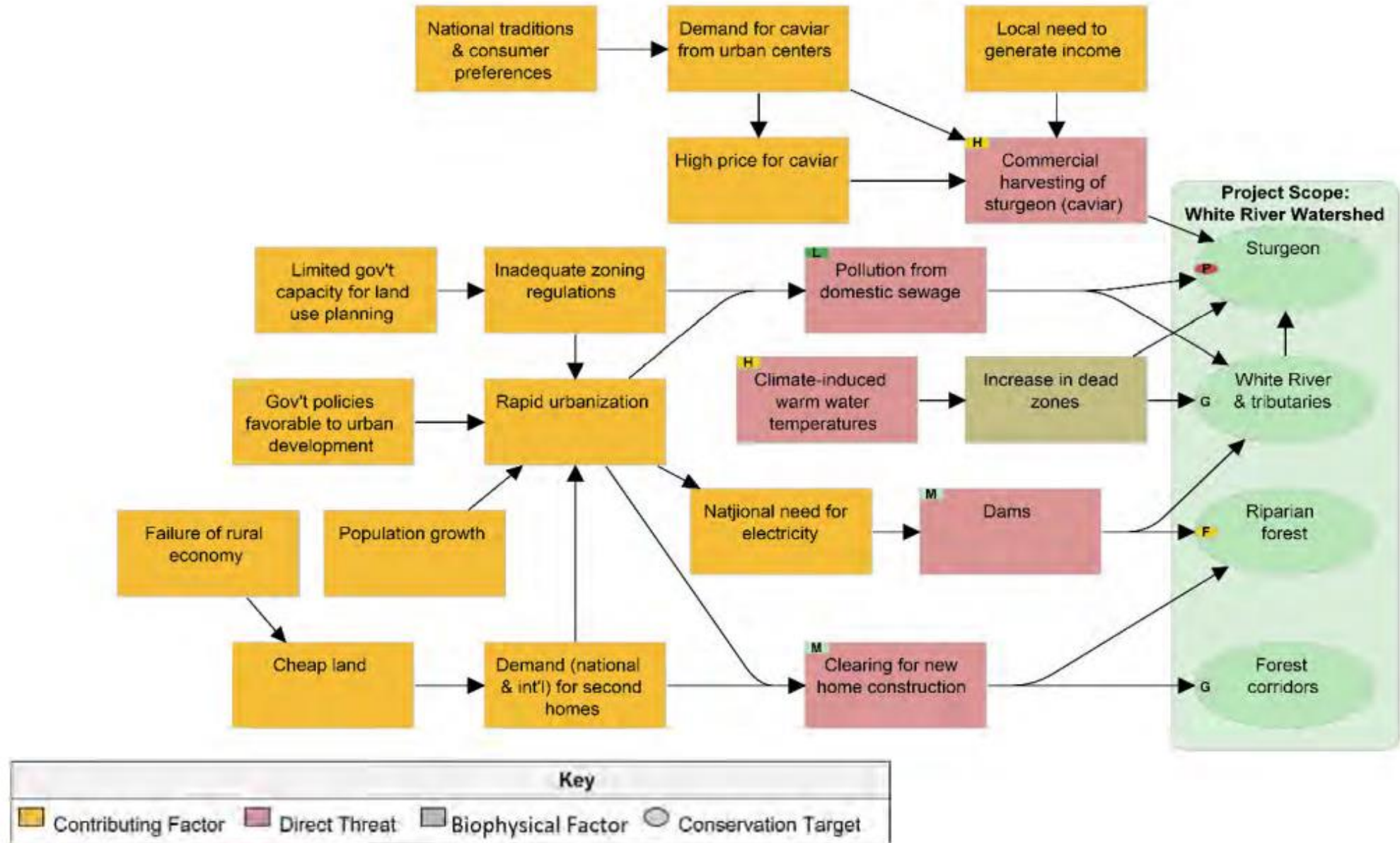
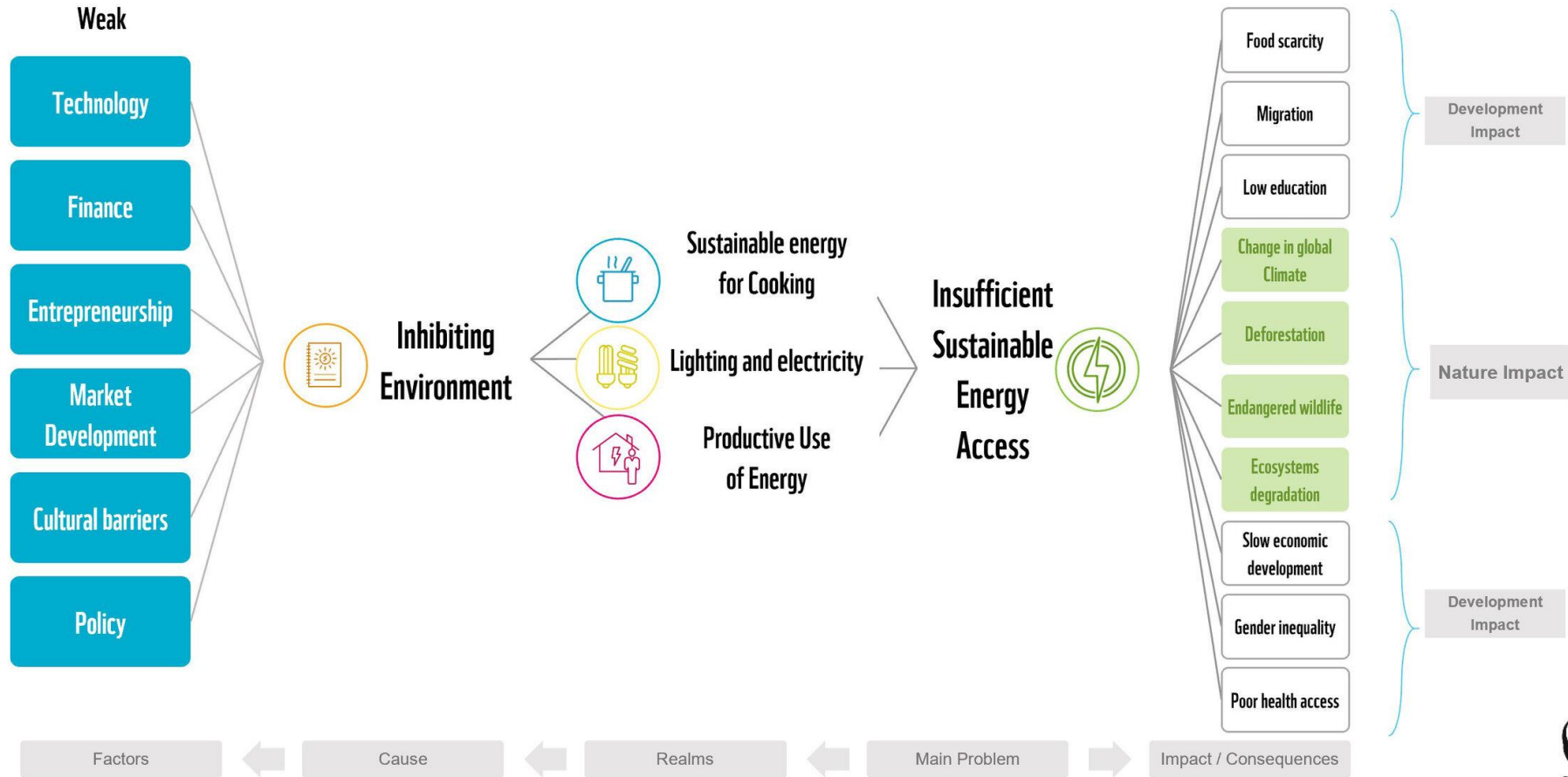


Figure 6.
Example Situation Model for Watershed Site

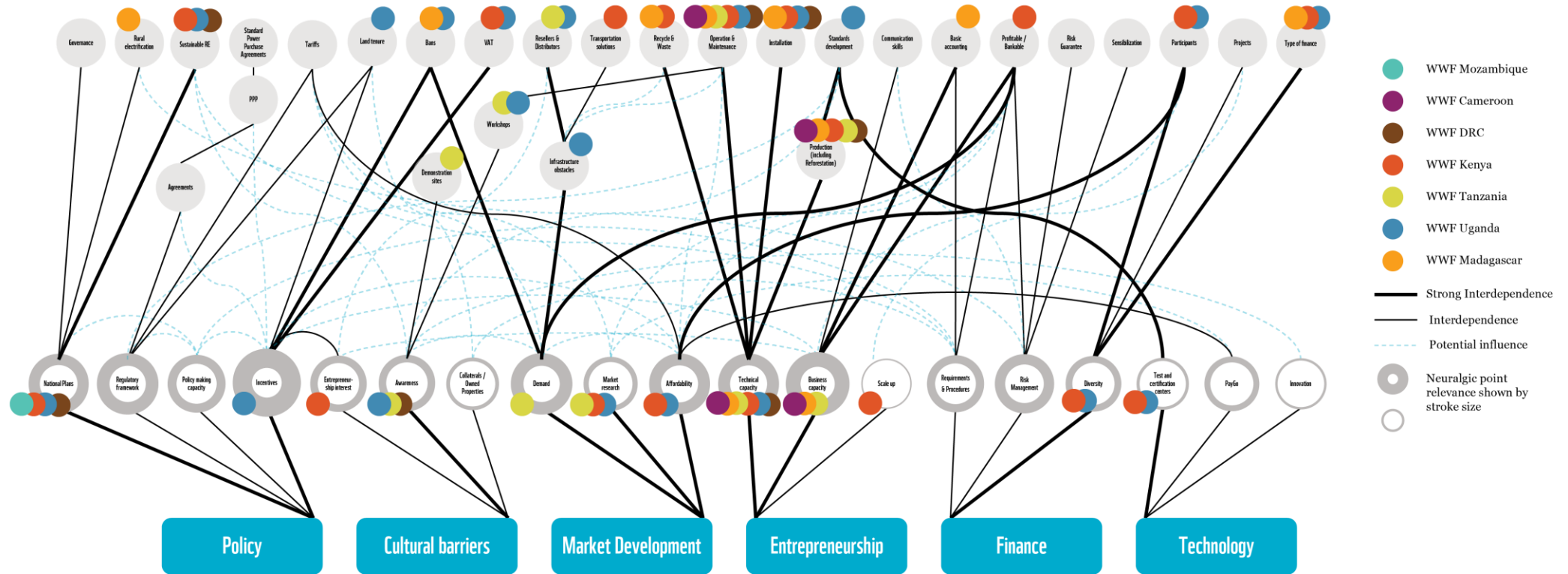


COMMUNICATION



OPPORTUNITY IDENTIFICATION

NEURALGIC POINTS + WWF WORK



RESEARCH

P PROBLEM LANDSCAPE

Households face difficult trade-offs between opportunity and cost in choosing where to live or work

In Boston, these choices have led to increasing inequalities. Lower-income households tend to live in areas which are more affordable in terms of housing, but are further away from jobs and other services.

