Eco—i Manual

Electronics Supplement

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INVESTING IN OUR PLANET

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Eco—i Electronics

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Eco—i Electronics

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How to use this supplement

The aim of this supplement is to provide electronics sector-specific information and guidance to service providers supporting electronics companies on how to manage eco-innovation opportunities in the electronics sector. It builds on the key principles from UNEP's Eco-innovation Manual (Eco-I Manual), which provides the complete eco-innovation process methodology including instructions, guidance, templates and learning case studies.

Although the primary target audience is service providers, electronic company representatives interested in business development and eco-innovation will also find the information in this supplement valuable.

In this document electronics cover both electronic and electrical equipment, such as large (e.g. refrigerators) and small household appliances, information technology (IT) and telecommunications equipment, photovoltaic panels, electrical and electronic tools and instruments also for monitoring and controlling, toys, leisure and sports equipment, and medical devices.

This supplement will be helpful to service providers advising a broad range of electronics related companies operating throughout the electronics value chain, including those focusing on the components' assembly and downstream activities. Much of the information and examples provided cover the business-to-consumer (B2C) and business-to-business (B2B) aspects of the electronics industry. Although these companies can be large, small or medium-sized enterprises (SMEs), it is important to note that the eco-innovation methodology was developed specifically for SMEs, especially those operating in developing countries.

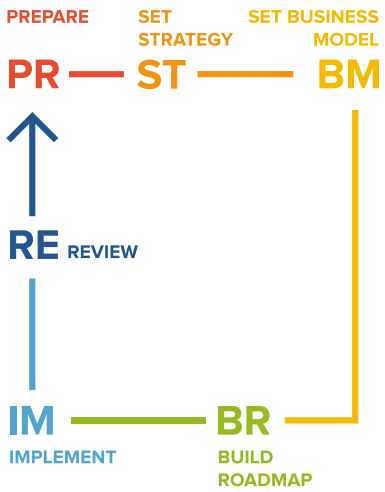


Figure 1: The eco-innovation implementation process.

The structure of the supplement follows the six phases of the Eco-I Manual and should be used in conjunction with the Eco-I Manual. The supplement adds electronic-specific details and considerations to certain of the eco-innovation activities outlined in the main manual. Steps and activities not covered in this supplement are clearly marked on pages six through eight. Please note that this supplement is not intended to be a stand-alone document.

The supplement also provides specific Tips & Tricks, examples, background information and relevant sources of information and bibliography in each section and sub-section to help companies to action eco-innovation within the electronic products' value chain. Users will also benefit from a glossary that includes industry-specific terminology definitions. Examples of innovation potentials with highest business prospects are described focusing on manufacturing, repair, refurbishing, and recycling activities, as well as initiatives to reduce environmental impact during the use phase. Eco-innovation focuses on the development and application of a business model, shaped by a new business strategy that incorporates sustainability throughout all business operations based on life cycle thinking and in cooperation with parters across the value chain. This supplements intents to bring this holistic view to electronic companies transitioning towards sustainability and circularity.

The use of chemicals in electronic products is a key concern in the transition to circularity. The supplement highlights this aspect, as well as how to better manage or phase out chemicals of concern in electronic products. The extraction of raw materials and production of additives (classified as chemicals of concern) are not covered in this supplement, as specific guidance can be found in the Eco-I Metals Supplement and Chemicals Supplement respectively.

In addition to industry-specific information and analysis, a company case study – Silicon Latina S.A. from Brazil- is included to show how the activities in the supplement can be applied in real life. Refrigerators and flat panel displays have been chosen for this case study, as these are consumed in virtually all markets, cultures, and income groups around the world. In particular, refrigerators are widely produced in the majority of developing countries. Refrigerators are also one of the most energy-intensive products during their use with promising innovation potentials. Very few countries produce the components of flat panel displays which are exported for their assembly, for example, to the rapidly growing economies with markets in expansion. Flat panel displays (FPDs) have a particular issue with flame retardants and other chemicals (such as plasticizers) contained in the plastic components of the displays that are chemicals of concern. From the chemicals of concern perspective, for this exercise the focus will be on those contained in the plastics components on the FPD. The presence of flame retardants and other chemicals of concern in plastics is a real challenge for many electrical and electronic producers around the world.

Finally, please observe that there can be significant differences between global analysis and developments in regional or local market conditions. Users of this supplement should therefore apply and adapt the information and analysis provided, so that it is useful for the specific company(ies) being advised.

List of activities with supplementary content*

Eco—i Electronics

PREPARE

Identify the right market for the eco-innovation services

Evaluate potential markets
PR.1

Build the right team to deliver the service

Build the right internal team
PR.2

Build the right external partnerships
PR.3

Understand the value chain sustainability hotspots, opportunities and threats

Identify sustainability hotspots across the value chain
PR.4

Identify the general opportunities and threats across the value chain
PR.5

Develop a concept for a more sustainable value chain

Develop a value chain vision
PR.6

Engage potential clients

Develop a value chain pitch
PR.7

Plan and implement engagement activities
PR.8

Gain approval from senior management to proceed

Pitch the benefits of eco-innovation to the CEO
PR.9

SET STRATEGY

Get ready for the Preliminary Assessment

Plan my data gathering strategy
ST.1

Understand the current business strategy

Interview the CEO
ST.2

Understand the current business model

Capture the current business model
ST.3

Understand the current operational performance

Do a Walk-Through Audit
ST.4

Do a workshop/ interviews with staff
ST.5

Update the sustainability hotspots
ST.6

Analyse the information I have gathered

Do a SWOT analysis
ST.7

Define the company vision and strategic goals of the new business strategy

Develop a vision for the company
ST.8

Define the strategic goals
ST.9

**Activities not covered in the supplement are faded*

List of activities with supplementary content

Eco—i Electronics

SET BUSINESS MODEL

Define the products, markets and selling points of the new business strategy

Generate ideas for new products, markets and selling points
ST.10

Evaluate ideas for new markets, products and selling points
ST.11

Select which ideas for new markets, products and selling points to include in the strategy proposal
ST.12

Get senior management approval for the new business strategy

Do an individual/ group review of the business strategy proposal
ST.13

Pitch the new business strategy to the CEO
ST.14

Consider key management issues for implementation
ST.15

Understand in more detail the performance of the company through an In-Depth Assessment

Update the data gathering strategy
BM.1

Gather additional data on the business model
BM.2

Gather additional data on operational performance
BM.3

Generating business model concepts at the big picture level

Generate business model concepts at the big picture level
BM.4

Generating ideas at the individual building block level

Generate ideas for the customer segments block
BM.5

Generate marketing ideas for the value proposition block
BM.6

Generate technical ideas for the value proposition block
BM.7

Generate ideas for the channels block
BM.8

Generate ideas for the customer relationships block
BM.9

Generate ideas for the revenue streams block
BM.10

Generate ideas for the key resources block
BM.11

Generate ideas for the key activities block
BM.12

Generate ideas for the key partnerships block
BM.13

Generate ideas for the cost structure block
BM.14

List of activities with supplementary content

Eco—i Electronics

Evaluate the business model concepts and select one to pitch

Evaluate the benefits
BM.15

Evaluate the costs
BM.16

Evaluate the risks
BM.17

Integrate all the evaluations and make the final selection
BM.18

Get senior management approval for the new business model

Pitch the new business model to the CEO
BM.19

BUILD ROADMAP

Build a roadmap for eco-innovation implementation

Prepare for the roadmapping workshop
BR.1

Do a roadmapping workshop with input from value chain partners
BR.2

Define and prioritise the requirements of the first project
BR.3

Get senior management approval for the implementation roadmap

Pitch the implementation roadmap to the CEO
BR.4

IMPLEMENT

Create a project plan and get it approved

Create a project plan
IM.1

Present the project plan to the Senior Management Team
IM.2

Support the implementation activities

Provide guidance and solve problems
IM.3

REVIEW

Review the performance of the first project for eco-innovation

Do a project review workshop
RE.1

Do a personal review
RE.2

Review the business model and roadmap and agree the next steps

Review the business model and roadmap
RE.3

Present the review conclusions and agree next steps with the CEO
RE.4

Introduction and overview

With the shift from the traditional industry to the information age in the late 20th century, technology and electronics became a significant part of the world economy. The developments and increased usage of electronics have enabled marketplace transformation and improved living conditions. International trade has been strengthened by significantly reducing overall business costs. In developing economies, technology and electronics support reductions in production costs, encouraging the growth of new business and advancing communication. Accessible, high performing electronics have come to the fore during the COVID-19 pandemic – keeping the world connected as never before.

Electronics are one of the fastest evolving, most innovative and highly competitive industries. In this sector, research and development towards innovation is of great importance and time is of the essence. The accelerated rate at which innovations lose their competitive advantage make for short lifetimes of products (obsolescence rate) and steep decline in demand by consumers. Obsolescence does not have to be caused by product failure but can be driven by fast consumption patterns. The average obsolescence rate of a new integrated circuit is up to 2 years according to Matric Group Inc (2018). Companies compete fiercely to bring the newest technology to market first.

A challenging context

These developments come with unplanned impacts on the environment and people. For example, demands for certain critical resources have increased and an ever-more complex mix of chemicals of concern are emerging. These chemicals of concern can and should be actively managed, and these 'constraints' can be transformed into a source of innovation for businesses.

Manufacturers of electronics face long-term challenges to attract and retain highly skilled people with the right experience to fill key positions. This supplement aims to build capacity and to reduce the risk of lack of resources. It has been found that companies that apply eco-innovation attract and retain talent in their work force.

At the same time, decision-makers at policy and business levels agree that a new industrial revolution is underway that combines traditional manufacturing, industrial platforms and practices with the latest smart technology based on electronics. This includes the use of machine-to-machine communication (M2M) and internet-of-things (IoT) deployments to provide increased automation, improved communication and self-monitoring, as well as smart machines that can analyse and diagnose issues without the need for human intervention. Many existing electronic products will become obsolete in this new environment.

There is also growing pressure and public attention for organisations to demonstrate their contribution to the Sustainable Development Goals and the Paris Agreement on Climate Change, while aligning to and observing the privacy codes, ethics of privacy and intelectual property rights.

In this context, the electronics sector faces growing challenges to:

- become "energy-efficient", "conflict-minerals-free", "child-labour-free", "free of chemicals-of-concern" and "environmentally friendly", among others, while avoiding greenwashing;
- improve harmonization (e.g. universal charger cables) and extend the durability of electronics products and parts;
- enhance the ability of their products to be reused, refurbished or recycled instead of being dumped in landfills;
- be at the speed of societal and business models changes (e.g. related to post-COVID-19) by accelerating the development of product innovations and solutions without sacrificing quality and sustainability attributes; and
- remain competitive while respecting privacy and intellectual property rights.

The drivers for eco-innovation in electronics

This supplement envisions accompanying you to address these challenges and create business value in the companies you are providing services to. From the publication 'The Business Case for Eco-innovation (UNEP, 2014)' a detailed description can be retrieved of main drivers generally identified from companies that successfully implemented eco-innovation measures, including to:

- access new and expanding markets
- increase profitability along the value chain
- stay ahead of standards and regulations
- attract investments
- increase productivity and technical capacity

Increased circularity, social license to operate, new promising business models and increased credibility of product claims are some additional drivers to consider for eco-innovation in electronics

- Circularity, as conventionalized in UNEP circularity platform, aims to keep products, components and materials at their highest level of utility and value for as long as possible, while designing out pollution and waste. Circular economy approaches are also linked to sustainable chemistry, which aims to increase resource efficiency with an additional focus on reducing health and environmental risks during the production and use (see extensive background information in the Eco-I Manual – Chemicals supplement). Fig. 2 illustrates the life cycle of electronics and potentials for intervention to increase the circularity. Collection, reuse, repair, refurbish and recycling are part of the first-end-of-life options as in Fig. PR.1-6.

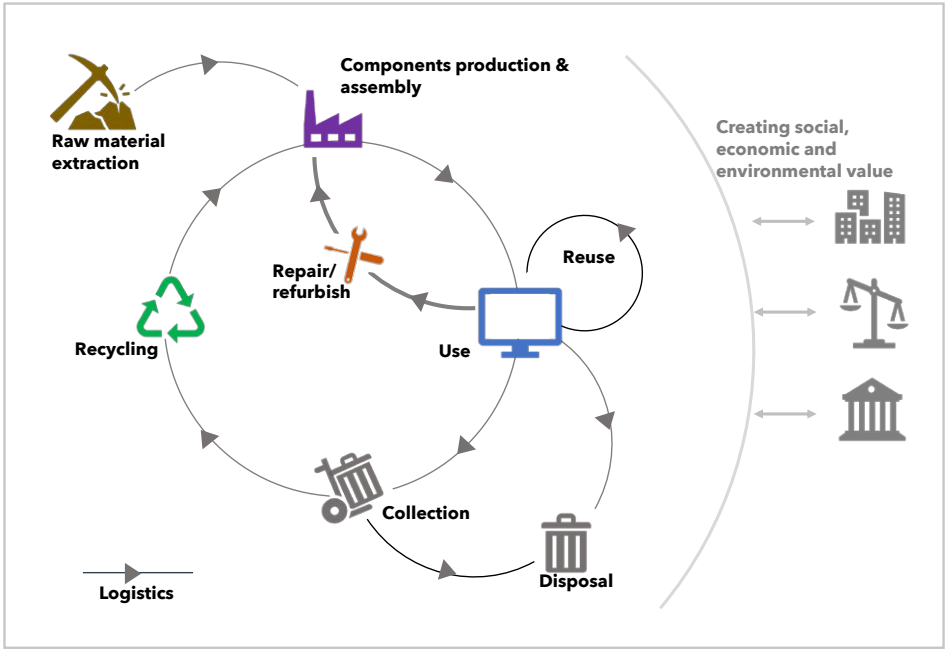


Figure 2: Options for increasing the circularity of electronics along their life cycle

- Social license to operate that is built on social responsibility upstream and downstream in the electronics value chain and is linked to working conditions, consumer health, human rights, and other social issues.
- Auspicious business models that prove the technical and economic feasibility of the eco-innovation measures, especially for SMEs in developing countries.

According to Statista (2022), the user penetration of electronics in 2022 is of 29.7% and is expected to hit 36.8% by 2025.

As can be expected, ownership per capita varies considerably per income level, as shown in Table 1:

Income [average purchasing power USD/ capita]	Average number of appliances owned per capita					
	Fridges	Laptops/ tablets	Lamps	Washing machines	Micro-waves	Mobile phones
High [51,581]	0.7	1.6	16	0.4	0.4	1.4
High/middle [21,697]	0.3	0.3	8	0.2	0.1	1.2
Middle [9,874]	0.1	0.2	6	0.1	0.03	1
Middle/low [3,503]	0.1	0.1	6	0.01	0.01	0.9
Low [1,261]	0.02	0.1	4	0.001	0.003	0.6

Table 1: Global average number of selected consumer products owned per capita, by country's income level (UNU et al., 2020)

International Standard of Industrial Classification (ISIC) codes (available from The Department of Economic and Social Affairs of the United Nations Secretariat (UNSTATS, 2008)) allow the management of statistics at national levels and exchange among countries (imports and exports). Table 2 provides the codes related to manufacturing, trading and repairing of electronics.