CITY OF BOSTON (AVERAGE):
\$60839 Median household income
2.1 Payroll jobs available
640K Jobs accessible within 30 minute transit
14% Transportation cost as % of income

UNDERSERVED AREAS: (ROXBURY, DORCHESTER & MATTAHAN):
\$49608 Median household income
0.7 Payroll jobs available
560K Jobs accessible within 30 minute transit
17-20% Transportation cost as % of income

Transportation can rebalance the trade-off between cost and opportunity

"BOSTON CAN BENEFIT SIGNIFICANTLY FROM A MORE ACCESSIBLE AND AFFORDABLE TRANSPORTATION SYSTEM, BEING ONE OF THE MOST UNEQUAL CITIES IN THE US."

S SOLUTION LANDSCAPE

Many stakeholders are involved in the solution of this issue

Initiatives taken thus far to address transportation equity focus in three key areas:

- ACCESSIBILITY**
 - LOCAL**
 - INFORMATION**: Neighborhood Mobility micro4Bis: Real-time interactive information displays
 - TICKETING**: Key to the City: Shared payment platform
 - ALTERNATIVE MODES OR TRANSPORTATION**:
 - Beverly Network Expansion: greater reach of low cost regional bike share program
 - Fairmount Greenway Neighbourhood: Walking and biking route in Hyde Park Mattapan and Downtown
 - Green line extension to Hyde Square
 - Fairmount Judge Line Improvements: Increased service frequency & walking and biking access to stations
 - Complete Streets: Safe, accessible and comfortable routes
 - SAFE ROUTES**: Access Guidelines with 3 principles: 500 meters as maximum walking distance, minimum service frequency, and span of service.
 - GLOBAL BENCHMARK**: YORK REGION (CANADA)
- AFFORDABILITY**
 - LOCAL**
 - NO MOTOR VEHICLES**: Complete Streets and Vision Zero + safe and walk-friendly communities
 - PRICES & SUBSIDIES**: Incentives to public transit use: discounts for low-income and youth under discussion
 - SERVICE COVERAGE**: 24-hour late night bus service: discussions underway with Dept. of Transportation
 - GLOBAL BENCHMARK**: SINGAPORE
- RELIABILITY**
 - LOCAL**
 - RAPID BUSES**: Reserved transit lanes and expansion of Transit Signal Priority
 - SEAMLESS CORRIDORS**: Fairmount Judge Line Urban Hall at higher speeds and increased frequency
 - SIMPLER SERVICE**: Consolidation of duplicate routes by Better Bus Project
 - OPERATOR ABSENCES**: Outourcing MP policies to reduce overtime expenditures & labor unrest
 - GLOBAL BENCHMARK**: LONDON

G GAPS AND LEVER OF CHANGE

We identified 4 gaps that, with the right levers of change, can improve transportation equity in Boston

- EQUITY-FOCUSED PROJECTS AND POLICIES ARE MOST OFTEN FRAMED IN A LONG-TERM HORIZON**
 - Risk of becoming unfulfilled or deprioritized over time
 - New measures, as introduction of regional bike share, do not constitute guaranteed source of improved equity due to inherent uncertainty

LEVER OF CHANGE: City & state decision makers must commit to early action, high priority transportation initiatives addressing equity.
- EQUITY IS A GUIDING PRINCIPLE BUT IT IS UNCLEAR HOW IT IS MEASURED AND WEIGHTED AGAINST OTHER CONSIDERATIONS IN IMPLEMENTATION**
 - Investment decisions and policy choices often deviate from stated objectives
 - City is now debating an increase in the MST4 fare, despite declared goal to make such fare more affordable and balanced for low-income populations

LEVER OF CHANGE: Advocacy bodies & planning authorities must adopt a common set of equity criteria and a toolkit for adequate evaluation of the state of equity in transportation.
- NO COORDINATED PLATFORMS ENCOURAGING STAKEHOLDER COLLABORATION**
 - During formulation of strategic plans, meetings are convened, but they are ad-hoc events with limited duration and impact
 - Existing coalitions at state and/or local level have limited agenda-setting and/or decision-making power

LEVER OF CHANGE: Establishment of a working group under political leadership to contribute and monitor the city's transportation efforts and exert public pressure to enforce them.
- EXPERTISE AND CAPABILITY GAPS IN TRANSPORTATION AGENCIES LEAD TO OUTSOURCING RESULTING IN HIGHER COSTS OF DESIGN AND IMPLEMENTATION**
 - Current skill pool could encompass more skills that can lead to greater impact through increased project experimentation (e.g. behavioral economics, design thinking)
 - Projects beyond core business are often outsourced to private companies

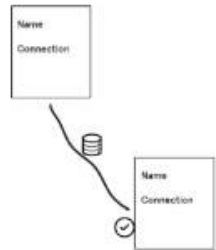
LEVER OF CHANGE: In-house capabilities can be diversified and strengthened to better address the complexity of the policy agenda and its equity considerations.

IT IS TIME TO MIND THE GAP, BOSTON!

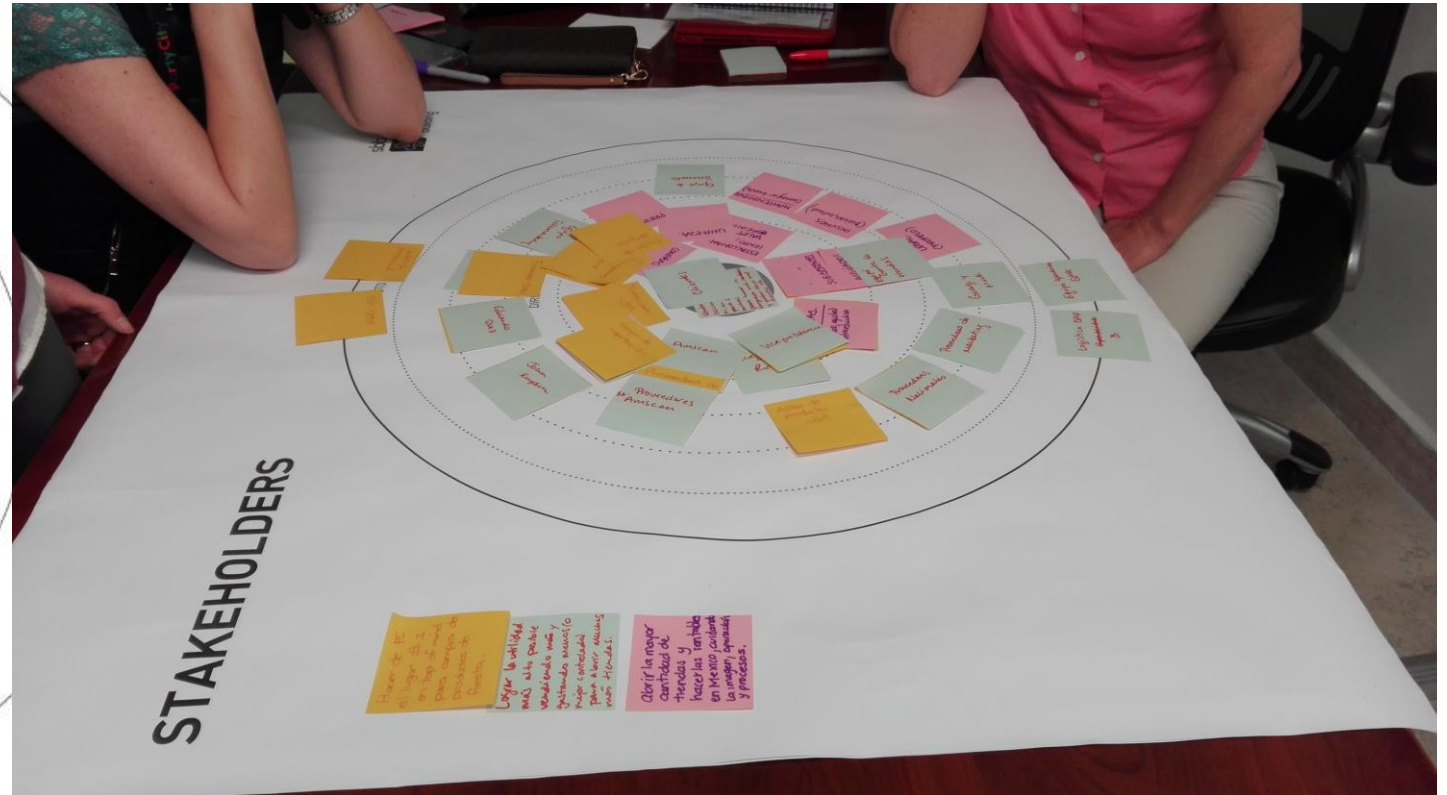
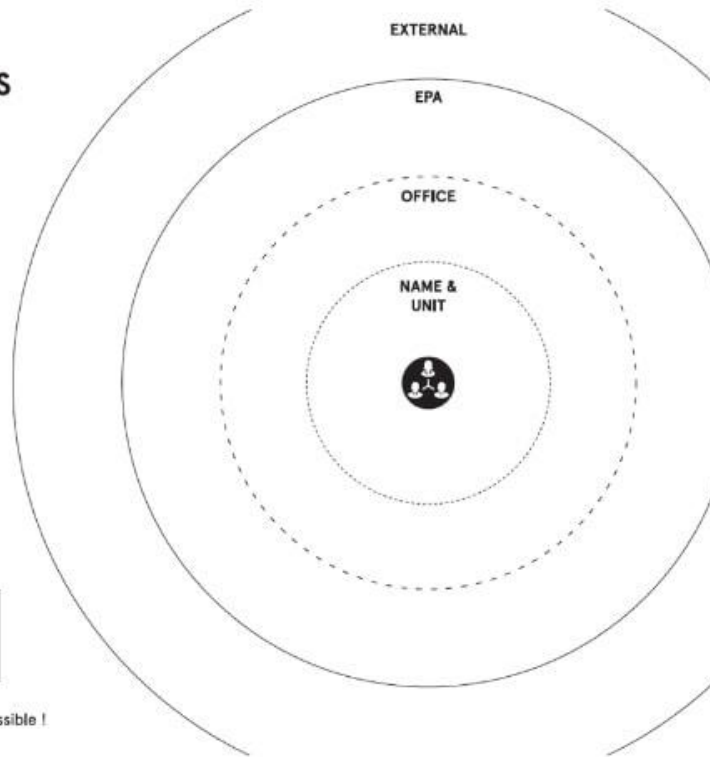
STARTING POINT