Activity type	Class and description
Manufac-turing	2592 Treatment and coating of metals; machining (incl. electroplating, plating)
	2610 Manufacture of electronic components and boards
	2620 Manufacture of computers and peripheral equipment
	2630 Manufacture of communication equipment
	2640 Manufacture of consumer electronics
	2680 Manufacture of magnetic and optical media
	2710 Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus
	2720 Manufacture of batteries and accumulators
	2730 Manufacture of wiring and wiring devices
	2731 Manufacture of fibre optic cables
	2732 Manufacture of other electronic and electric wires and cables
	2733 Manufacture of wiring devices
	2740 Manufacture of electric lighting equipment
	2750 Manufacture of domestic appliances
	2790 Manufacture of other electrical equipment
Trading	4651 Wholesale of computers, computer peripheral equipment and software
	4652 Wholesale of electronic and telecommunications equipment and parts
Recycling	3830 Materials recovery
Repair	3313 Repair of electronic and optical equipment
	3314 Repair of electrical equipment
	9511 Repair of computers and peripheral equipment
	9512 Repair of communication equipment

Table 2: ISIC codes for manufacturing, trading and repairing of electronics

	EU Category	HS product codes
1	Large household appliances (incl. refrigerators)	HS 8418: Refrigerators HS 8419: Cooking machines HS 8450: Laundry machines
2	Small household appliances	HS 8510: Shavers, hair clippers and hair removal appliances HS 8509: Domestic appliances, other than vacuum cleaners
3	IT and telecommunications equip-ment (incl. computers screens)	HS 8517: Telephone/mobile sets HS 8471: Automatic data processing machines and units thereof incl. PC computers and laptops
4	Consumer equipment and photo-voltaic panels	HS 8528: Television receivers (incl. screens such as LCD displays) HS 8541: Photovoltaic panels
5	Lighting equipment	HS 9405: Electric ceiling or wall light fittings
6	Electrical and electronic tools (with the exception of large-scale stationary industrial tools)	HS 8514: Electric ovens and furnaces
7	Toys, leisure and sports equipment	HS 9503 10: Toys, i.e., electric trains
8	Medical devices (with the exception of all implanted and infected products)	HS 9022: X-ray apparatus
9	Monitoring and control instruments	HS 9032: Regulating or controlling instru-ments such as thermostats and manostats
10	Automatic dispensers	HS 8476: Automatic goods-vending machines

Table 3: International codes for traded electronics products

For product codes, the Harmonized System (HS) of the World Customs Organisation (2022) provides the reference for trading commodities, and the European Union (2012) gives a useful reference of ten electronics product categories. A selection of these are provided in Tables 2 and 3.

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PREPARE

PREPARE to engage a company and its value chain and
build the potential company's interest
in the rewards available from eco-innovation

Eco—i Electronics

PR.1
Evaluate potential markets



This activity provides a structured approach to identifying suitable markets on the electronics sector to target with eco-innovation services.

ORIENTATION

Your initial assessment for Target Identification has likely included electronics as a main industrial sector in your country and therefore led you to this supplement. The guidance in the Eco-innovation Manual suggests starting with assembling basic information about the industry sector, as well as the markets and the companies operating in this sector in your country, to determine if these are suitable to target with your eco-innovation services.

At the industry sector level, key things for you to consider include the contribution to global environmental sustainability problems, the social impacts – both positive and negative - and the amount of attention the sector gets from non-governmental organisations (NGOs).

At the market level, key considerations are the market's growth and profitability profile, the level of government policy and financing supporting the market in your country, the credibility and experience your organisation has in the market, and the channels you can access to approach companies.

Considerations **at the company level** include the commercial success of the company, its history of innovation and its sustainability performance.

The Target Identification template suggests straightforward, points-based scoring for the sector level, market level and company level based on the above considerations. The aim of this supplement is to provide you with direct input for setting a score within the global electronics sector, as well as to offer you insights into the business-to-business (B2B) and business-to-consumer (B2C) electronics market that may inform your process when assembling information for the relevant market(s) in your country.

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- A well-defined market (or set of markets) that you will target with your eco-innovation services.
- Preliminary list of relevant companies in your target market, used in activities PR.4 Identify sustainability hotspots across the value chain and PR.8 Plan and implement engagement activities.

PR.1 Evaluate potential markets

Eco—i Electronics

LEARNING CASE STUDY

This supplement makes use of a fictional company in an emerging economy to demonstrate how the eco-innovation methodology can be applied in practice in an electronics value chain. The fictional company is Silicon Latina S.A. in Brazil, which manufactures refrigerators, LCD television and computer screens:

PRESENTING THE ECO-INNOVATION PROCESS THROUGH THE EXAMPLE OF A FICTIONAL COMPANY

Silicon Latina is based in Brazil and with about 600 workers this company is considered a medium size one. They sell their own brand refrigerators including new smart fridges with flat panel displays incorporated in the door. This more recent activity led them to diversify, and they now also sell flat screen TVs and computers.

Their refrigerators are entirely produced and assembled in-house, while their LCD flat panel displays (FPDs) for fridges, TVs and computers are only assembled in-house – giving them less control over this side of the business.

Main suppliers:

- Electronic and plastic components for the FPDs are provided by Sustainable Electronics Industries Co (SELCo), a new brand which manufactures its own products in South Korea. SELCo has a small market share worldwide and about 200 workers.
- Packaging materials are provided by Packaging Chile (PackChi).

Silicon Latina's clients are across Latin America and the Caribbean (LAC), mainly in Mexico, Colombia, Argentina and Brazil. Silicon Latina is the 3rd most sold brand in the LAC region.

Following its corporate social responsibility (CSR) policy, Silicon Latina provides a service collection service for used or broken products (defined as e-waste) in all countries where they operate. This e-waste is then channeled to local companies for proper treatment and recycling.

The plastic components of FPDs have been shown to contain flame retardants that exceed the threshold levels of 1000 ppm for chemicals of concern (such as from the RoHS 3 EU Directive 2015/863 (2015) regulation) which is limiting recycling yields.

Silicon Latina has not directly addressed sustainability aspects of their products in their market positioning. While they have excellent records of environmental and health-related legal compliance thanks to their risk management system, Silicon Latina has limited experience in product innovation. They lack trained personnel on new technology development related to their products.

Decision-making processes for investments above USD 100,000 rely on the Board of Directors, with a more flexible process for smaller investments.

Growing pressure from increasingly environmentally aware customers to demonstrate environmental and health improvements; and new materials and technological options emerging in the market, make it a perfect time for Silicon Latina to consider strategy, operational and technical improvements related to production and service providers.

The aim to the company is to:

- increase the circularity of their products
- improve the management of chemicals of concern
- boost competitiveness in the face of accelerated pace of technological developments
- enhance supply chain security.

For this exercise, the eco-innovation analysis of Silicon Latina's refrigerator activity will cover all aspects of the business (whole-of-life impacts, new business models etc.) while the FPDs will focus uniquely on issues related to chemicals of concern in the plastics components. The presence of flame retardants and other chemicals of concern in plastics is a real challenge for many electrical and electronic producers around the world.

The following is an example of a sector and market level analysis for Silicon Latina using the 'target identification' template from the Eco-I Manual.

PR.1 Evaluate potential markets

Eco—i Electronics

A. SECTOR-LEVEL DESCRIPTION

Sector name: Consumer electronic products

This sector has high potential for eco-innovation and is a target market for the company. Highlights include:

- Steep and continued growth. According to Statista (2022), the market for electronics will continue growing with an annual revenue increase from 2022 to by 2025 of 7.71%. Most global consumption will occur in emerging economies.
- Increasing environmental concerns. Environmental hotspots are related to energy consumption and CO_2 emissions in the use phase, problematic substances used in production and waste management (e.g., lead and mercury) as well as chemicals of concern in products (e.g. chromium VI in printed circuit boards and polychlorinated biphenyls in capacitors), and depletion of non-renewable critical and valuable raw materials such as lithium and cobalt from batteries, among others.
- Reputational risks. There is increasing awareness of consumers and policy makers about the working conditions in supply chains, such as child labour and gender pay gaps, especially in developing countries.

B. MARKET-LEVEL DESCRIPTION

Description of the market: Home appliances (refrigerators) and electronic flat panel displays (computers and TVs) in Latin America and the Caribbean (LAC)

Home large and small appliances. According to Mordor Intelligence (2022), the consumption of home appliances in LAC is growing by 2.5% annually, driven by increasing average household incomes (based on the compound annual growth rate – or CAGR – between 2020 and 2025). The demand of home appliances is dominated by Brazil with more than 50% of the total. The main appliances traded in Latin America are refrigerators, basic cookers and washing machines. Smart technology including energy efficiency drives the market. The Latin American home appliance market is moderately consolidated and dominated by a few international players with huge revenues worldwide. These companies have substantive R&D investments, constantly innovating and introducing new designs in the market to remain competitive. All this suggests that there is a market niche for innovative products.

The share of households with a refrigerator varies from country to country: from 32% to 99.4% (see below). This shows gaps in the Latin American market which are on the other hand opportunities for suppliers of these products. On top of that, the demand for refrigerators per 1000 inhabitants is increasing, in part due decreasing households sizes.

Country	% of households
Chile	99.4
Costa Rica	97.8
Argentina	97.4
Brazil	96.9
Paraguay	90.4
Mexico	90.1
Colombia	87.2
Ecuador	86.6
Peru**	58.2
Bolivia	32-69%*

*Table PR.1-1: Percent of households with a refrigerator (between 2019-2020), GlobalDataLab (2020) *2017 ** ENAHO (2020)*

Electronic flat panel displays (computers and TVs). This product market is expected to grow due to the numerous technological innovations in the past years and the increasing average buying power of potential consumers in emerging economies and industrialized countries. According to Allied Market Research (2019), annual growth of 6.1% is expected between 2019 to 2026. Flat panel displays are significantly lighter and thinner than traditional Cathode Ray Tube (CRT) screens, and use Liquid Crystal Display (LCD), Light-Emitting Diode (LED) and Organic Light-Emitting Diode (OLED) technologies. They are mostly used in consumer electronic devices such as television and digital signage, PC & laptops, smartphone & tablets, smart wearables (e.g. watches). LCD is the most widely used technology (with about 55% in 2020) followed by a newer development LED (and OLED) with about 25% (see Fig. PR.1-2).

PR.1 Evaluate potential markets

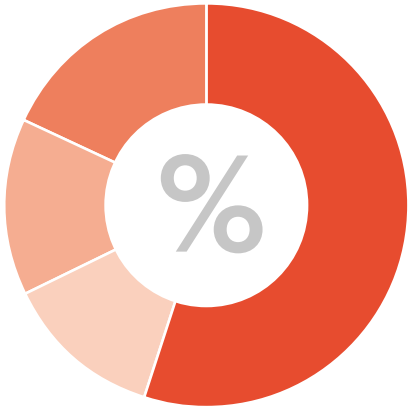


Figure PR.1-2: Global flat panel display market shares per technology (KVB Research, 2020)

TVs and digital signage, smartphones and tablets, PCs and laptops represent more than 80% of the total production of flat panel displays (see PR.1-3).

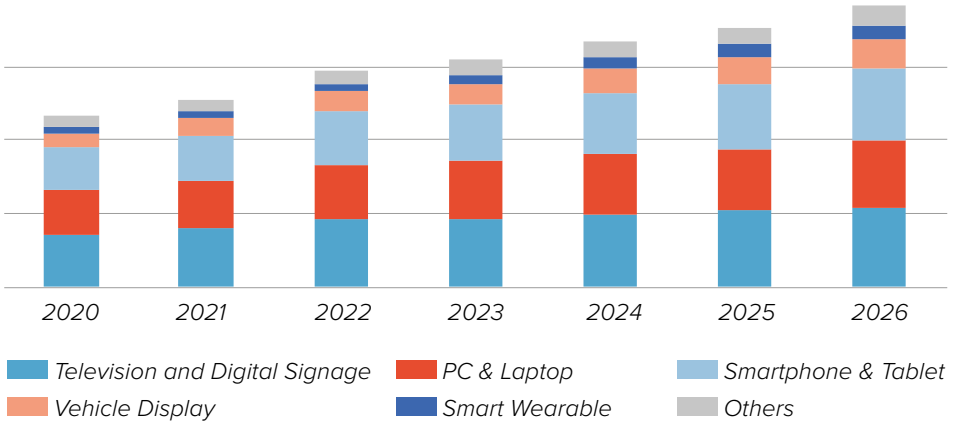


Figure PR.1-3: Global demand of flat panel display per product applications (KVB Research, 2020)

Latin America (excluding Mexico in this particular case) accounts for about 10% of the global market with a revenue growth (CAGR) forecasted of 3.24% between 2019 and 2027. Mexico and Brazil stand out in the regions as main producers and consumers (businesswire, 2020).

A common driver for innovation in both appliances - refrigerators and flat panel displays - are increasingly strict regulatory environments. This includes restrictions on using HFC and HCFC (with 2030 as the full phase-out deadline for HCFC and 2045 as the 80% phase-out deadline for HFC in developing countries) and chemicals of concern (such as certain flame retardants in plastic components), CO_2 emission reduction targets, extended producer responsibility and the management of waste electrical and electronic equipment (WEEE).

POTENTIAL SCORING ANALYSIS BASED ON ECO-I MANUAL METHODOLOGY

Following the methodology described in the section 'How to Go About It' of PR.1 of the Eco-I Manual, the following scoring is made (for details see Fig. PR.1-4):

1. The assessment of eco-innovation potential of the electronics sector is assessed based on the guiding questions and scoring methodology (max score 10) provided in the Eco-I Manual. This sector scored high with 9 points.
2. Based on the high sector-level score, the specific markets of the company concerned are further assessed according to the market-related questions indicated in the Eco-I Manual. The refrigerators markets scored 16 (out of 20) and the flat panel displays one 15. Both are considered high scores.
3. Finally, the eco-innovation potential at company-level is analysed. Silicon Latina scored 8 points which means medium-high eco-innovation potential.

In summary, Silicon Latina has a proactive business model and strategy in support of exploring eco-innovation and with a sub-system for risk management in place e.g. related to disruptions in the supply chain. On the other hand, they lack capital investment capacity and trained personnel on new technologies related to their products.

The full assessment is provided in the following table, identifying general opportunities, threats, strengths and weaknesses of Silicon Latina to be considered in the eco-innovation process.

PR.1 Evaluate potential markets

Eco—i Electronics

Sector-level analysis

Sector potentials score for electronics: 9/10 points

A1 To what extent does the sector contribute to global greenhouse gas emissions and climate change (taking into account the full lifecycle of the product or service delivered by the sector)?
Major contributor. 2 points (it is among major contributors during the use phase)

A2 To what extent does the sector contribute to global consumption of non-renewable resources and potable water (taking into account the full lifecycle of the product or service delivered by the sector)?
Major contributor. 2 points (especially concerning the use of resources some of them with high depletions risks)

A3 To what extent does the sector contribute to global pollution problems (taking into account the full lifecycle of the product or service delivered by the sector)?
Major contributor e.g. see list above. 2 points (for example e-waste is the fastest growing waste stream worldwide)

A4 How important is the sector for the national economy?
Medium importance. 1 point (contributes over 5% of GDP or employs over 5% of workforce)

A5 To what extent has this sector been targeted by Non-Governmental Organisations (NGOs) to encourage improvements in sustainability performance?

Major focus. 2 points (this sector is being targeted by NGOs through sustained global campaigns)

Market-level analysis

Questions B1-B6 assess the likely demand for eco-innovation services in the market. Questions B7-B10 assess the probability that your organisation could successfully provide this service.
Market potentials score for refrigerators: 16/20 points; Market potentials score for flat panel displays: 14/20 points

B1 How strong is the growth of the refrigerators and flat panel displays (FPD) market?
Moderate. 1 point for each (2%-5% per year)

B2 How strong is the competition in this market?
Strong. 2 points for each (6+ companies competing)

B3 To what extent is government policy encouraging and supporting moves towards improved sustainability performance?
Moderate support from policy, but no financial measures. 1 point for refrigerators due to energy efficiency and (H)CFC programs. No support from policy. 0 points for flat panel displays

B4 Is this market affected by new or forthcoming legislation?
Moderate changes required to meet new or forthcoming legislative requirements: 1 point for each
Relevant legislations identified:
- Most countries are enforcing legislations - or are in the process of doing so – for removing HCFC and HFC from refrigerators. For example, in Brazil the Kigali Amendment to the Montreal Protocol was approved in 2022 (legal decree DL nº 95). In addition, energy efficiency programs support innovations in this product group.
- Ministries currently considering restrictions to trade of products with flame retardants.

B5 How interested are the end customers of this market in improving sustainability performance?
Moderate interest – information about sustainability performance is considered as part of the purchase decision, but not a deciding factor. 1 point for refrigerators focusing on energy efficiency and 0 for FPD.

B6 Are there trends that would encourage eco-innovation in this market?
Relevant trends include energy efficient technologies being developed as well as international drivers towards the removal of chemicals of concern.
Yes, several strong trends that would encourage eco-innovation. 2 points for each

B7 Do you have existing customers, reputation and credibility in this market?
Yes, significant number of existing customers and well known in this market. 2 points for each.

B8 Are the potential companies in this market similar to the types of organisation that we normally choose to work with? Would they make good companies for our organisation?
Yes, exactly the type of companies that we aim to work with. 2 points for each

B9 Do we have the necessary sector and market knowledge within our organisation today to deliver eco-innovation services to this market?
Yes, we have several staff with relevant sector and market knowledge. 2 points for each

B10 How easy would it be to collaborate with other organisations within this market based on geographic location?
Relatively easy – majority of market, including final customer, is within the same country. 2 points each

Company-level analysis

Company's potentials score for eco-innovation: 8/10 points

C1 To what extent is sustainability an explicit and public part of the core strategy and values of the company?
Major focus on sustainability – public statements, in-house policy or literature explicitly stating that sustainability is a core part of the company strategy and values. 2 points

C2 To what extent is sustainability performance of the company's products and services part of their product marketing and positioning?
Moderate focus on sustainability –a minor and occasional feature of the marketing and branding of the products and services of the company. 1 point

C3 What experience and capability does the company have in innovation?
Limited experience and capability – some notable innovations, but limited resources dedicated to supporting innovation. 1 point for each

C4 What experience and capability does the company have in managing environmental issues?
Significant experience and capability – environmental management system in operation and resources dedicated to supporting environmental improvement: 2 points

C5 What is the position of the company in their market?

Not at the top 20% of the global market leader but the 3rd in the LCA region. 2 points

Figure PR.1-4: Scoring results for the sector-level, market-level and company-level analysis

PR.1 Evaluate potential markets

Eco—i Electronics

TIPS & TRICKS

There are three important levels of granularity to consider when looking for new markets to target: sector, market and company level.

The Eco-I Manual elaborates key considerations at the market and company levels as follows:

Market level considerations	Company level considerations
• Existing supporting policy and finance mechanisms in the country of the company • Markets where you have outreach capacity and credibility • Markets with growth and profitability potential	• Commercial success • Innovation track record • Existing sustainability performance commitments

The Eco-I Manual also provides general tips & tricks for evaluating potential markets, highlighting the need for desk research activity, adding your own criteria and keeping record of potential customers. Additional tips & tricks for the electronics sector include:

MAP YOUR VALUE CHAIN. Get a clear understanding of the actors, segments and markets related to the electronics sector, and where the company sits. Component producers, assembly facilities, electronic systems producers and distributors are among the value chain actors. Application industries include automation, energy, security, lighting, health, home appliances and consumer electronics. End markets include businesses, governments and consumers. Figure PR.1-6 can help you define specific actors, segments and markets and the position of the company in the value chain. From here, upstream and downstream business partners can be identified as well as those potentially interested in eco-innovation investments and goods provided.

UNDERSTAND CAPACITIES. Especially in developing countries and emerging economies, it is essential to understand capacities to better manage the capability of suppliers to deliver required components (see PR.3), reducing the risk of supply disruption. Developing countries typically manufacture and export mid-end technological products (not linked to the newest product developments) such as capacitors, batteries and lamps. Key emerging countries such as China and countries with strong research and development programs have high-end technological capacities (related to more recent inventions and developments) which focus on penetrating new markets such as lighting, energy (smart grids), sports and clothing (sensors) and e-mobility. For this purpose, you should record the geographical locations of the suppliers of components.

EXPLORE INNOVATION TRENDS. Assess and identify the potential markets and innovations, and anticipate the movements of the competitors. Dig deeper on markets, business models and technological trends based on most recent reports for innovative products with similar functionalities. Note that market intelligence and technology development reports are typically not for free, hence, if no resources are available you can start with own research based on national and international statistics, as well as references and open tools collected in this supplement.

IDENTIFY LEGAL REQUIREMENTS AND STANDARDS. These may provide market drivers for eco-innovation. Operating in higher standard environments increases potential for uptake and economic feasibility of eco-innovation projects, for example countries with more advanced development and enforcement of regulations for the electronics sector. This initial screening of existing requirements can be done in more detail once you know which electronics products the company you represent produces (see PR.5). For exporting companies, start with identifying international requirements and their level of adoption in the countries concerned in the company's value chain such as those in Box 1.

INVESTIGATE CIRCULARITY OPPORTUNITIES. Electronics have high potential to use less raw and non-renewable materials in their manufacture. Revisit the electronics value chain from the materials perspective based on life cycle thinking to unveil eco-innovation potential for increasing the circularity in the company you represent (see Fig. 3). Strategies include designing electronics for longer lifetime, repairability, refurbishment and resource efficiency, eliminating the need for chemicals of concern (in products) at design stage and removing (process) chemicals of concern during production, and increasing energy efficiency along the life cycle including the use phase.

PR.1 Evaluate potential markets

TIPS & TRICKS

LOOK TO FRONTRUNNERS. Identify and investigate leading companies in the electronics sector working on initiatives such as extended producer responsibility, responsible sourcing and sustainable product design for inspiration. Define benchmarks for the company representing economically and technically feasible options for improvement that also increase sustainability. Consider industrial initiatives such as take-back systems, re-furbishing hubs and responsible sourcing programs (e.g. child-labour free materials) and assess the performance of their members. By working together, companies that are part of these initiatives leverage results and excel in their performance and innovation. Investigate what benefits to the company can be leveraged from joining these initiatives.

	Developing countries		Developed countries	
Deadline	Reduction of HCFCs (%)	Reduction of HFCs (%) (countries group 1)	Reduction of HCFCs (%)	Reduction of HFCs (%)
By 2020	35%	n.e.t.	Total phase out	5%
By 2025	67.5%	n.e.t.	–	35%
By 2029	n.e.t.	10%		70%
By 2030	Total phase out	n.e.t.	–	n.e.t.
By 2035	–	30%	–	n.e.t.
By 2036	–	n.e.t.	–	85%
By 2040	–	50%	–	–
By 2045	–	80%	–	–

n.e.t.: no specific target

Table PR.1-5: Montreal Protocol reduction targets of hydrochlorofluorocarbons (HCFCs) (at a base level calculated as the average of 2009 and 2010 consumption levels) and Kigali Amendment reduction targets of hydrofluorocarbon (HFCs)

Global initiatives include:

- The Paris Agreement on Climate Change (UN, 2015) (for energy efficiency and CO_2 reduction)
- The Stockholm Convention (on persistent organic pollutants) (UNEP, 2001)
- The Basel Convention (transboundary movements of e-waste) (UNEP, 1989)
- The Montreal Protocol towards phasing-out (H)CFCs (see Table PR.1-5) (UNEP, 1987) and the Kigali Amendment for phasing-down HFC (fact sheet 5) (UNEP, 2016).

National laws that can influence market may also be in place in areas like:

- eco-design directives
- energy labelling schemes
- waste electrical and electronic equipment (WEEE) management
- single-use packaging restrictions
- chemicals of concern restrictions or overarching chemicals regulation
- adopted international conventions and agreements in countries and translated into national action plans.

The European Union, for example, has regulations and directives that also apply to any companies exporting to this region including:

- European Conflict minerals regulation EU 2017/821 (2017) to prevent minerals and metals exploitation in resource-rich but also conflict-affected and high-risk areas.
- EU Directive 2011/65 /EU (2011) on Restriction of Hazardous Substances (RoHS) in electrical and electronic products and EU Directive 2015/863 (2015) on Amending Annex II to Directive 2011/65/EU of the European Parliament and of the Council as regards the list of restricted substances.

Other useful resources concerning chemicals of concern include:

- OECD e-chem portal provides information on chemical substances, including links to information on uses, toxicology and regulatory assessments.
- US National Institutes of Health (NIH) PubChem is more focussed on the scientific community but also includes information on toxicology.
- For chemicals of concern used by the company, check the list of regulatory frameworks (UNEP, 2020) concerning potential use restrictions in different countries.

Box 1: Examples of legal requirements and standards to investigate

PR.1 Evaluate potential markets

Eco—i Electronics

TIPS & TRICKS

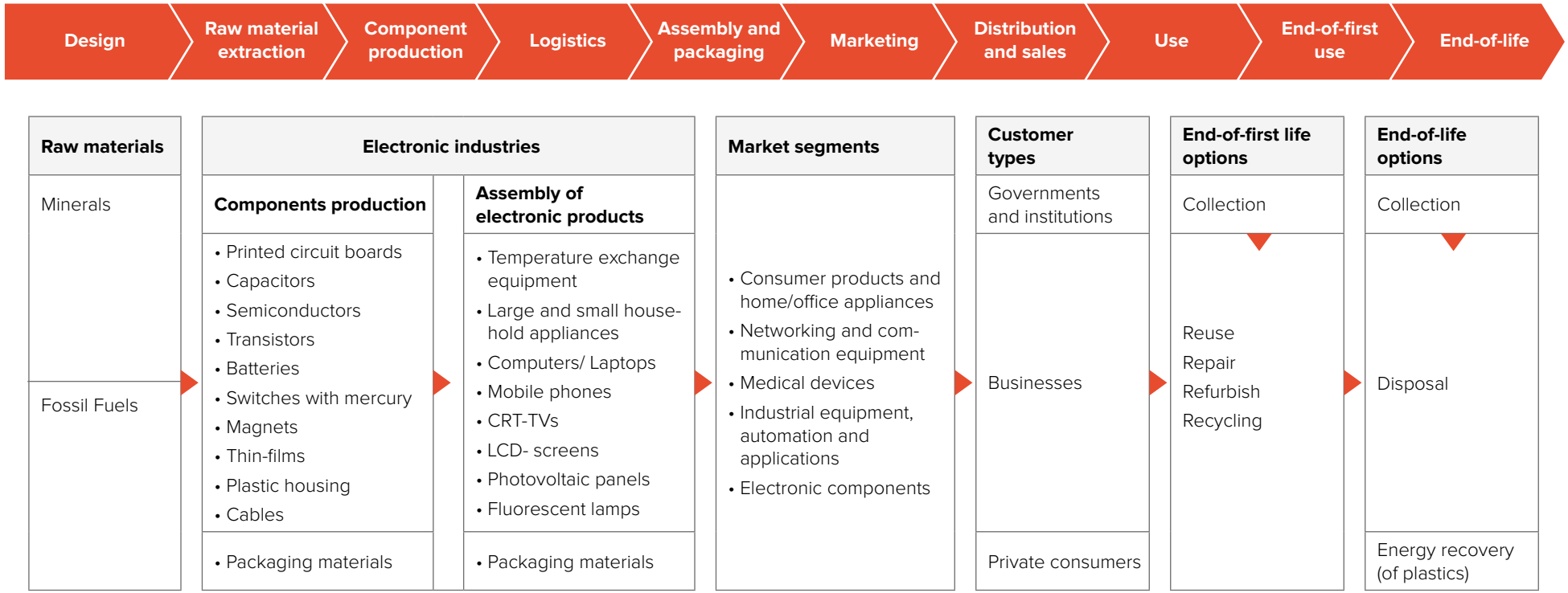


Figure PR.1-6: Simplified electronics value chain with illustrative examples

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PR.2
Building the right internal team



This activity helps you think about the competencies, skills and knowledge necessary to deliver eco-innovation services, identify what gaps exist within your team and plan how to address these gaps.

ORIENTATION

As described in the Eco-innovation Manual, this activity starts by identifying the skills necessary for your team to deliver eco-innovation services, followed by identifying any critical gaps in those skills. The manual then offers ways for you as a Service Provider to fill those gaps, including training, recruiting, partnerships and buying services.

The learning case study in the manual populates the Competencies Checklist template with a suggested list of competencies, which should be complemented with sector-specific knowledge. Electronics-specific expertise is key to working with electronics companies on eco-innovation.

If additional knowledge about sustainable electronics is needed, this supplement lists selected accessible, cost-free training resources for your team.

Template of Competencies Checklist

Competence	Essential/ beneficial	In-house	Needs

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Plan for how to fill any gaps you have in your internal team in terms of the competencies, skills and knowledge required to deliver your eco-innovation services.

PR.2 Building the right internal team

Eco—i Electronics



LEARNING CASE STUDY OF COMPETENCIES CHECK LIST

The following table provides general and specific examples of core competencies for your eco-innovation team in the electronics sector in the form of a checklist. It is applied to the learning case, i.e. shows how the service provider supporting Silicon Latina in applying eco-innovation analysed their own internal team and capacity to provide those services to Silicon Latina. The table also indicates the importance of these competencies in your team ('essential' for one at least, 'essential' for all, or 'beneficial').

After checking within your eco-innovation team whether required competencies exist, the focus will be on solving the identified gaps. As per the Eco-I Manual, competencies can be acquired through:

- In-house training,
- Coaching during the implementation,
- Buy-in services,
- Recruitment of new personnel, or
- Establishing cooperation with strategic partners.