MAPPING CONNECTIONS

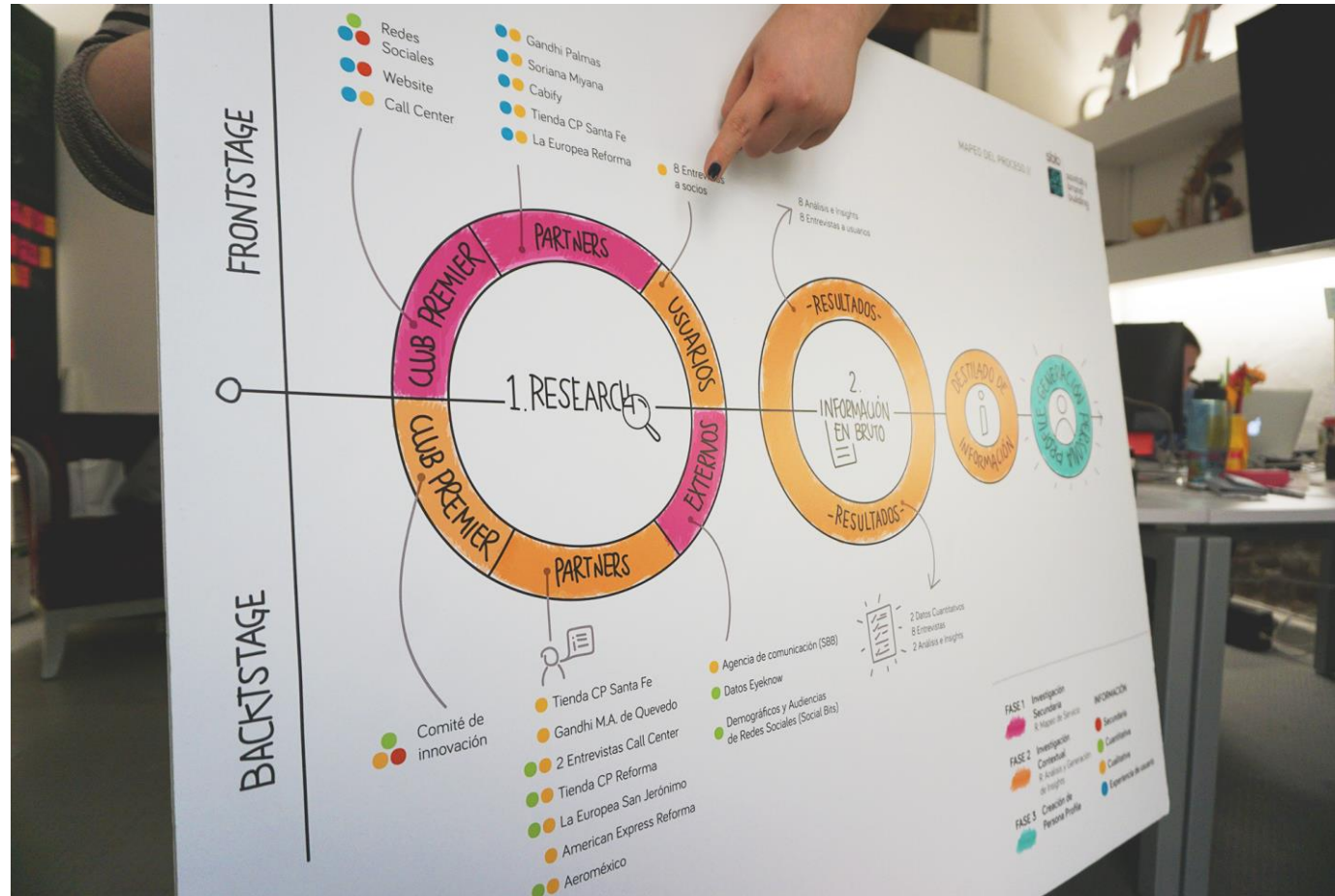
-  people & organisations
-  data & research
-  decision points
-  themes policies



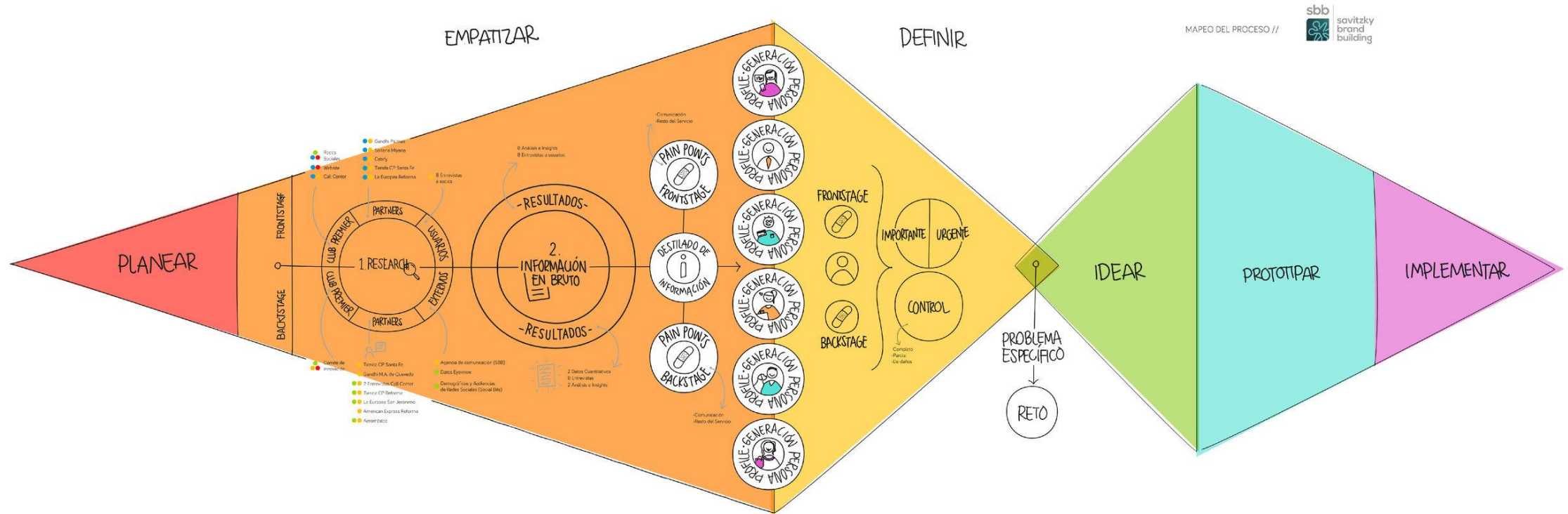
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STARTING POINT