PR.2 Building the right internal team

Eco—i Electronics

LEARNING CASE STUDY OF COMPETENCIES CHECK LIST

Required competences/skills	Importance	Presence in-house (filled in by service provider helping Silicon Latina to apply eco-innovation for the service provider's team)			Strategy to bridge gap
		Team member 1	Team member 2	Team member 3	
General					
Teamwork	Essential (all team members)	✓	✓	✓	Training & coaching
Effective communication and reporting	Essential (all team members)	✓	✓		Buy in-service from a marketing firm
Good understanding of the needs and expectations of consumers (e.g. lifestyles and marketing dynamics)	Essential (at least one team member)				
Creative thinking	Essential (for team leads)	✓	✓		
Eco-innovation and life cycle approaches	Beneficial				Engage external service provider and coach team
Electronics sector specific					
Problem-solving supported with methodological thinking, research, data collection and databases management	Essential (for team leads)		✓		
Technical skills about electronics	Essential (for team leads)		✓		
Knowledge on electronics supply chain management	Essential (at least one team member)	✓			
Knowledge on electronics business models	Essential (at least one team member)	✓			
Understanding of the policies and the legal context where the company is based in	Essential (at least one team member)			✓	
Knowledge about chemicals used in electronics and compliance	Essential (at least one team member)			✓	Engage external expert on chemicals monitoring and compliance
Understanding of environmental hotspots such as critical raw materials, batteries, etc.	Essential (at least one team member)	✓	✓		
Packaging innovation thinking	Beneficial				Partnership with a packaging firm

PR.2 Building the right internal team

Eco—i Electronics

TIPS & TRICKS

LEGAL AND TECHNICAL EXPERTISE.

Make sure your eco-innovation team has specific technical skills in:
- Technological development aspects for the production of electrical and electronic equipment
- New materials or components substituting current ones
- Treatment processes for re-use, refurbishment and waste management.

Regarding legal requirements, chemicals of concern potentially used in electronics and data confidentiality aspects are areas of particular concern that need to be followed-up by a competent team member. This member is tasked to keep the knowledge about legal requirements up-to-date and to assess the implications of (non-) compliance not only in the countries of production but also in the importing ones.

UNDERSTANDING OF STRATEGY AND BUSINESS MODELS.

Following the market segment and company analysis (in PR.1), ensure your team includes strategic expertise on these main drivers for innovation nationally (where the company is based) and internationally (where main customers are). Experts from the marketing area can perform well in these roles. People with strong understanding of business models for the sector will be crucial in your team. Understanding of consumers lifestyles and marketing dynamics will also be relevant.

TRAINING RESOURCES.

The following is an initial set of selected accessible learning resources that you may offer suitable opportunities for building relevant competencies in your team. Most courses and portals are cost-free. Some courses provide the option of payment if certificates are required.

- edX (2022) offers MOOCs in subjects such as 'Designing Electronics for Recycling in a Circular Economy', 'Sustainable Design of Electronics', 'Circuits and electronics', 'Electronic materials and devices', among others, from top educational institutions.
- Class central (2020) includes courses on 'Introduction to electronics' from Georgia Tech and 'Design as applied to small electronics products and projects' from the Indian Institute of Science.
- Basel Convention (2020) provides The E-waste Challenge Massive Open Online Course (MOOC).
- KJ Manjunatheshwaraa (2021) introduces a review of the state of the art of sustainable electronics product design and manufacturing.
- The US Environmental Protection Agency (US-EPA, 2022) maintains a portal and publications on the sustainable management of electronics.
- The iFixitEdu (2022) platform offers training for self-repairing based on individual projects.

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PR.3
Building the right external partnerships

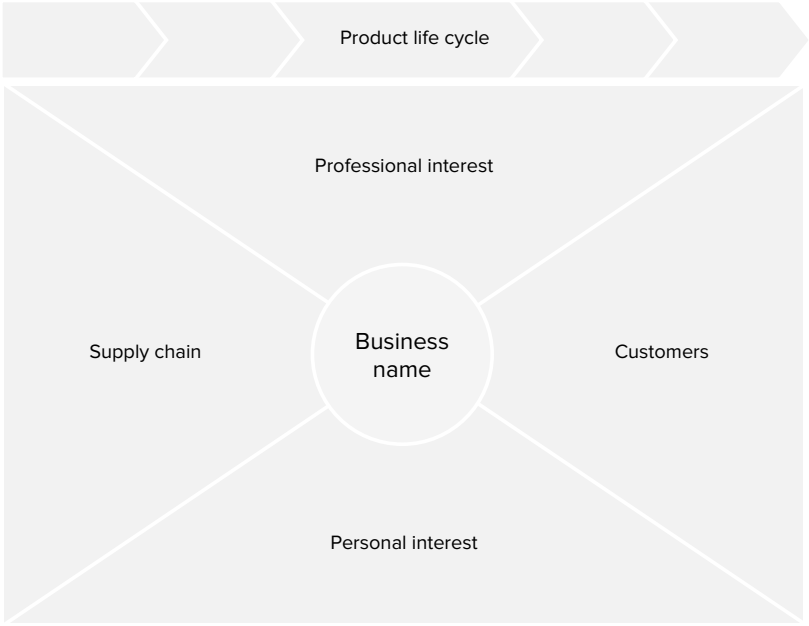


This activity enables you to identify external stakeholders and think about how they could contribute to your eco-innovation services and activities.

ORIENTATION

As an initial step in building the right partnerships, the Eco-innovation Manual suggests applying the Life Cycle Stakeholders template as a guide, to help you identify key stakeholders along the value chain of your target company. You will plan for how to fill any gaps you have identified in the stakeholders list mapped.

Template of Cycle Stakeholders



EXPECTED OUTPUTS FROM THIS ACTIVITY:

- New external partnerships initiated where appropriate.
- List of key stakeholders.

These outputs are used in the activities *PR.6 Develop a value chain vision and ST.7 Do a SWOT analysis.*

PR.3 Building the right external partnerships

Eco—i Electronics

BACKGROUND INFORMATION

Partnerships in the electronics industry can be clustered according to stakeholder types. Where not yet in place, these partnerships are of essence in an eco-innovation process. A general mapping of potential partners is presented in the following lines and in Fig. PR.3-1 which can be adapted to specific value chains.

CUSTOMERS:

- Retailers of consumer electronics
- International brands partnerships for addressing environmental and social hotspots along the value chain
- Individual end-consumers
- Businesses including manufacturing industries
- Public organisations such as ministries, public schools and universities, public hospitals.

UPSTREAM AND DOWNSTREAM ACTORS IN THE ELECTRONICS INDUSTRY:

- Metallurgical processors
- Packaging manufacturers and services
- Providers of alternative materials such as alternatives to certain plastics, including those providing alternatives
- Final manufacturers
- Take-back schemes supporting good-quality collection
- Recycling associations
- Repairers and refurbishers for used or broken products
- Equipment suppliers in associated value chains. For example, the metal processing and fabrication industries present many opportunities to collaborate with equipment providers for the provision of complete product-service offerings in the following areas: a) metal parts cleaning with solvent, b) metal polishing and finishing processes, and c) electroplating
- Waste management service providers (including collectors and recyclers)
- Supply chain management experts.

STAKEHOLDERS WITH PROFESSIONAL INTERESTS:

- Initiatives on extended producer responsibility (EPR), responsible materials sourcing, collaborative sustainable electronics design, among others
- Chemical industry associations and responsible care networks
- Innovation hubs
- Circular economy networks
- Inspection, verification, testing and certification companies (to assist in obtaining ecolabels or sustainability certification)
- Civil society representatives such as consumer associations, labour rights organisations, environmental protection and indigenous rights groups
- Universities and research institutes on focusing on electronics, green chemistry, green business, etc.
- Environmental protection agencies (local, national, regional).

STAKEHOLDERS WITH PERSONAL INTERESTS:

- Workers including sub-contract personnel
- Community members and neighbours of the facilities
- Workers in the informal sector and their families.

PR.3 Building the right external partnerships

Eco—i Electronics

EXAMPLE OF LIFE CYCLE STAKEHOLDERS TEMPLATE APPPLIED TO THE ELECTRONICS INDUSTRY

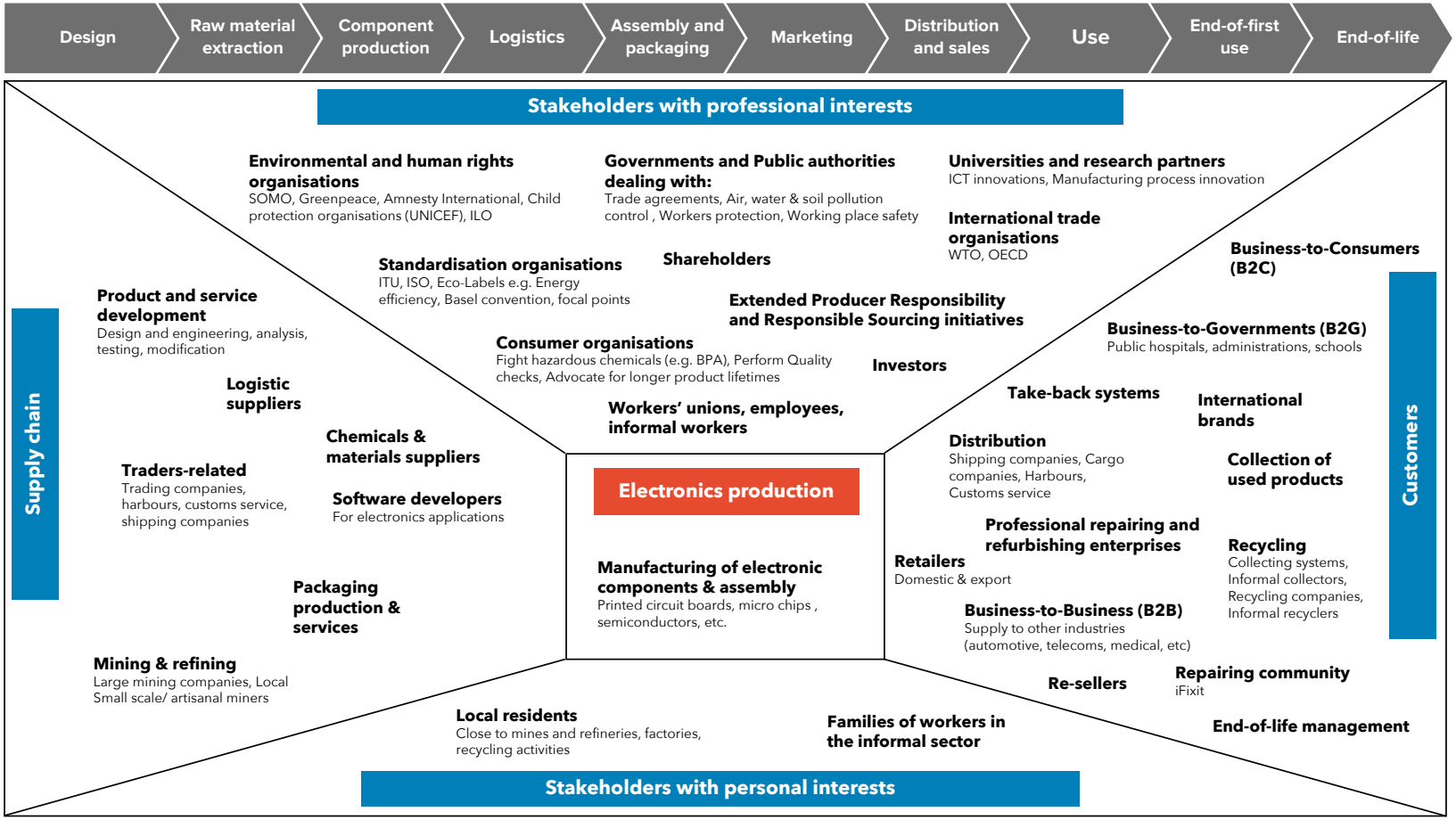


Figure PR.3-1: General mapping of electronics life cycle stakeholders

PR.3 Building the right external partnerships

Eco—i Electronics

LEARNING CASE STUDY OF LIFE CYCLE STAKEHOLDERS FOR SILICON LATINA

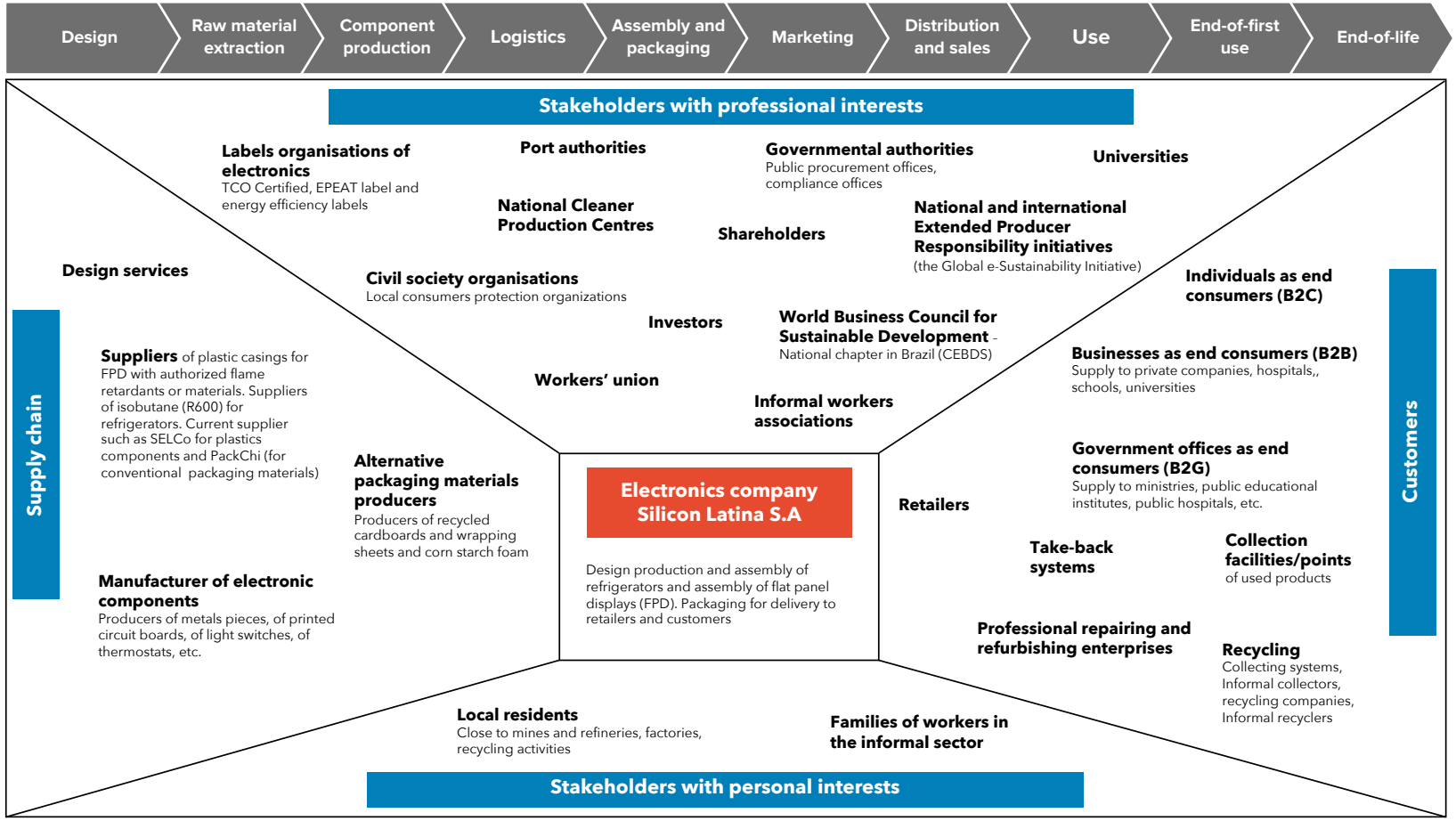


Figure PR.3-2: Mapping of electronics life cycle stakeholders of Silicon Latina

PR.3 Building the right external partnerships

Eco—i Electronics

LEARNING CASE STUDY

The following list describes how some potential partners of Silicon Latina could contribute to eco-innovation activities.