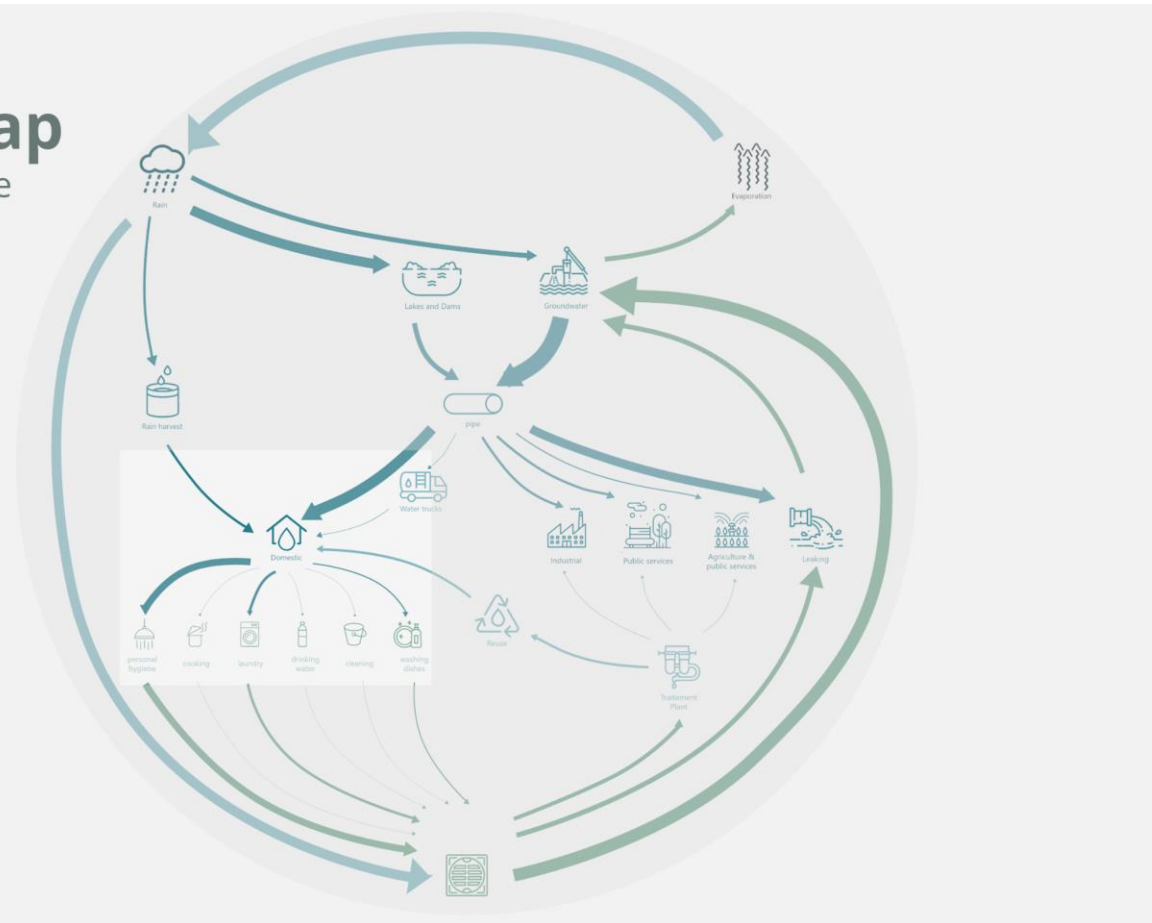


STARTING POINT



CONSTRAINTS AWARENESS

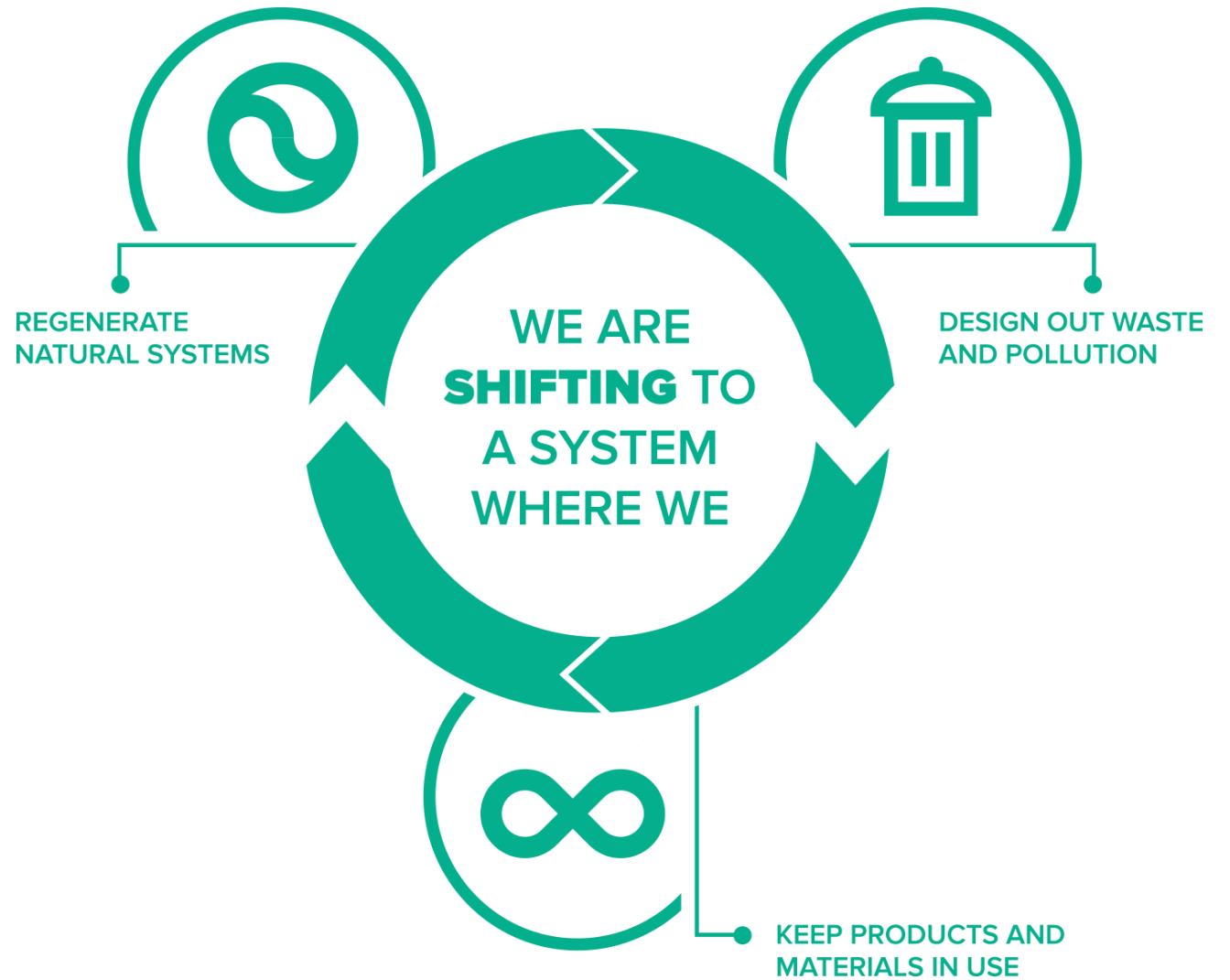
System map
An unbalanced cycle



DEFINING THE SCOPE

Getting some help from “frameworks”

CIRCULAR ECONOMY



DEGENERATIVE ECONOMY

LINEAR



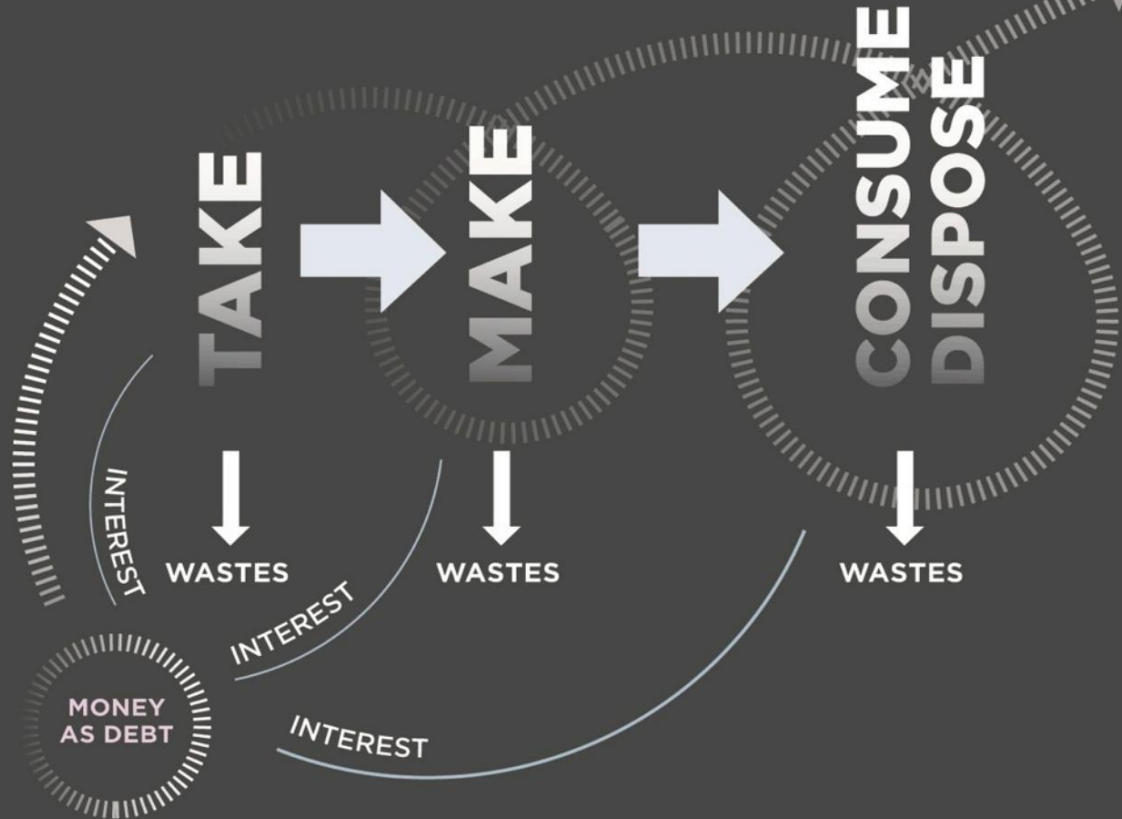
REGENERATIVE ECONOMY

CIRCULAR

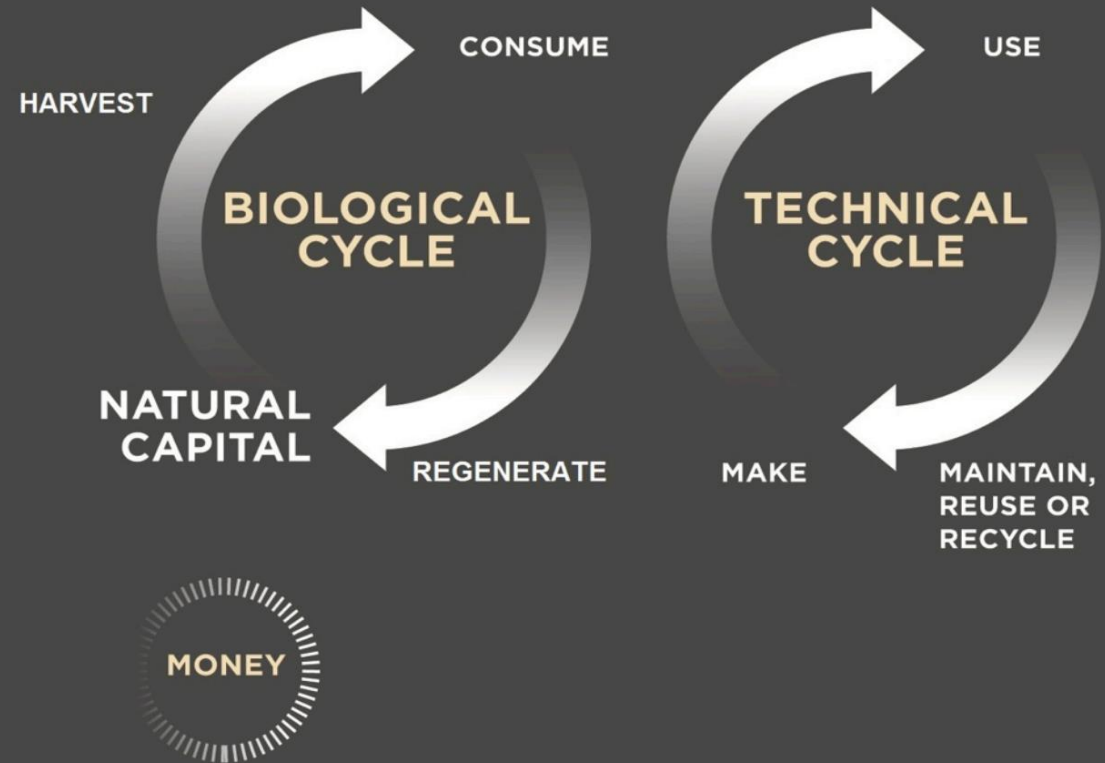


FOSSIL FUELS

ECONOMIC GROWTH
MORE AND MORE



ENERGY



WHAT WOULD A
MONEY AND FINANCE
CYCLE LOOK LIKE
IN A RESTORATIVE
CIRCULAR ECONOMY?

Source: Ken Webster

OUTLINE OF A CIRCULAR ECONOMY

PRINCIPLE

1

Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows
 ReSOLVE levers: regenerate, virtualise, exchange



Regenerate Substitute materials Virtualise Restore

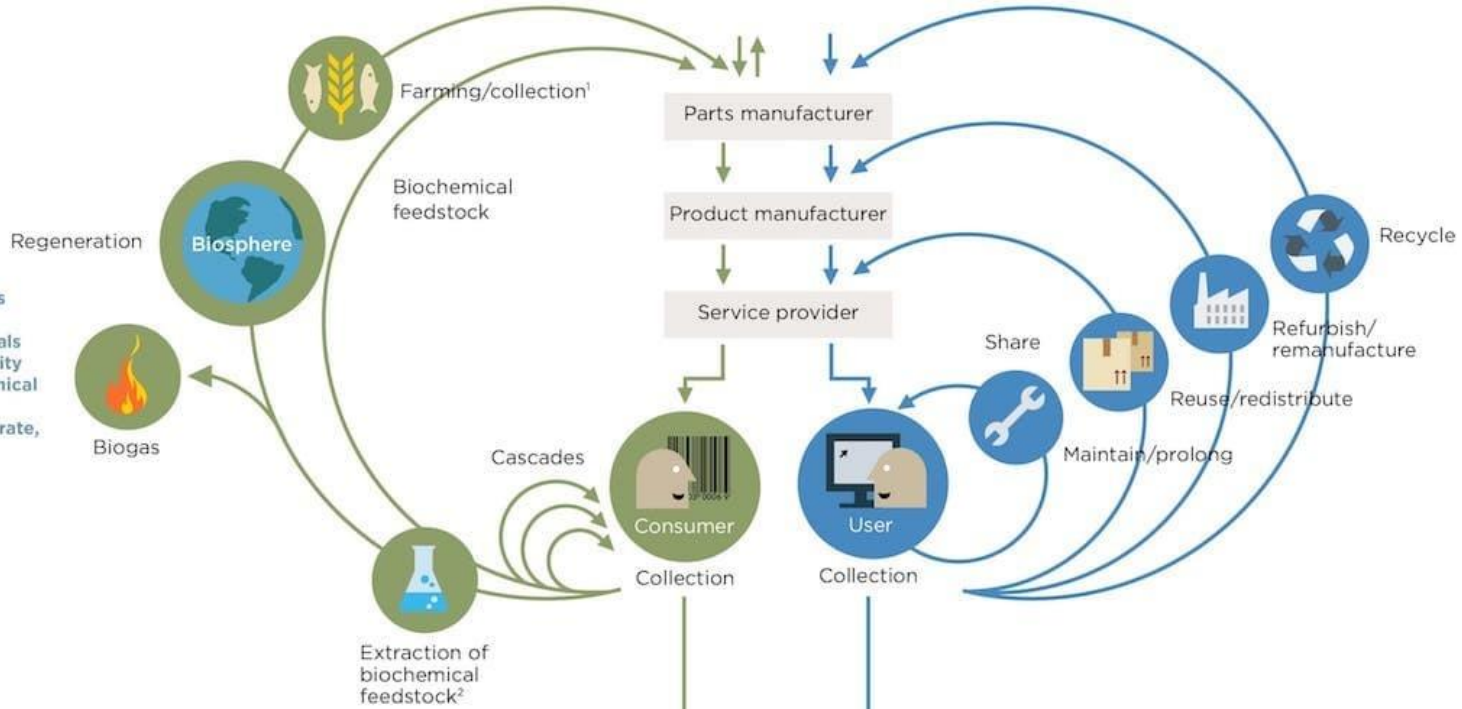
Renewables flow management

Stock management

PRINCIPLE

2

Optimise resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles
 ReSOLVE levers: regenerate, share, optimise, loop



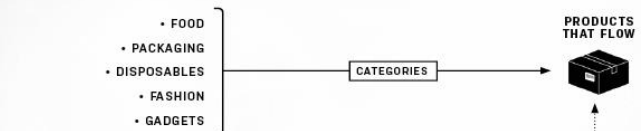
PRINCIPLE

3

Foster system effectiveness by revealing and designing out negative externalities
 All ReSOLVE levers

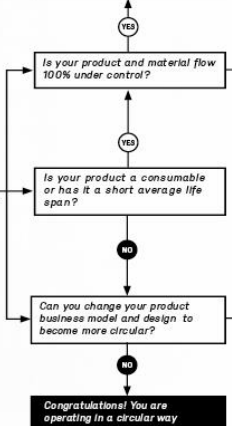
Minimise systematic leakage and negative externalities

1. Hunting and fishing
 2. Can take both post-harvest and post-consumer waste as an input
 Source: Ellen MacArthur Foundation, SÜN, and McKinsey Center for Business and Environment; Drawing from Braungart & McDonough, Cradle to Cradle (C2C).

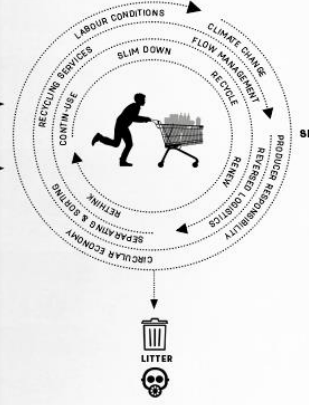


CHAPTER 2
FLOW TYPES

This is quite an accomplishment! Congratulations, you are operating in a circular way.



- CHAPTER 3
BUSINESS OPPORTUNITIES
- 1. FLOW MANAGEMENT
 - 2. REVERSED LOGISTICS
 - 3. SEPARATION & SORTING
 - 4. RECYCLING
- SERVICES
- 5. PERFORMANCE
 - 4. ACCESS
 - 3. GAP EXPLOITER
 - 2. HYBRID
 - 1. CLASSIC LONG LIFE
- BUSINESS MODELS



PRESERVING MATERIAL VALUE

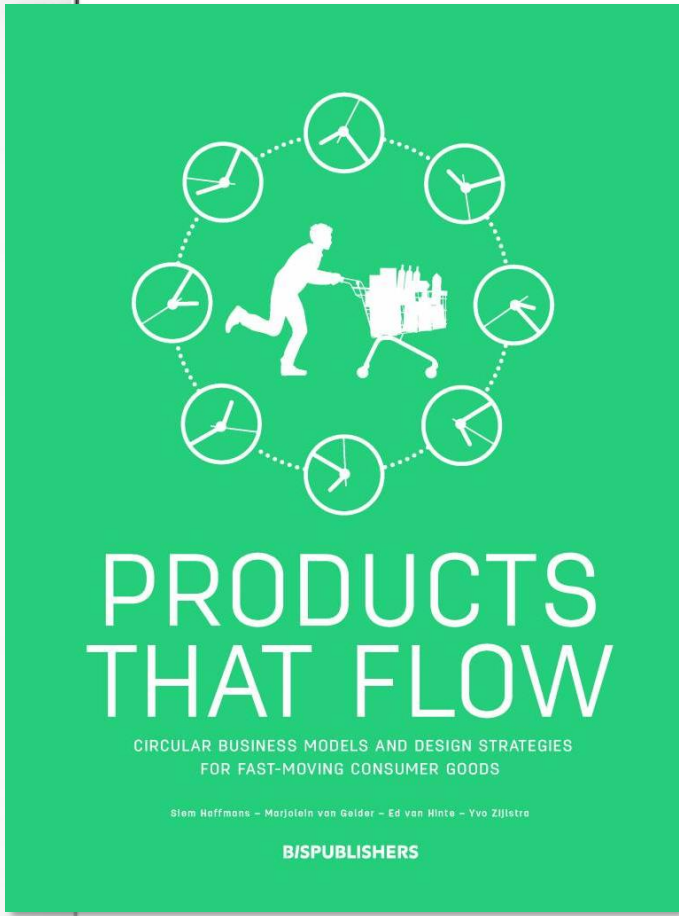
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MINIMIZING WASTE

- CHAPTER 4
DESIGN STRATEGIES
- 1. RETHINK
 - 2. CONTIN-USE
 - 3. SLIM DOWN
 - 4. RECYCLABILITY
 - 6. RENEWABILITY
 - 6. DIS - AND REASSEMBLY
 - 6. UPGRADABILITY
 - 4. EASE OF MAINTENANCE
 - 3. DURABILITY
 - 2. STANDARDISATION
 - 1. ATTACHMENT & TRUST

- CHAPTER 5
MATERIAL FLOWS
- 1. METALS
 - 2. CERAMICS
 - 3. PLASTICS
 - 4. ORGANIC MATERIALS
 - 5. COMPOSITES
- CHAPTER 6
COMMON GROUND
- MOVING AROUND IN CIRCLES
 - CONSUMER INFLUENCE
 - CONSUMER BEHAVIOUR
 - CHANGING MARKETS
 - GOVERNMENT ATTRACTIVE
 - TECHNOLOGICAL OPPORTUNITIES