- **Electronics certification/ labelling bodies** can provide reference practices and proposed thresholds of chemicals of concern such as flame retardants for sustainable electronics.
- **Research centres at universities** can test new technologies, changes and design.
- **Suppliers of plastics casing** can help ensure environmentally friendlier plastic components in flat panel displays (such as recycled plastics).
- **Suppliers of packaging materials** can tailor their products to increase the sustainability of Silicon Latina's packing.
- **Specialized refrigerator repairers** can assist customers as part of the after-sales services and within the guaranty of the product. This will support extending the lifetime of the product through maintenance, repair and refurbishment.
- **National take back systems** can communicate about and coordinate the collection of used products which should include proper collection points (e.g., at retailers' facilities).
- **Retailers** can be trained to properly communicate the advantages and sustainability benefits of the products. In most cases they are the direct (and only) contact with the end-consumers.

PR.3 Building the right external partnerships

Eco—i Electronics

TIPS & TRICKS

IDENTIFY AND ENGAGE THE SUPPLY CHAIN.

Consider the most relevant suppliers that deliver materials or services needed for the eco-innovation measures, based on amount purchased, being the only providers of a certain material, with special agreements for joint research, other strategic reasons. After identifying key suppliers and potential areas for eco-innovation through cooperation (see results from the market analysis), present the options to your company for feedback. Seek additional insights about the suppliers selected and additional names to consider. When approaching suppliers, clearly communicate the business benefits of working together on the eco-innovation process. Once an agreement is reached, disclosure agreements should be put in place.

INCLUDE DOWNSTREAM VALUE CHAIN PARTNERS.

Businesses that maintain and repair the company's products, and those that recycle them at end-of-life are important to consider in new product development. These stakeholders can provide you with feedback on improving repairability to help extend the life of the products, and systems to better reuse or recycle components.

JOIN EXISTING BUSINESS NETWORKS.

Networks that foster experience sharing and best practices between businesses include:

- **General business contact networks** such as chambers of commerce and industrial roundtables. They can offer fresh ideas to your eco-innovation concepts development, often holding meetings on relevant topics.
- **Professional associations or knowledge networks** such as electronic engineers associations, ISO Technical Committee (TC) 22/SC32 on EEE components and specialized committees on electronics of national standardisation bodies (ISO mirror bodies).
- **Specialized business associations** that gather peer companies, suppliers and competitors to work collaboratively in support of the global value chains and the sector. One example is the Global e-Sustainability Initiative (GeSI) which, for example, has produced a comprehensive assessment framework for the evaluation of information and communication technology products and services in terms of environmental, human rights and utility aspects. The Electronic Components Industry Association (ECIA) is another example.
- **Specialized non-business associations, networks or platforms** including civil society organisations such as consumer and governmental initiatives that contribute to regulations development among others. Some examples are The Consumer Electronics Association (CEA), The GoodElectronics network, the Platform for Accelerating the Circular Economy (PACE) and regional circular economy networks (such as the African Circular Economy Alliance (ACEN), the Latin-American and Caribbean Regional Coalition on Circular Economy (UNEP, 2022) and the European Circular Economy Action Plan (EU, 2020).
- **National resource efficient and cleaner production centres** (RECPnet) can help validate eco-innovation options in the local market through their large industry networks.
- **Bodies holding** cradle-to-cradle, TCO certified, EPEAT and energy efficiency **labels** (EPREL) can provide guidance on how to meet their criteria and market to new, higher revenue generating customer segments.

References:

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PR.4
Identify sustainability hotspots across the value chain



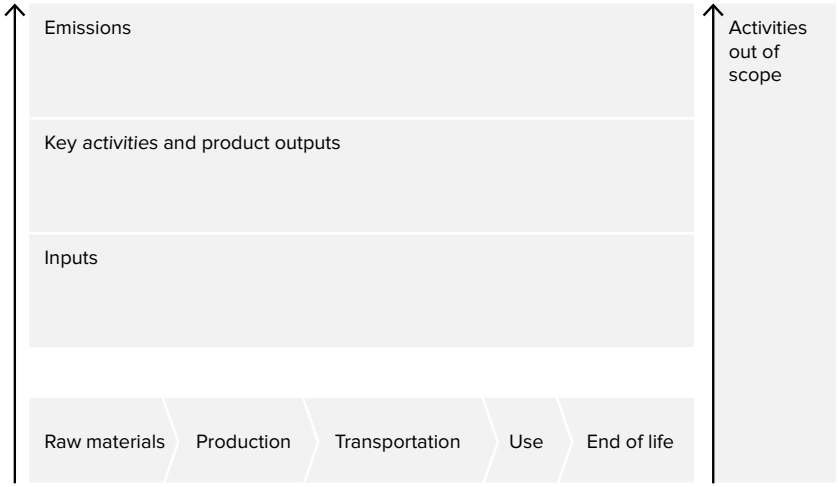
To know where eco-innovation is most needed and generate the biggest improvements in overall sustainability performance, by identifying 'sustainability hotspots'.

ORIENTATION

The first step suggested in the Eco-innovation Manual for this activity is to create a life cycle inventory, which is then translated into a life cycle thinking template to identify potential sustainability hotspots (a list of specific environmental, social and economic impacts that occur across the value chain). The explanation of electronics life cycle activities in the introduction section of this supplement gives you a foundation for creating the life cycle inventory and completing the life cycle thinking template.

You will apply these inputs to your target company or companies. There can be significant differences between aggregate global impact assessments and local country or regional assessments. Several factors not related to country or region, including the type of product and how it is produced, can have both positive and negative environmental and social impacts.

Template of Life Cycle Inventory



EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Identification of the sustainability hotspots that occur across the value chain, used in the activities *PR.6 Develop a value chain vision* and *ST.6 Update the sustainability hotspots.*

PR.4 Identify sustainability hotspots across the value chain

Eco—i Electronics

LEARNING CASE STUDY OF LIFE CYCLE INVENTORY OF SILICON LATINA

For the shortlisted electronics products at Silicon Latina, diagrams of product life cycle inventories are elaborated using the template of Life Cycle Inventory of the Eco-I Manual. The diagrams in Figs PR.4-1 and PR.4-2 show the physical inputs and outputs (emissions, wastes and wastewater) of each activity. The scope (activities) defined in the diagrams are further analysed to define hotspots and opportunities for eco-innovation (Tables PR.4-3 and PR.4-4).

PR.4 Identify sustainability hotspots across the value chain

Eco—i Electronics

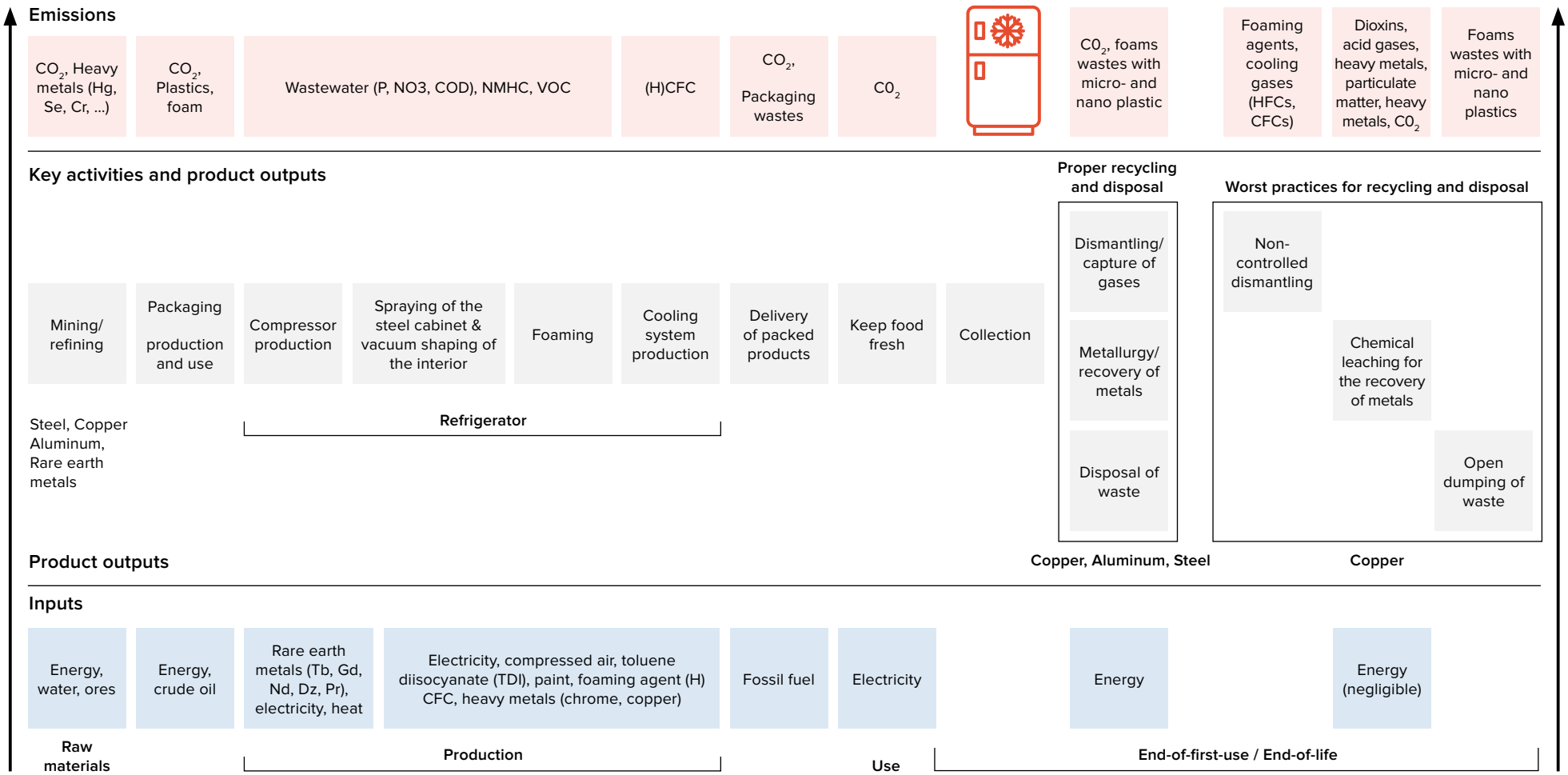


Figure PR.4-1: Illustration of typical stages of refrigerators along their life cycle – Basis for a quantitative life cycle inventory

PR.4 Identify sustainability hotspots across the value chain

Eco—i Electronics

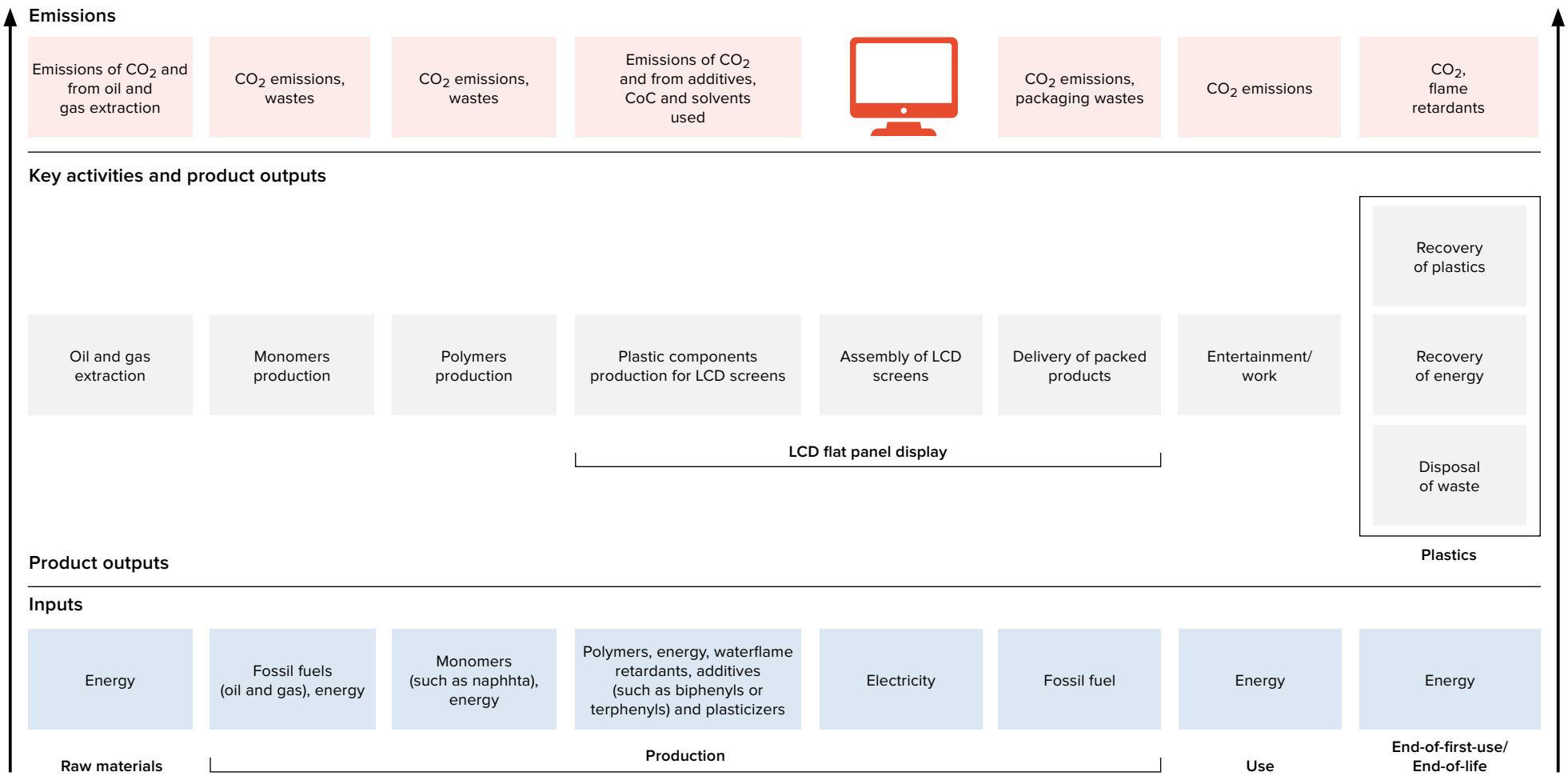


Figure PR.4-2: Illustration of the typical life cycle stages of a LCD flat screen focusing on plastic components – Basis for a quantitative life cycle inventory

PR.4 Identify sustainability hotspots across the value chain

Eco—i Electronics

LEARNING CASE STUDY OF LIFE CYCLE THINKING

The inputs and outputs defined during the life cycle inventory, are now converted to potential environmental, social and economic impacts across the value chain using the remaining columns of the Life Cycle Thinking template (see in Eco-I Manual). Examples of the qualitative assessment are presented in Tables PR.4-1 and PR.4-2. Areas with several different medium-rated (M) or high-rated (H) impacts are identified as sustainability hotspots. A wrap-up of the sustainability hotspots can be found at the end of each table.