THE SANDWICH

SYSTEMS THINKING

- SCIENTIFIC WORLDVIEW
 - COMPLEX ADAPTIVE SYSTEMS
 - HOW WE TEACH AND LEARN
-



THE SANDWICH

SYSTEMS THINKING

- SCIENTIFIC WORLDVIEW
- COMPLEX ADAPTIVE SYSTEMS
- HOW WE TEACH AND LEARN

PRODUCTION & CONSUMPTION

- CRADLE TO CRADLE
 - PRODUCT SERVICE SYSTEMS ETC
-



THE SANDWICH

SYSTEMS THINKING

- SCIENTIFIC WORLDVIEW
- COMPLEX ADAPTIVE SYSTEMS
- HOW WE TEACH AND LEARN

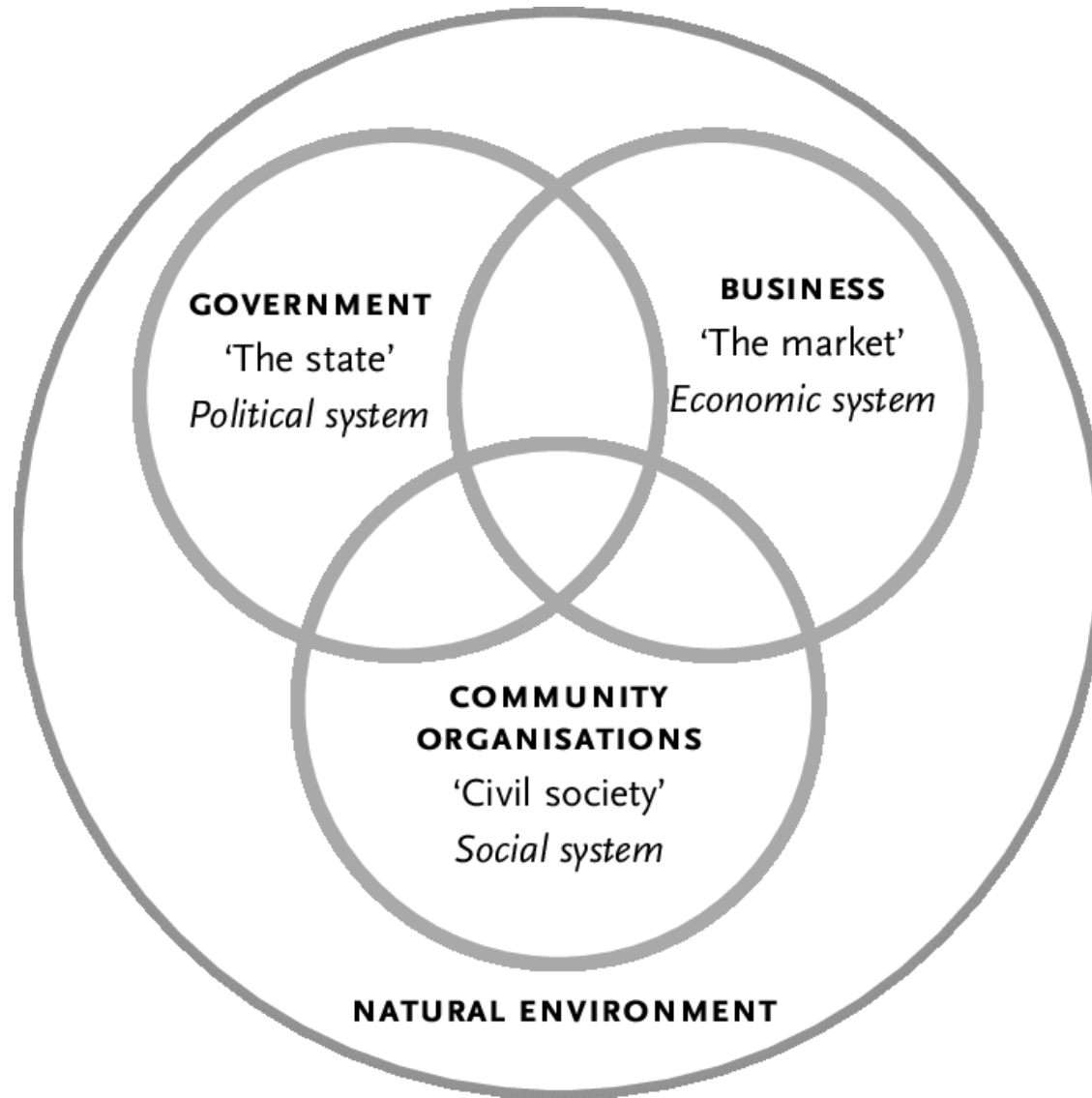
PRODUCTION & CONSUMPTION

- CRADLE TO CRADLE
- PRODUCT, SERVICE, SYSTEMS ETC

ENABLING CONDITIONS

- GOVERNMENT 'RULES OF THE GAME'
 - ICT REVOLUTION ETC
-





DRIVERS FOR CHANGE

Economic losses

Price risk

Supply risk

Natural systems degradation

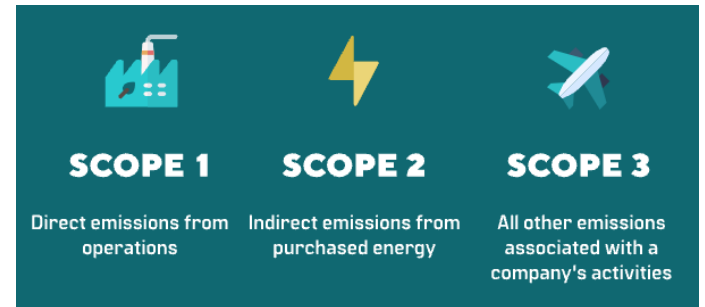
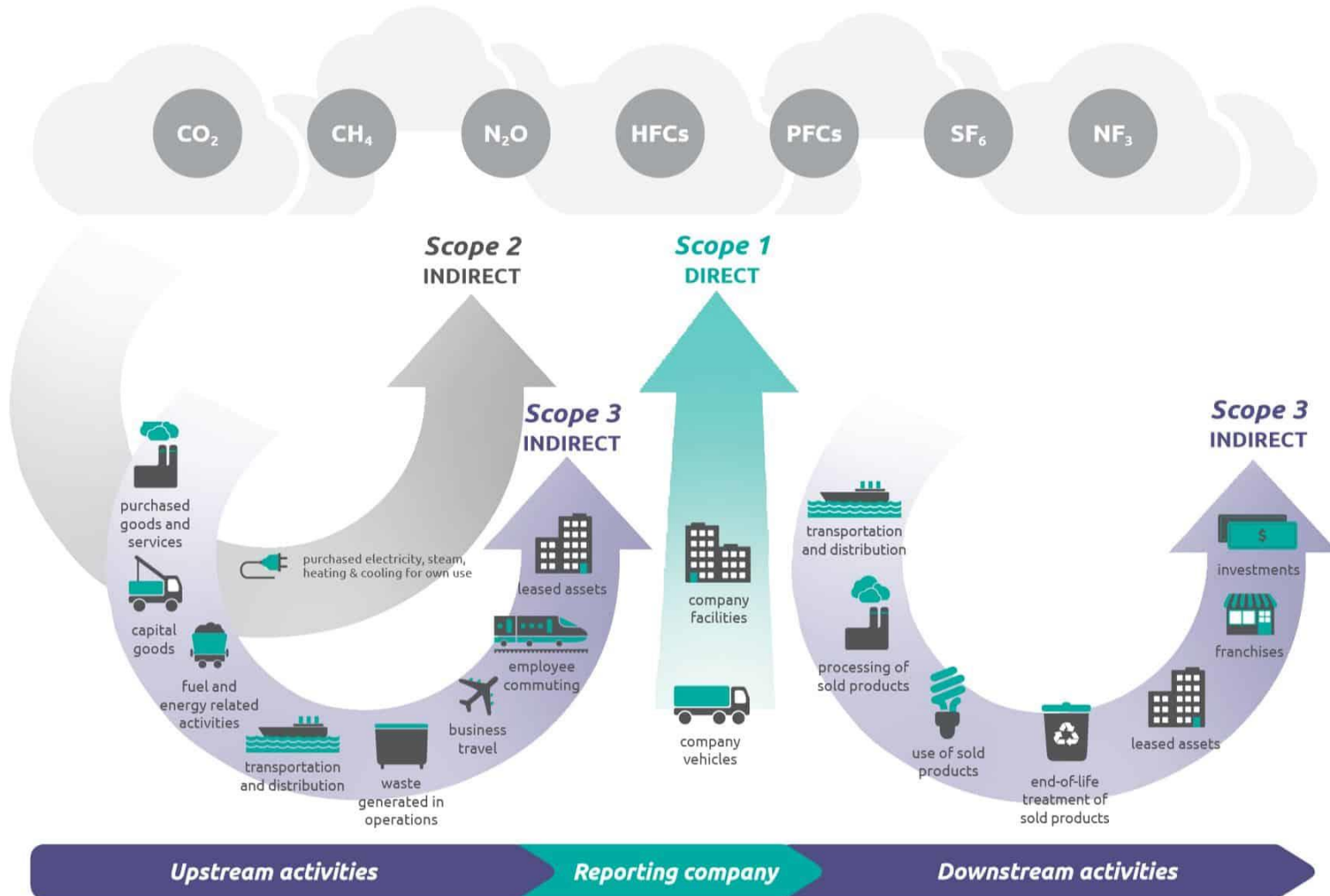
Regulatory trends

Advances in technology

Acceptance of alternative business models

Urbanizaation

EMISSIONS SCOPE



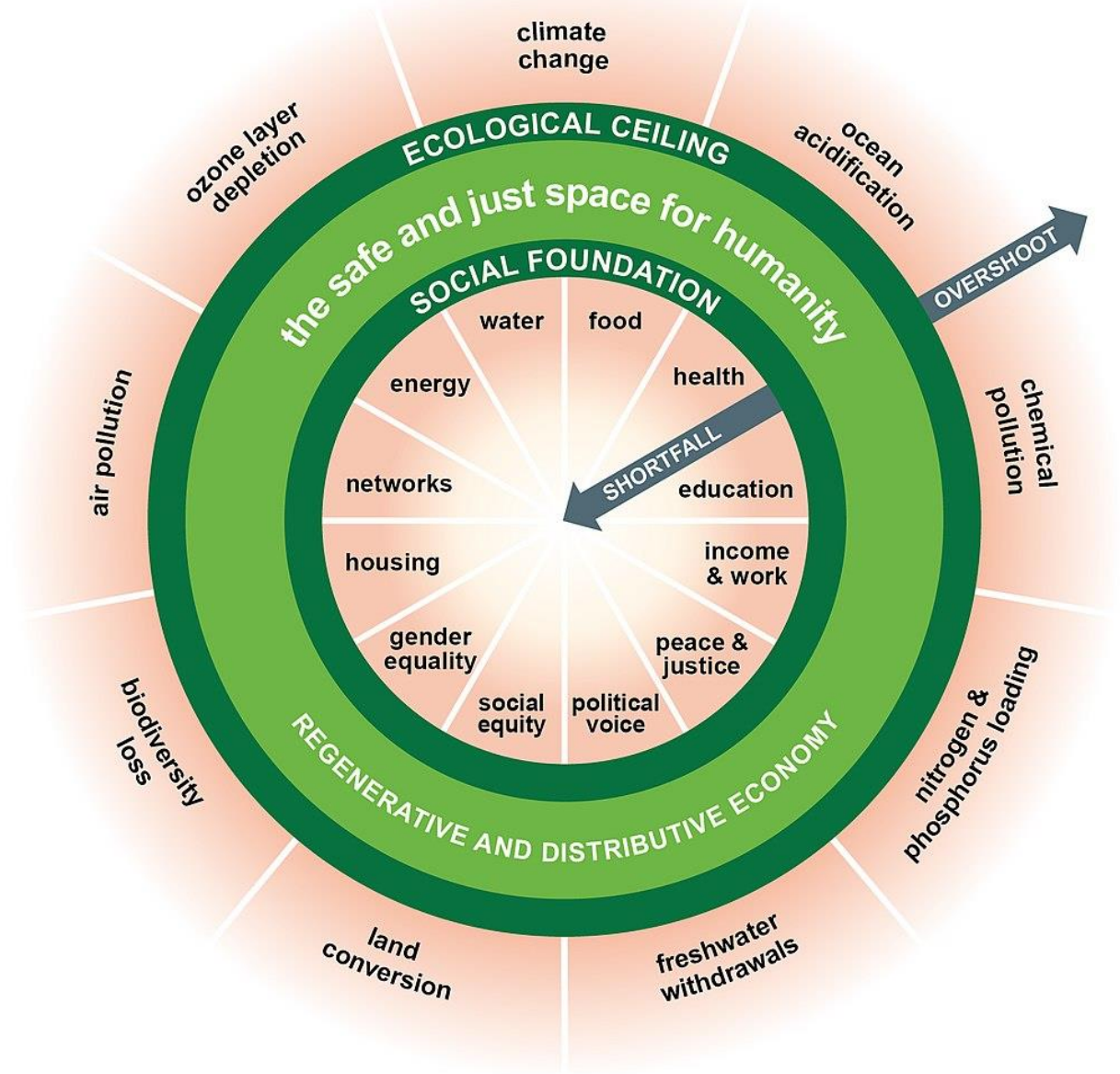
SUSTAINABLE DEVELOPMENT GOALS



SUSTAINABLE DEVELOPMENT GOALS
17 GOALS TO TRANSFORM OUR WORLD



DOUGHNUT ECONOMICS



ACTIVITY

1. Take your system maps
2. Identify one of these frameworks that could help, expand your systems map
3. Add three more elements using that framework
4. Share the question that you had to ask to get to that element in the chat

SOME EXAMPLES

Inspiration from businesses that got the challenges of their systems

RESOLVE FRAMEWORK

EXAMPLES

<p>REGENERATE </p>	<ul style="list-style-type: none"> • Shift to renewable energy and materials • Reclaim, retain, and restore health of ecosystems • Return recovered biological resources to the biosphere 	    
<p>SHARE </p>	<ul style="list-style-type: none"> • Share assets (e.g. cars, rooms, appliances) • Reuse/secondhand • Prolong life through maintenance, design for durability, upgradability, etc. 	    
<p>OPTIMISE </p>	<ul style="list-style-type: none"> • Increase performance/efficiency of product • Remove waste in production and supply chain • Leverage big data, automation, remote sensing and steering 	    
<p>LOOP </p>	<ul style="list-style-type: none"> • Remanufacture products or components • Recycle materials • Digest anaerobic • Extract biochemicals from organic waste 	       
<p>VIRTUALISE </p>	<ul style="list-style-type: none"> • Books, music, travel, online shopping, autonomous vehicles etc. 	     
<p>EXCHANGE </p>	<ul style="list-style-type: none"> • Replace old with advanced non-renewable materials • Apply new technologies (e.g. 3D printing) • Choose new product/service (e.g. multimodal transport) 	    

LOOP: REUSABLE PACKAGING



Shop ▾

How It Works ▾

Why It Matters ▾

Search products



Log in

Join Loop



Your favorite products are now zero-waste!

Available Nationally!



A new way to shop, without the waste.

Join Now!

Featured Products

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TERRACYCLE



NATIONAL RECYCLING SOLUTIONS ZERO WASTE BOX™ REGULATED WASTE RECYCLING ABOUT



UNITED STATES

SIGN UP

SIGN IN



(0)

Recycle everything with TerraCycle®

WASTE STREAM

LOCATION

SEARCH

See all



TerraCycle's global impact



PEOPLE RECYCLING

202,831,611



WASTE RECYCLED

7,762,174,415



MONEY FOR CHARITY

\$44,806,327

MORE EXAMPLES ON PACKING



Reuse can...



PELA EARTH

Celebrate Autumn - Up to 50% Off
10% off 1 item, 20% off 2 items, 35% off 3 items, 50% off 4+ items

You care about the planet.
Pela makes it easy to show it.

Until September 30th - Up to 50% off all items - including iPhone 13 cases



48,000+ 5 Star Reviews - The internet's most loved case.

SHOP AUTUMN SALE



PELA EARTH: LOMI



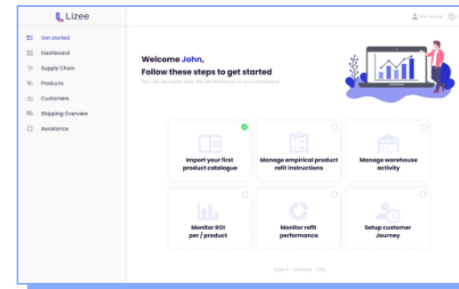
LIZEE: ENABLING RENTAL MODELS



From selling to renting

We enable brands and retailers to adapt their businesses to the shift in consumer behavior with circular rental models.

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They trust us

DECATHLON

DELSEY
PARIS

Galeries
Lafayette

SKFK™



Circular Lighting

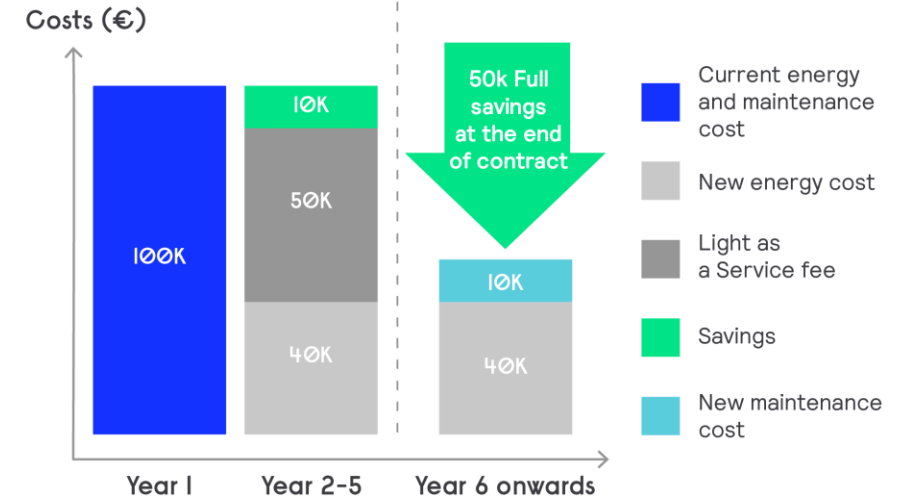
Putting sustainability at the center of your lighting system

We create lighting solutions customized to suit your business needs, in line with a clear set of Key Performance Indicators. These solutions include everything from design and build, to operation and maintenance.

You can also choose to simply buy the light you use instead of owning the lighting system, giving you financial flexibility right from the start.



10K instant annual savings, 50K annual service fee during the Service Agreement (Year 2-5), and 40K new annual Energy Cost (Year 6 onwards)





WHY IS ACHIEVING UNIVERSAL RENEWABLE ENERGY ACCESS SO HARD?



[Energy System Map – Student Energy](#)

[Energy Access Home » CrossBoundary](#)



CROSSBOUNDARY ENERGY

CrossBoundary LLC was a frontier market investment firm. Established in 2011, CB's stated mission was to "unlock private capital for underserved markets." CrossBoundary sought to achieve this by providing investment and economic development services in frontier markets and fragile states. The firm had broad experience in a largely consultative capacity providing sourcing of opportunities, due diligence, transaction advisory, and investment expertise in Sub-Saharan Africa. Its work primarily had involved (i) assisting investors to navigate and perform due diligence on opportunities in unconventional markets, (ii) supporting frontier market companies to identify and raise capital, and (iii) advising policy makers on blended finance initiatives. CrossBoundary's advisory arm had offices in Washington DC, New York, Nairobi, Bamako, and Johannesburg. Its clients included Fortune 100 companies, private equity firms, impact investors, and development finance institutions. The firm had advised on over \$300 million in closed private investments into healthcare, agribusiness, consumer products, transport, media, energy, and technology in countries including Afghanistan, Iraq, South Sudan, Liberia, Mali, Cote d'Ivoire, Ethiopia, Rwanda, Uganda, Kenya, Ghana, Mozambique, Malawi, Zambia, and Haiti. By 2017, CrossBoundary LLC had over 30 investment professionals on the advisory side of the business across their five offices.