PR.4 Identify sustainability hotspots across the value chain

Eco—i Electronics

*H= high impact positive, *H= high impact negative, M= medium impact, L= low impact

Life cycle stage	Activity	Input	Product output	Emissions or wastes	Environmental impact*		Social impact*			Economic impact*
					Resource use	Ecosystem quality	Workers	Consumers	Stakeholders	Profitability
Raw materials	Mineral extraction	Energy, water, coal	Steel & aluminium	CO_2, Heavy metals (Hg, Se, Cr, ...)	Depletion of critical raw materials & fossil resources (M)	Land use, fresh water toxicity & climate change (H)	Adverse health effects on workers (M-H)	Negligible	Impacts on local communities such as water & air pollution (H) Community employment creation (H)	Mineral resources price increases & fluctuations (H) Cost of compliance with due diligence (M)
	Smelting & refining	Energy (e.g. heat, electricity), acids (e.g. cupper sulfates)	Purified metals	CO_2, sludge, acid & alkaline wastes,	Depletion of mineral & fossil resources (L)	Land use, fresh water toxicity, toxic air emissions & climate change (L-M)	Adverse health effects on workers (L-H)	Negligible	Impacts on local communities such as air pollution, noise, uncontrolled waste & traffic (H)	CRM price increases & fluctuations (H)
	Plastic production	Energy, crude oil, natural gas, hard coal	Plastics	Negligible	Depletion of fossil resources (L)	Negligible	Health issues if poor working conditions (M)	Negligible	Impacts on local communities due to plastic waste pollution (L)	Negligible
Production	Compressor production	Rare earth metals (Tb, Gd, Nd, Dy, Pr)	Refrigerator	CO_2	Depletion of critical raw materials (M)	Negligible	Health issues if poor working conditions (M)	Negligible	-	Negligible
	Spraying of steel cabinet	Electricity, compressed air, paint		VOC, CO_2	Negligible	Ozone layer depletion (L)		Negligible	Smog formation (M)	Negligible
	Vacuum shaping of the interior	Electricity, heat		NMHC (non-methane hydrocarbons)	Negligible	Climate change (L)		Negligible	Possible human toxicity through air pollution (M)	Negligible
	Foaming	Electricity, compressed air, toluene diisocyanate (TDI), foaming agent (HFC-134a)		Wastewater (P, NO3, COD) Foam wastes (low amounts of HFC-134a)	Negligible	Climate change (M), eutrophication (M & fresh water toxicity (M)		Negligible	Negligible	Cost of compliance with stricter legal requirements for foam waste management (L)

PR.4 Identify sustainability hotspots across the value chain

Eco—i Electronics

*H= high impact positive, *H= high impact negative, M= medium impact, L= low impact

Life cycle stage	Activity	Input	Product output	Emissions or wastes	Environmental impact*		Social impact*			Economic impact*
					Resource use	Ecosystem quality	Workers	Consumers	Stakeholders	Profitability
Packaging production	Packaging	Fossil fuels	Packaging materials	Wastes from plastics and other polymers	Negligible	Climate change (M), eutrophication (M & fresh water toxicity (M)		Negligible	Negligible	Negligible
Use	Keeping food fresh	Electricity	–	CO_2	Depletion of fossil resources linked with energy use (depending on energy source) (H)	Climate change impacts of energy use (depending on energy source) (M)	Negligible	Food conservation (H)	Negligible	Depends on the efficiency of the technology used (L)
Collection	Collection	Used refrigerators	Used refrigerators with recoverable parts or components	Wastes (broken parts)	Negligible	Land use (L)	Health impacts of working conditions (H)	Negligible	Community employment creation (M)	Positive economic impact depending on the collection rate & quality of collected items (M-H)
Proper recycling and disposal	Dismantling	Used refrigerators with recoverable parts or components	Components	Wastes (broken parts), waste foam & plastics	Negligible	Land use (L)	Negligible	Negligible	Negligible	Positive economic impact depending on the quality of dismantled items & concentrations of recoverable materials (M-H)
	Metallurgy	Energy, components with recoverable metals	Metals recovered	Air emissions, CO_2	Depletion of mineral & fossil resources (L)	Climate change, air pollution (L)	Negligible	Negligible	Negligible	Profitable recycling & recovery of metals (H), contribution to a continued supply of critical raw materials (M)
	Disposal of waste	Waste foam, plastics	Negligible	Negligible	Negligible	Land use (H)	Negligible	Negligible	Landscape degradation & emissions impact local communities (H)	Avoided disposal costs through higher recovery rates (L)

PR.4 Identify sustainability hotspots across the value chain

Eco—i Electronics

*H= high impact positive, *H= high impact negative, M= medium impact, L= low impact

Life cycle stage	Activity	Input	Product output	Emissions or wastes	Environmental impact*		Social impact*			Economic impact*
					Resource use	Ecosystem quality	Workers	Consumers	Stakeholders	Profitability
Uncontrolled recycling and disposal	Dismantling	Used refrigerators with recoverable parts or components	Components	Wastes (broken parts), waste foam & plastics, cooling gases (HFCs, CFCs)	Negligible	Land use (L)	Poor working conditions of collectors in developing countries (H)	Negligible	Community employment creation typically in cities in developing countries (M)	The prices of materials recovered under non-controlled conditions have a lower market price due to mixed batches, impurities & informal market conditions (L)
	Disposal of waste	Waste foam, plastics	Negligible	Wastes (broken parts), waste foam & plastics, cooling gases (HFCs, CFCs) Air emissions, CO_2, dioxins, acid gases, heavy metals, particulate matter, heavy metals	Negligible	Adverse impacts on land used (H)	Adverse working conditions of collectors in developing countries e.g. from open burning of plastics & foam (H)	Negligible	Landscape degradation & emissions (H) Adverse health issues for communities around open landfills in developing countries e.g. from open burning of plastics & foam (H)	Fines vary from municipality & country to country. These can be extremely high up to closure of the business for this activity considered as 'environmental crime' (L-H)

Table PR.4-3: Qualitative life cycle thinking table for refrigerators (hotspots with negative impacts are in red and key positive impacts in blue)

PR.4 Identify sustainability hotspots across the value chain

Eco—i Electronics



The sustainability hotspots with negative impacts for refrigerators are:

- **The production of steel and aluminium.** These require considerable raw materials and can create competition with local communities (at times in extreme poverty) for water and land, leading to social conflicts. Moreover, bauxite is a critical raw material primarily used for aluminium, thus, impacting the depletion of resources.
- **Packaging.** This is an-often neglected hotspot which consumes enormous amounts of resources some of which are not economically recoverable (e.g. expanded polystyrene), with high disposal costs.
- **Impacts on climate change during use phase and at end-of-life.** Inadequate maintenance and not following use guidelines of the refrigerator exacerbate these impacts. 'Right-sizing' and replacing older, inefficient fridges are also important here. Hydrofluorocarbons (HFC) released if end-of-life refrigerators are disassembled in a non-controlled way might not be impacting on the ozone layer but on climate change considering their high global warming potential compared to CO_2 (HFC-134a used for the foaming is 1400 times more impactful than CO_2) (Infraserv, 2022).
- **Impacts on the health of poorly equipped workers due to chemicals emitted.** Chemicals include those used during the spraying of the steel cabinet with VOC substances (for example).
- **Impacts on the health and safety of informal collectors and dismantlers.** These groups are particularly important in developing countries, typically working informally without proper personal protection equipment and permits. These workers are often persecuted as they are considered to carry out illegal activities
- **Open dumping of end-of-life refrigerators.** This is one of the worst forms of disposal, especially existing in poorer economies that lack infrastructure and legal enforcement. Risks of pollutants being emitted to the environment and health impacts on waste-pickers are high.

PR.4 Identify sustainability hotspots across the value chain

Eco—i Electronics

*H= high impact positive, *H= high impact negative, M= medium impact, L= low impact

Life cycle stage	Activity	Input	Product output	Emissions or wastes	Environmental impact*		Social impact*			Economic impact*
					Resource use	Ecosystem quality	Workers	Consumers	Stakeholders	Profitability
Raw materials	Oil and gas extraction	Energy	Fossil fuels	Emissions to air from gas leakages (H)	Depletion of fossil resources (M) Deforested area (H)	Leakages and spillage on land, freshwater sources and/or ocean (H)	Job creation (M) Difficult working conditions with no facilities for families (e.g. in camping sites) (H)	Negligible	Indigenous areas and their modus vivendi affected (H)	As long as environmental costs (externalities) are not internalized, the extraction of fossil fuels remains profitable (H) Negative environmental costs (H)
Production	Monomers and polymers production	Energy, crude oil or gas	Naphtha (monomer) and polymers	Polymers waste CO_2, air emissions	Depletion of fossil resources (M)	Leakages and spillage on land, freshwater sources and/or ocean (H)	Health issues due to CoC associated to the production (H)	Negligible	Possible human toxicity through air pollution (M)	Potential savings if recycled plastic is used to produce new polymers (M).
	Plastics component production	Energy, crude oil, natural gas, hard coal, chemicals (e.g. brominated flame retardants, plasticizers & pigments)	Different plastic components in different plastic types (ABS, PS, PC & PVC)	Negligible	Depletion of fossil resources (L)	Negligible	Health issues due to solvents released (M)	Negligible	Possible human toxicity through air pollution (M)	Potential savings at the latter recovery stage if material declaration sheets are available (plastics are marked as well) (M).
	Assembly of plastics components	Electricity, heat	Plastic casings & other plastic units for flat screens	CO_2	Negligible	Negligible	Health issues if poor working conditions (H)	Negligible	Negligible	Material & compliance cost savings of reducing flame retardants to essential uses only (H) Costs of health incidents among workers in poor working conditions (H)
Use	Information display for entertainment or work	Energy source in general	–-	CO_2	Depending on the energy source used	Negligible	Negligible	Negligible	Negligible	Impact of addressing & communicating sustainability aspects of the screens on sales (can be positive or negative) (H)

PR.4 Identify sustainability hotspots across the value chain

Eco—i Electronics

*H= high impact positive, *H= high impact negative, M= medium impact, L= low impact

Life cycle stage	Activity	Input	Product output	Emissions or wastes	Environmental impact*		Social impact*			Economic impact*
					Resource use	Ecosystem quality	Workers	Consumers	Stakeholders	Profitability
Recovery and disposal	Recovery of plastics (50% material recovery)	Energy, plastic components	Plastics recovered	Air emissions, CO_2	Depletion of mineral & fossil resources (L)	Climate change, air pollution (L)	Health issues if poor working conditions (H)	Negligible	Negligible	Profitable recycling & recovery of plastics (M)
	Disposal of waste (25% landfill, 25% energy recovery)	Plastics with chemicals of concern Chemicals of concern in fluorescent backlights of LCD screens (mercury)	Energy recovered	Controlled air emissions	Negligible	Negligible	Negligible	Negligible	Negligible	Income for the energy recovery from plastics (L)
			Wastes disposal	Wastes disposed of Dioxins & toxic gases if openly burnt in a non-controlled way	Land use	If disposed of in a non-controlled way or openly burnt: • severe impacts on land use; • toxic emissions to the environment (H)	Negligible	Negligible	If disposed of in a non-controlled way or openly burnt: • landscape degradation from the emissions or wastes; • decreased livelihoods; • health issues (H)	Externalities are carried out by the population if non-controlled disposal or end-of-life (H)

Table PR.4-4: Qualitative life cycle thinking table for plastics components of LCD flat panels display (hotspots with negative impacts are in red and key positive impacts in blue)

Main sustainability hotspots of plastics components in flat panel displays are due to the extraction activities to produce the polymers and to the use of additives (e.g. colorants, stabilizers and catalysts) used in plastics. These result in the following impacts:

- **Impacts on the health** of poorly equipped workers due to chemicals emitted.
- **Impacts on the environment and society** from the uncontrolled oil leakages and disposal of wastes including of plastics, if this is not recycled (nor energy is covered).
- **Impacts on natural forests** if oil is extracted there with potential social impacts on local communities and indigenous people.

PR.4 Identify sustainability hotspots across the value chain

Eco—i Electronics

TIPS & TRICKS

SEEK RELIABLE DATA.

Publicly available innovation reports, environmental and health-impacts related publications in peer-reviewed journals, environmental and social life cycle assessments (LCAs), civil society communications and existing social impacts studies can all contain useful, sector-specific information. When searching on the internet, apply effective search methods such as varying search engines, narrowing your search and validating the credibility of the sources.

You can also access free data through the internet to complement your knowledge as needed (e.g. impacts from chemicals use, electricity sources, labour intensity per sector, etc.).

Examples of UNEP affiliated platforms providing internationally acknowledged reports and tools about life cycle thinking, LCAs of plastics, chemicals management, and general LCA and hotspots data include:

- The Life Cycle Initiative and the LCA reports of plastics
- The Strategic Approach to International Chemicals Management (SAICM)
- Global LCA Database Access Network (GLAD) with possibility to access datasets on products some of them for free
- Hotspot Analysis Tool for Sustainable Consumption and Production (SCP-HAT)

START WITH KNOWN ENVIRONMENTAL AND HEALTH HOTSPOTS FOR ELECTRONICS.

These include:

- When considering **resources depletion**, critical raw materials (CRM) contained in the selected products will be key. These materials are increasingly scarce, expensive and hold high risks of depletion.
- For **climate change**, energy consumption during the use phase often accounts for more CO_2 emissions than the production phase.
- Regarding **impacts to health and the environment,** pay attention to chemicals of concern used or released during the production, use, assembly or recycling of electronics.

Selected relevant publications and databases containing information on proxy hotspots[1] include:

- The European Commission (EC, 2020) critical raw materials (CRM) list
- The European (EC, 2006) REACH regulation defining chemicals of concern associated to electronics
- The OECD (2010) Scenario Document for Chemicals used in the Electronics Industry
- The Chemicals Watch (2020) report with regulatory developments from around the world on chemicals in electronics
- The Electronics Watch (2020) code for the production of electronics
- LexisNexis (2017) recommendations on Ethical Sourcing and Everyday Electronics
- Review of life cycle assessment on consumer electronic products: Developments and the way ahead (Subramanian K. & W.K.C., 2016).

In particular, if additional information is required about specific chemicals associated to the production of electronics or released during their handling and recycling, following databases can be taken into account:

- The United Nations/SETAC (USETox) 2.12 with toxicity (Human health related) and eco-toxicity (environment related) values of over 3000 substances
- OECD (2022) e-chem portal with access to more than 1.5 million chemicals substances data
- The German Institute for Occupational Safety and Health (IFA, 2022) hosts a database with 8700 substances.