In 2013, the management team of CrossBoundary LLC observed the dramatic reduction in the cost of solar generation capacity and also the nascent success of distributed solar generation in developed markets, for example at companies such as SolarCity and Clean Power Finance. Solar installed cost per kW of generating capacity had fallen by almost 85% since 2008. For an increasing number of businesses in Africa, solar power could provide a cheaper and cleaner source of electricity than otherwise available. However, due to the high upfront cost of solar, effective financing was required to make solar attractive to

corporate users. After a survey of the market, CrossBoundary developed the firm belief that the provision of finance for 'Commercial and Industrial' solar was a major gap. Large solar utility projects, 10 megawatts and above, were getting financed. So too were solar home system companies, such as mKopa and Off Grid Electric that provided very small 8-50 watt systems to power a light and charge a cell phone. But no one was financing the 50 kilowatt to 5 megawatt range that could serve African corporates.

Cusack noted that this market gap was driven by a 'chicken and egg' dilemma. Due to transaction costs, each project was too small for a financier to engage with on its own. But without engagement from investors who could finance such long-term cash flowing assets, projects could not be built. Jake and Matt felt that the real need was for a dedicated investment vehicle to take a standardized approach and demonstrate the potential of C&I solar as an asset class in Africa.

With that vision, the team began fundraising for CrossBoundary Energy in 2014. When the fund closed, alongside its development partners CBE would finance, install, own, and operate multiple solar projects to provide cheaper, cleaner electricity to businesses in Africa. This was an extension into the realm of investment principals, building a separate but affiliated vehicle to the largely advisory services of CrossBoundary LLC. (Please see **Exhibit 5** for a summary of the proposition to investors.)

Approaches

Tilleard explained that, according to the World Bank, the two most commonly cited barriers to growth for African commercial enterprises were access to energy and access to finance. CrossBoundary Energy targeted both barriers. Across Africa, access to electricity was limited, relatively expensive and extremely unreliable. Reliance on expensive and polluting diesel generation was commonplace. Switching to cleaner renewable technologies would save many firms money. However, renewables required a higher upfront capital expenditure – and usually that was precluded by little access to finance.

The partners felt that the two barriers to growth were related. Poor access to electricity was a major constraint on growth; yet poor access to finance prevented entrepreneurs from investing in economically and environmentally attractive "own-generation" (do it yourself) renewable solutions.

To address this gap, CrossBoundary Energy financed, built and maintained solar power plants that served businesses in Africa. In potential partnership with NVI, CBE hoped to pioneer the adoption of commercial solar Power Purchase Agreements (PPAs) in East Africa. The firm's portfolio included the recently constructed 858 kWp distributed solar plant at Garden City Mall in Nairobi and additional grid-tied and off-grid systems in the region.



CROSSBOUNDARY ENERGY ACCESS

Identifying Target Clients

CBE financed grid-tied and off-grid systems ranging from 100kWp – 5MWp.^a The best customers were, obviously, clients that had 7 day a week energy demand concentrated during daylight hours.

CBE target industries included:

- Manufacturing / light industrial
- Shopping malls, campuses
- Commercial real estate, hotels, lodges
- Agribusinesses

^a A kWp is a measure of potential or capacity of a PV system when fully operating in bright and direct sunlight. A kW of energy is 1000 watts. A US light bulb might draw 100 watts and a hair dryer might be rated for about 1500 watts or 1.5 kW. A hair dryer running for an hour would use 1.5 kWh or kilowatt-hours of energy. Energy use was measured as rate of usage x time. Over a full 24 hours, solar PV systems typically ran at a “capacity factor” of about 25% due to darkness at night.

CBE also supported the following system configurations:

- Solar / grid-tied systems
- Solar / diesel-hybrid systems
- Solar / battery systems

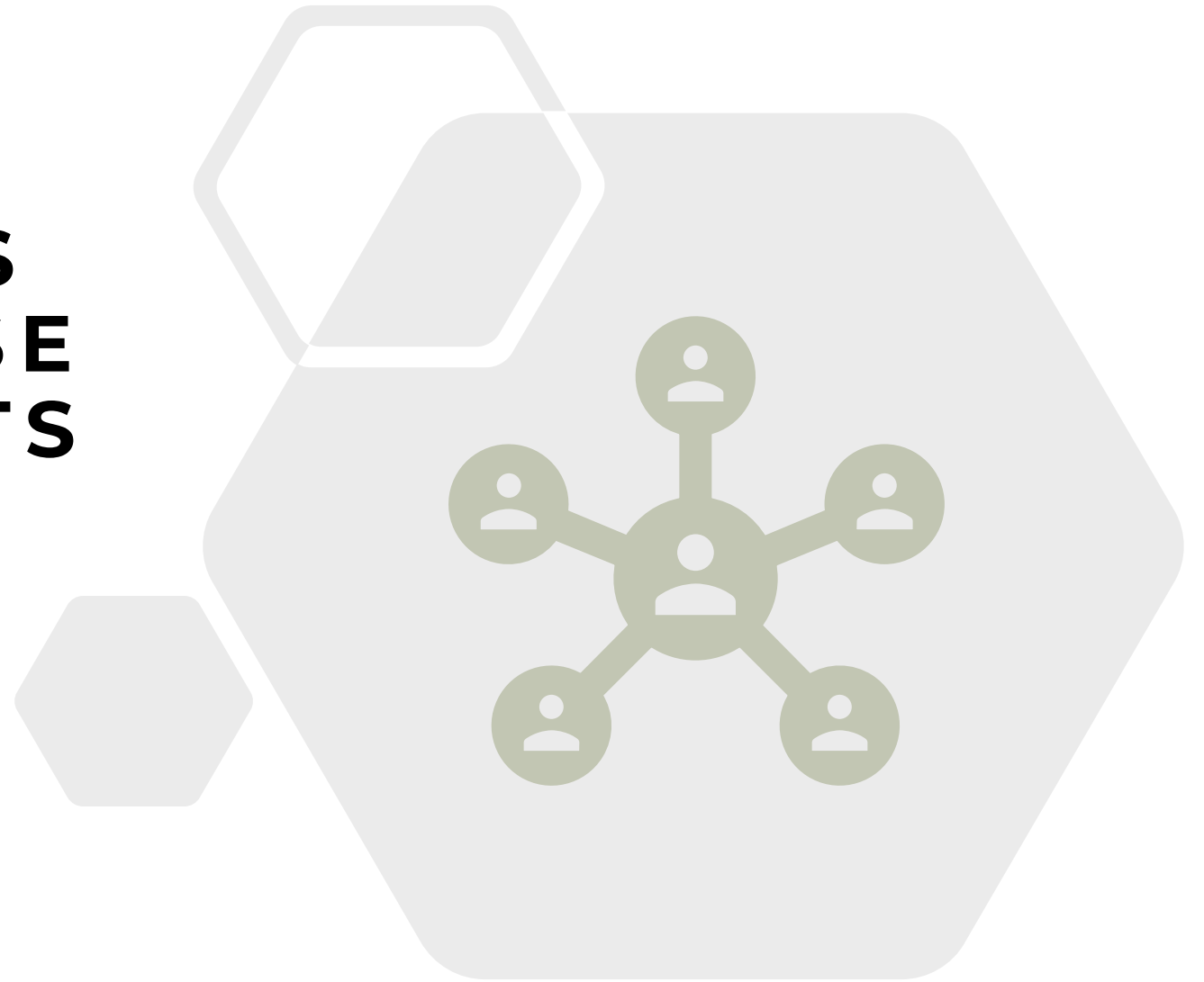
Selecting Target Countries

CBE selected markets based primarily on a) the strength of the business case of financed solar for firms in the country, and b) the feasibility of efficient execution. A number of factors influenced this geographic prioritization:

- **High existing cost of power (high grid tariff rates and / or high diesel genset usage):** The higher the existing cost of power in a given country, the greater the savings that could be delivered by a financed solar PPA. CBE required that the business case for solar be attractive without the need for government incentives or special provisions.
- **Business, macro-economic and political stability:** CBE targeted countries with thriving commercial sectors and with relatively high ease of doing business (e.g. as indicated in the World Bank’s ‘Doing Business’ survey). CBE also prioritized countries with governments that had a strong track record of democracy and who recognized and enforced business rights. CBE’s committed capital was denominated in USD and therefore, careful consideration was given to currency stability and any exchange controls in place in each market.
- **Demonstrated Commercial and Industrial demand:** CBE targeted countries where it had identified a large number of potential Commercial and Industrial (C&I) customers (each with at least 5 MWp worth of near-term, high-probability energy need and project capacity). The market demand assessment was performed through proactive country studies and outreach (e.g. through existing clients in Kenya who may have had a facility in the target country) and by tracking inbound requests from clients or from local developers who owned proven portfolios in-country.

CBE had a legal business presence in Kenya and Rwanda and expected to be incorporating an entity in Ghana soon. Target countries for future growth included Liberia, Nigeria, Senegal, Ivory Coast, and Tanzania.

**MANY
TECHNOLOGIES
MAKE NO-SENSE
UNTIL THE DOTS
CONNECT...**



THANKS!

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FOR REFLECTION AFTER TALK

- What are the business advantages for circular economy?

Gaspar: There are so many business reasons to be more circular. It allows to detach the economic growth from the finite resources which decreases operational risks, creates business opportunities through new business models, allows to meet the new needs and expectations of consumers, makes the use of materials more efficient, motivates the company workers, enables the innovation of new products and services, etc

- What are the limits/influences of a sharing economy/rental models?
- For what other purposes are system maps helpful?
- Is it more helpful to zoom out or to zoom in during system mapping?
- When is mapping systems better done with stakeholders? Which stakeholders?
- What are the elements that make an enabling environment for your business? What are some that are always repeating?