In Table PR.4-6a you are furnished with a selection of different electronic products in the rows, the components are made of and examples of chemicals of concern contained in the columns. The chemicals that could be found in electronics include Cadmium (Cd), Lead (Pb), Mercury (Hg), and Hexavalent Chromium: (Cr VI). These are severely restricted under the European Directives EU 2011/65/EC (RoHS 2) and EU 2015/863 (RoHS 3).

Use Table PR.4-6b to help identify the different electronic equipment (see the rows) and examples of manufacturing processes for two broadly used components (printed circuit

1) Most severe impacts based on average results from a number of studies by applying scientifically sound assessment methods such as LCA, materiality studies, etc.

PR.4 Identify sustainability hotspots across the value chain

TIPS & TRICKS

boards and plastics housing or casing) (in the columns). In the additional columns, you can find examples of chemicals of concern associated to the corresponding manufacturing processes. This matrix synthetises the review of chemicals used in electronics provided by the OECD (2010). The color code relates the manufacturing processes with the chemicals of concern associated.

Raw materials, such as rare earth metals and other precious metals, play key roles in today's technologies and are thus indispensable for modern industries and economies. Many of those metals have become increasingly scarce and are termed critical raw materials (CRM). Circular economy approaches and recycling technologies help to ensure a continued supply of CRMs and contribute to the creation of climate friendly and resource resilient economies. Table PR.4-6c provides an overview of recoverable critical raw materials (including gold and silver) from a set of components.

MAP POTENTIAL SOCIAL AND SOCIO-ECONOMIC HOTSPOTS ACROSS VALUE CHAIN ACTORS AND STAKEHOLDERS.

Group potential social impacts per value chain actor and stakeholder group based on the finding of your review (in Fig. PR.3-1). The social life cycle assessment (SLCA) framework (UNEP, 2020) provides a list of potential social impacts and methodological sheets for their assessment (UNEP, 2021). Typically, two to three impact subcategories are selected as crucial for each group (see Fig. PR.4-5). Existing codes of practice (e.g. (Electronics Watch, (2020)) for this sector focus on:

- ensuring safe and healthy working environments, and proper labour arrangements (contractual agreements) of workers and suppliers
- preventing child labour and other forms of exploitation in the production of raw or secondary materials
- social inclusion of the informal sector as key value chain actors refurbishing, repairing and providing secondary raw materials.

Stakeholder categories	Workers	Local community	Value chain actors (not including consumers)	Consumers	Society	Children
Sub-categories	1. Freedom of Association and Collective Bargaining 2. Child labor 3. Fair salary 4. Working hours 5. Forced labor 6. Equal opportunities/ Discrimination 7. Health and safety 8. Social benefits/ Social security 9. Employment relationship 10. Sexual harassment	1. Access to material resources 2. Access to immaterial resources 3. Delocalization and migration 4. Cultural heritage 5. Safe and healthy living conditions 6. Respect of indigenous rights 7. Community engagement 8. Local employment 9. Secure living conditions	1. Fair competition 2. Promoting social responsibility 3. Supplier relationships 4. Respect of intellectual property rights 5. Wealth distribution	1. Health and safety 2. Feedback mechanism 3. Consumer privacy 4. Transparency 5. End-of-life responsibility	1. Public commitments to sustainability issues 2. Contribution to economic development 3. Prevention and mitigation of armed conflicts 4. Technology development 5. Corruption 6. Ethical treatment of animals 7. Poverty alleviation	1. Education provided in the local community 2. Health issues for children as consumers 3. Children concerns regarding marketing practices

Figure PR.4-5: Stakeholders and impact subcategories (UNEP, 2020)

PR.4 Identify sustainability hotspots across the value chain

Eco—i Electronics



Moreover, due attention should be also paid to ensuring women-friendly ergonomic, safe and healthy working environments (SMART, 2019).

ASSESS POTENTIAL TRADE-OFFS.

Trade-offs can occur between the environmental impact categories, productivity and repairability, life cycle stages, stakeholder groups, among others. Stakeholders differing expectations and perspectives will also greatly influence their understanding of the functionality and sustainability of the product.

Balance trade-offs carefully when considering eco-innovation measures, as for example:

- The **high electricity consumption** of an old washing machine or refrigerator often makes it worthwhile to replacing it with a newer model and recycle the used one. The much higher energy efficiency will reduce CO_2 emissions compared with keeping the old washing machine functioning. On the other hand, **more materials** (including scarce ones) are **used** to produce the new appliance. To minimize trade-offs between energy consumption and materials use, ensure proper recycling of the old appliance, for example through a take-back system initiative.
- The production of electronics with less assembly steps **increases productivity**, but often requires components with less features. Repairable components generally have additional-features to allow for disassembly – hence favouring **repair, refurbishing and recycling**, but increased assembly impacts on productivity during the production. To increase repairability, consider focusing on the 2-3 components with highest failure rates to minimise impact on the productivity of the assembly line.
- **Improving the working conditions along the value chain** could result in **cutting contracts with suppliers non-compliant** with health and safety aspects and working only with the rest. This could mean a huge social impact in communities where jobs are lost. To address potential social impacts, consider training suppliers to improve their practices. This is a standard supporting mechanism provided in more mature and successful value chains.
- Original Equipment Manufacturers (OEM) provide their own distinct chargers for mobile phones and other devices that do not work with competitors' models. While changing to a standardised model would greatly **benefit consumers and the environment**, companies will have to **invest 'unnecessary' resources** to change their production. If the company you represent wants to explore the standardisation of chargers, it can join emerging initiatives such as through the International Telecommunication Union (ITU, 2022).

PR.4 Identify sustainability hotspots across the value chain

Eco—i Electronics

TIPS & TRICKS

Electrical and Electronic Equipment (EEE)		Selected chemicals of concern contained in a set of electronics components						
WEEE category (2012/19/EU)	Electronic devices	Printed circuit boards	Plastics casing or housing	Capacitors	Fluorescent lamps/switches with mercury	Lead-acid batteries		Cooling system
		Cr (VI)	"Flame retardants -FR: polybrominated biphenyls (PBB), polybrominated diphenyl ethers (PBDEs), tetrabromobispenol-A (TBBP-A), short-chain and medium-chain chlorinated paraffins (SCCPs and MCCPs), antimony trioxide, tris(2-chloroethyl) phosphate (TCEP), and triphenyl phosphate (TPP)"	Polychlorinated biphenyls	Hg	Pb	H2SO4	CFC, HCFC, HFC
1	Temperature exchange equipment (TEE)	x	x	x	x			x
1	Large household appliances others than TEE	x	x	x				
2	Small household appliances others than TEE	x	x					
3	Desktop computers	x	x					
3	Laptops	x	x					
3	Mobile phones	x	x					
3	Tablets	x	x					
3	External CDD, ODD, devices with external CDD, ODD	x	x					
4	CRT monitors and TVs	x	x		x			
5	Fluorescent lamps				x			
Others	Lead-acid batteries					x	x	

Table PR.4-6a: Electronics product groups and their components and selected chemicals of concern contained (Sustainable Recycling Industries, 2022)

PR.4 Identify sustainability hotspots across the value chain

Eco—i Electronics

TIPS & TRICKS

Electrical and Electronic Equipment (EEE)		For two typical components, selected production processes using chemicals								Selected chemicals of concern used for selected manufacturing processes and potentially emitted during the manufacturing																					
		Printed circuit boards							Plastics casing, housing or others																							
WEEE category (2012/19/EU)	Electronic devices	Electroless plating	Electroplating	Semiconductor production (silicon-based, use of Sb and As)	Photolithography, spin coating	Soldering	Cleaning of PCBs & semiconductors	Etching	Injection molding of polymers and additives	Formaldehyde	Pb		Sn (Tin)			Cyanide	Cr (VI)			Zn	Cd	Ni	Industrial solvents & detergents (e.g. alkyl ethoxylates), N-methylpyrrolidone (NMP) & 1,2-dichloroethane	HNO3 (Nitric acid)		HCl (Hydrocloric acid)		H2SO4 (Sulfuric acid)		Phtalates (DBP, DEHP, DIBP, DCHP and BBP)	Polybrominatedbiphenyls (PBB) or bromitaed flame retardants **
1	Temperature exchange equipment (TEE)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	(x)	x	x	x	x	x	x	x	x	x	x
1	Large household appliances others than TEE	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	(x)	x	x	x	x	x	x	x	x	x	x
2	Small household appliances others than TEE	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	(x)	x	x	x	x	x	x	x	x	x	x
3	Desktop computers	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3	Laptops	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3	Mobile phones	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3	Tablets	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
3	External CDD, ODD, devices with external CDD, ODD	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
4	CRT monitors and TVs	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Others	Li-ion batteries (BEV, (P)HEV)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Electroless plating | Electroplating | Semiconductor production (silicon-based, use of Sb and As) | Photolithography, spin coating | Soldering | Cleaning of PCBs & semiconductors | Etching | Injection molding of polymers and additives

Table PR.4-6b: Electronics product groups and their components and selected chemicals of concern associated with the production processes - based on the OECD (2010) and EU (2012)

PR.4 Identify sustainability hotspots across the value chain

Eco—i Electronics

TIPS & TRICKS

Electrical and Electronic Equipment (EEE)		Recoverable critical raw materials plus gold and silver from selected electronics components								
WEEE category (2012/19/EU)	Electronic devices	Printed circuit boards			Plastics casing or housing	Fluorescent lamps/switches with mercury				Lithium-ion batteries
		Pd	Ag	Au	Sb	Eu	Y	Ce	La	Co
1	Temperature exchange equipment (TEE)	x	x	x						
1	Large household appliances others than TEE	x	x	x						
2	Small household appliances others than TEE	x	x	x						
3	Desktop computers	x	x	x						
3	Laptops	x	x	x	x					x
3	Mobile phones	x	x	x	x					x
3	Tablets	x	x	x						x
3	External CDD, ODD, devices with external CDD, ODD	x	x	x						
4	CRT monitors and TVs	x	x	x		x	x	x	x	
5	Fluorescent lamps					x	x	x	x	
Others	Li-ion batteries (BEV, (P)HEV)		x	x						x
Others	Lead-acid batteries				x					

Table PR.4-6c: Electronics product groups and their components and recoverable critical raw materials plus gold and silver associated to the electronics components – adapted from (CEWASTE, 2021) Annex I, and expanded

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PR.5

Identify the general opportunities and threats across the value chain



Having identified sustainability-related threats and opportunities, in this activity you will try to identify other sources of threat and opportunity that are not directly linked to sustainability issues.

ORIENTATION

This activity in the eco-innovation methodology aims to identify macro trends and external issues that will or could have an impact on your target value chain (from the activity *PR.1 Evaluate potential markets)*, be it a general threat or an opportunity. As stated in the manual, a PESTEL analysis is often used by a company to scan their environment for emerging issues, and involves searching for significant issues or trends related to the headings: political, economic, social, technological, environmental and legal (PESTEL). A rough assessment is then made to determine how significant the respective issues are for the company, addressing their likelihood and timing (as reflected in the template headings). The PESTEL is also a useful tool for you to convince your potential electronics company clients to engage in eco-innovation.

Template of PESTEL

	Definition	Prompting questions
Political		
Economic		
Social		
Technological		
Environmental		
Legal		

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- A structured list of sustainability challenges and opportunities for the value chain, used in the activity *PR.6 Develop a value chain vision.*

PR.5 Identify the general opportunities and threats across the value chain

Eco—i Electronics

LEARNING CASE STUDY OF PESTEL PROMPTS

PESTEL Area	Product	Description or example	Time scale	Impact (I)	Likelihood (L)	Significance
				0= min/low, 5= max/high		S = I*L >15 = priority (bold)
Political	Refrigerators	**National programmes endorsing energy efficiency labels (such as the EU ecolabel)** provide incentives that improve the enabling conditions for increasing the energy efficiency of appliances. These programmes could enhance the market conditions for providing eco-innovated products at more accessible conditions for the population, such as through reduced import tariffs.	Continuous process	4	3	12
		The **Montreal Protocol Secretariat provides a platform** with exchange and resources for addressing the HCFC phasing-out and HFC reductions and provides alternatives.	Continuous process	4	4	**16**
	Plastic components for LCD screens	**A UNIDO helpdesk with technical assistance for countries** supports the responsible use of flame retardants in plastics components of LCD flat panel displays. Similarly, **the Stockholm Convention Secretariat provides a platform** for exchange of experiences and resources for addressing this issue.	Continuous process	2	3	6
	For both products	**Supply chain disruptions**. The impact of events such as COVID-19 on global supply chains are significant and represent a threat for Silicon Latina which is sourcing most of its components from abroad.	In regional or global crisis times	5	4	**20**
		Sustainable or green public and private procurement initiatives increasingly favour products that adopt best environmental practices along the life cycle (e.g. ecolabels, social accountability, responsible sourcing, extended producer responsibility).	Continuous process	5	3	**15**
Economic	Refrigerators	**Funding options for climate change investments** are increasing especially since the issuing of the Paris Agreement in 2015. This extends in both public and private investments and from micro-scale to large ones.	Continuous	5	3	**15**
		Low-cost competitors, especially manufacturers in countries with low-labour costs and environmental compliance can sell their products at lower prices than the average market process and still remain profitable.	Continuous competition	5	4	**20**
		Energy efficiency reduces running costs, making a refrigerator more affordable over its life. This is increasingly becoming an argument to replace old appliances with new ones, especially in countries where energy costs are not subsidised.	Continuous	4	5	**20**
		Disposal costs of wastes from end-of-life fridges can be high, as proper disposal requires degassing and treating of insulation foams in specialised facilities results.	Continuous process	5	3	**15**
		Waste management costs via take-back systems for used products, e.g. in cooperation with local governments, represents an opportunity for reducing management costs of end-of-life products and improve the reputation and visibility of the company.	Continuous process	4	3	12

PR.5 Identify the general opportunities and threats across the value chain

Eco—i Electronics

PESTEL Area	Product	Description or example	Time scale	Impact (I)	Likelihood (L)	Significance
				0= min/low, 5= max/high		S = I*L >15 = priority (bold)
Economic	Plastic components for LCD screens	**Stricter restrictions on the use of flame retardants in plastic components** will also apply to flat screens. Certain brominated flame retardants are considered 'chemicals of concern' and subject to increasingly strict regulations, requiring resources to demonstrate compliance and creating potential reputational risks from increasingly aware consumers.	Continuous process	4	5	**20**
		There is a major push to **use recycled plastics** in new products, driven by emerging national and corporate circular economy strategies globally. The presence of chemicals of concern (mentioned above) hampers the ability to use plastic components in future cycles – increasing incentive to reduce or substitute them. The shift in recycling systems to meet demand will also impact the availability of recycled plastics for Silicon Latina to use in future production.	Continuous process	4	4	**16**
		End-of-life costs are higher for plastics with flame retardants, as they may not be appropriate for recycling leaving landfill and energy recovery as the only options. These are the lowest priorities in the circular economy hierarchy and if appropriate price signals are in place (such as landfill taxes) will be more expensive. With emerging initiatives to make companies responsible for the end-of-life management of products, this will impact negatively on the cost structure of the company. This depends on how functional the related waste management systems are, the type of waste management policies in place and the degree of legal enforcement.	5-10 years	4	5	**20**
		Low-cost recyclers are usually able to offer lower treatment fees by not dealing with hazardous fractions correctly. This is unfair competition and impacts the more responsible recyclers and take-back systems as a whole, opening up to reputational risk for all involved.	Continuous process	4	4	**16**
	For both products	**Increasing diversity of business models** targeting specific products and audiences which offer successfully tested on-the-ground experiences. The successful business models showcased can help leapfrogging eco-innovation in other contexts. **Larger scales of sustainable financing schemes worldwide** from international organisations or banks (such as the European Commission, Interamerican Development Bank, Asian Development Bank, World Bank, among others), development cooperation agencies (e.g. GIZ from Germany) and public-private funding sources. This allows seed funding for improving the circularity of products.	Continuous process	4	5	**20**

PR.5 Identify the general opportunities and threats across the value chain

Eco—i Electronics



PESTEL Area	Product	Description or example	Time scale	Impact (I)	Likelihood (L)	Significance
				0= min/low, 5= max/high		S = I*L >15 = priority (bold)
Social	Refrigerators	**Demand for refrigerators** worldwide is high – with most households having at least one – and increasing significantly, driven by increasing household incomes and reduced household sizes.	Continuous process	5	4	**20**
		Consumers' awareness about energy efficiency of the products they use is growing. New low-cost and more efficient technologies are emerging which are more accessible in developing countries (e.g. solar power-driven small appliances).	Continuous process	3 (short term) 5 (long term)	5	**15 to 25**
		Lifestyle changes with smaller households and increasing capacity to manage more advanced technologies (including Internet-of-things) driving innovation. Markets are also experimenting with different ways of accessing products, such as sharing or leasing, that pave the way for new business models.	Continuous process	3 to 5 (depending on segment)	5	**15 to 25**
	Plastic components for LCD screens	**Increasing consumer awareness about health issues** includes considering potentially hazardous chemicals in products they use, especially if these can impact their children. Civil society organisations campaigning against the risks of certain flame retardants in TVs has led to Directives restricting their use, extending to all screens. Additives still in use, such as heavy metals in pigments, may pose reputational risk.	Continuous process	2 to 5 (depending on segment)	5	**15 to 25**
	For both products	**Concerns about poor working conditions in the value chain** are critical, with informal workers in developing countries responsible for about 90% of e-waste collection and recycling activities – frequently involving child labour. These operate in the absence of e-waste policies which promote well-functioning extended producer responsibility programs.	Continuous process	4	3	12

PR.5 Identify the general opportunities and threats across the value chain

Eco—i Electronics



PESTEL Area	Product	Description or example	Time scale	Impact (I)	Likelihood (L)	Significance
				0= min/low, 5= max/high		S = I*L >15 = priority (bold)
Technological	Refrigerators	**Increasing energy efficiency of latest models**, taking advantage of technological advances in insulation and refrigeration systems. The market advantage for products that reduce energy costs in the use phase and increase the overall sustainability is significant. Large brands are introducing highly efficient technologies, though predominantly for more expensive models, designed for a high-income consumers. This opens up an opportunity for the company to introduce such new technologies in less expensive models for medium-income or even low-income consumer groups.	Continuous process	5	5	**25**
		Internet-of-things (IoT) and artificial intelligence (AI) are growing in popularity and affordability – opening up new possibilities to equip cooling appliances with features to cut food waste, minimize energy use and enhance the overall consumer experience.	Continuous process	3	5	**15**
		Emerging disruptive technologies at a small scale such as new ways of cooling food and beverages are emerging with the aim to switch to clean energies. Examples include off-grid solar powered refrigeration. Small local producers are engaging in these activities.	Continuous process	5	2	10
	Plastic components for screens	**Minimising flame retardants** can be achieved by removing them in components that are not exposed to high temperatures. For components that need flame retardants (FR) for safety, there is no consensus about how to define the minimum amount of chemicals needed – generally polymers are overdosed with flame retardants. Depending on the FR you use, you can check thresholds in your local regulations (for example, 0.1% of total weight such as the penta, octa, decaBDE)). The company can be a frontrunner in removing flame retardants where these are not needed.	Continuous process	5	4	**20**

PR.5 Identify the general opportunities and threats across the value chain

Eco—i Electronics

PESTEL Area	Product	Description or example	Time scale	Impact (I)	Likelihood (L)	Significance
				0= min/low, 5= max/high		S = I*L >15 = priority (bold)
Environmental	Refrigerators	**Climate change impacts** due to the highly potent greenhouse gases such as Hydrofluorocarbons (HFCs) contained in many refrigerators, which replaced the former ozone depleting substance CFC. The global warming potential of HFCs can be in the thousands or tens of thousands higher than the impact of CO_2 emissions.	Continuous	4	4	**16**
		Waste foams are not economically recyclable and end up in huge piles on landfills in the global south. The rigid foams for refrigerator and freezer thermal insulation systems use blowing agents (such as HFCs and more recently cyclopentane).	Now (increasing critically)	2 (industrial countries) 5 (developing countries)	4	**8–20**
	Plastic components for LCD screens	**Incineration of plastic wastes** in non-controlled environments can release toxic gases such as dioxins – severely impacting the environment and human health. This occurs in countries lacking waste management infrastructure and regulations. Plastic components containing additives and flame retardants are not accepted for recycling and are only suitable for landfilling or incineration for energy recovery.	Continuous	4 (industrial countries) 5 (developing countries)	4	**16–20**
Legal	Refrigerators	**Refrigerants to be removed by 2030**. In developing countries HCFCs (Ozone depleting substances) are still permitted as blowing agents until the year 2030. In addition, the Kigali Amendment of the Montreal Protocol is restricting since 2020 the use of HFCs used as alternatives of HCFCs with a deadline of 2045 for a 85%-phase out worldwide.	2030	3	5	**15**
	Plastic components for LCD screens	**Strict export requirements for products containing chemicals of concern** such as flame retardants and heavy metals in the flat screens. The exporting bureaucracy needs to be carefully dealt with to avoid delays or fines when entering into international markets. Requirements might become stricter with the addition of chemicals of concern to existing lists of importing countries. Regular and thorough follow up of regulations and requirements is needed.	Continuous process	5	4	**20**
		Increasing banning of exports of plastic wastes, such as those containing certain brominated flame retardants. China's 2018 "National Sword" policy prohibited the import of most plastics and other materials destined for recycling in China, and many Asian countries have followed suit. The Basel Convention is also considering adopting provisions in this regard for plastics that are not properly classified.	Continuous process	4	4	**16**

Table PR.5-1: PESTEL Analysis for refrigerator and plastic components produced by Silicon Latina

PR.5 Identify the general opportunities and threats across the value chain

Eco—i Electronics



The following list provides a summary of the sustainability challenges and opportunities resulting from the PESTEL template for the products targeted by Silicon Latina: refrigerators and plastic components in LED flat panel displays (see Table PR.5-1).

Opportunities

- Worldwide demand for refrigerators and flat panel displays is expected to increase, especially in emerging and rapidly growing economies. The demand for refrigerators per 1000 inhabitants is increasing also, in part due to shrinking household sizes. Emerging technologies including internet-of-things systems are increasingly accessible for the average medium-income consumer. While still a small share of the market, consumers are becoming more aware of environmental and health issues, including climate change, and hence seek energy efficient equipment manufactured responsibly using sustainably sourced raw materials. Many mainstream consumers are also better informed about the running costs of highly inefficient refrigerators and seek new energy efficient models.
- Through regulations and standards, importing countries are imposing more restrictions to products containing chemicals of concern. This results in an increased motivation to substitute chemicals of concern with alternatives that are environmentally friendlier and low health impacts.
- Public and private sustainable procurement initiatives establish requirements that give preference to products that adopt best environmental practices, including reducing chemicals of concern, across the life cycle (e.g. ecolabels, social accountability, restricted chemicals list, etc.).

Threats

- Supply chain disruptions, such as the one caused by COVID-19 on global supply chains, represent a threat for Silicon Latina SA which is sourcing most of components from abroad.
- Adverse effects to the environment from non-controlled management of end-of-life refrigerators and waste hazardous plastics components can be significant. Waste foams from refrigerators (containing ozone depleting substances) is a growing waste stream with no technical solution, especially in developing countries.
- Competition from low-cost regional and international companies are putting pressure on the market share of domestic manufacturers.

PR.5 Identify the general opportunities and threats across the value chain

Eco—i Electronics

TIPS & TRICKS

EXAMINE RELEVANT VOLUNTARY AND INTERNATIONAL RECOMMENDATIONS AND NATIONAL LAWS.

Get a sense of the trends and directions of legal and voluntary standard development, as they might become forces supporting eco-innovation. These include standards and sectoral codes of practice that represent highest excellence goals and are typically applied by frontrunners (for example companies with highest market shares). Conduct a prospective analysis of possible developments in international convention spheres. This exercise is one step further to the 'requirements mapping' conducted in PR.1. In your research consider the following from the perspective of eco-innovation:

- ISO standards under developments for the electronics sector and/or eco-innovation measures
- Upcoming updates of international conventions (such as on chemicals of concern lists and their thresholds)
- National action plans resulting from the adoption of international conventions (see the example in Table PR.1-5 of targets for phasing-out HCFCs and HFC in countries adopting the Montreal Protocol and the Kigali Amendment).

Identified trends may add incentive for the company to:

- change current product designs (for example, for increasingly smaller and lighter products or more energy efficient systems)
- change materials (for example, substitutes for conflict minerals)
- rethink the functionality of the product (for example, by selling printing services instead of the printer itself).

Early identification and management will help avoid reputational threats, for example if socially unacceptable conditions such as child labour or poor working conditions in factories occur.

Once the requirements and trends are identified, evaluate how prepared the company and its supply chain are for these changes, In order to then help them prepare actions to avoid negative consequences of non-compliance.

IDENTIFY CONSUMER TRENDS.

Use market intelligence to anticipate emerging concerns and needs. In the electronics sector growing trends of consumers interest include the areas of smart homes, e-education and e-mobility. For detailed insight into consumer concerns and needs of the electronics products targeted, consider the following external sources of competitive intelligence:

- Competitor websites and annual reports
- Free or commercial databases
- Market reports from marketing intelligence organisations
- Primary data (on site data)
- Social media
- Patent databases.

Market reports can be based on surveys among consumers and supply chain actors, interviews, focus groups, or customer observation. Different segments include the green consumer, the younger generations with small households (1-2 persons), average middle-class households, high-income households, etc.

Statistics on country-to-country exports or country-from-country imports per product (in units and amounts in USD traded) are freely accessible in theComtrade database (United Nations, 2022).

PR.5 Identify the general opportunities and threats across the value chain

Eco—i Electronics



INVESTIGATE EMERGING SERVICES AND PRODUCTS.

Technological development evolves at an exponential pace along with cost reduction of electrical and electronics components. A prospective technological, environmental and economic assessment will help identify competitive trends and potential eco-innovation opportunities in the sector. In your assessment consider supply risk as criteria. The availability of certain raw materials (defined as critical) is decreasing due to geopolitical reasons leading to price increases and supply disruptions that can put overall business models at risk. Developments to consider in the PESTEL analysis, include new technologies (see box), replacing current materials with those that have a lower impact on the environment, repairing as after-sales services, partnering with take-back schemes to increase re-use and recycling of materials, and new business models such as leasing household appliances or sharing electrical and electronic equipment like 3D-printers.

SELECTED NEW TECHNOLOGIES FOR ELECTRONICS PRODUCTS

- Internet-of-things (IoT) that enables the collection and transfer of data between internet-connected devices (for example to minimize energy consumption)
- Flexible batteries with conformability, light weight, and portability advantages
- Fast integrated circuits (chipsets) for mobiles
- Graphene transistors that are 100 times faster than silicon ones
- Three-dimensional integrated circuit (3D IC) with reduced power consumption
- Smart or switchable glass whose light transmission properties alter with voltage, light, or heat.

Reference:

- United Nations (2022). UN Comtrade Database. https://comtrade.un.org/

PR.6
Develop a value chain vision



In this activity you will develop a vision of a sustainable value chain using the information you have gathered to date about the value chain.

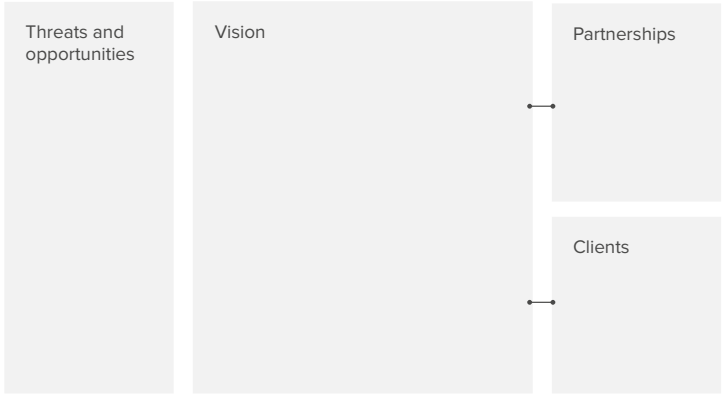
ORIENTATION

As outlined in the Eco-innovation Manual, developing a value chain vision encourages inspirational and open-minded thinking without constraints or limitations. This helps you establish a 'big picture' that can guide your activities with companies based on a shared vision for the value chain.

On a practical level it will help you to decide who you need to be working with and who you should target first with your services (key stakeholders from the activity *PR.3 Build the right external partnerships).* The value chain vision does not need to be detailed but should outline how the sustainability hotspots, (from the activity PR.4 Identify sustainability hotspots across the value chain) and threats and opportunities (from activity *PR.5 Identify the general opportunities and threats across the value chain)* can be addressed.

The supplement provides examples of visions for electronics associations these are key stakeholders identified in activity PR.3, which can provide inspiration as you prepare your own value chain vision for electronics. Note that while the eco-innovation methodology suggests a five-to-ten-year horizon for vision statements, the examples provided in this section have longer, shorter, or unspecified time horizons.

Template of Value Chain Vision



EXPECTED OUTPUTS FROM THIS ACTIVITY:

- A vision of a sectoral sustainable value chain proposed, used in the activity *PR.8 Plan and implement engagement activities.*

PR.6 Develop a value chain vision

Eco—i Electronics

BACKGROUND INFORMATION

The following examples show how sector organisations and companies have articulated their vision for more sustainable value chains in different parts of the electronics sector.

Partnerships representing the electronics value chain are for example:

Circular Electronics Partnership (CEP, 2021): Our vision of a circular electronics industry.

Vision statement. The circular electronics industry establishes and strengthens loops and maximizes the value of components, products and materials throughout the full life cycle, using safe and fair labor. It depends only on circular resources and generates economic value while having a greater positive social and environmental impact.

Vision of the Global eSustainability Initiative (GeSI, 2022)

Vision statement. In collaboration with members from major Information and Communication Technology companies and organisations around the globe, the Global Enabling Sustainability Initiative (GeSI) is a leading source of impartial information, resources and best practices for achieving integrated social and environmental sustainability through ICT.

References:

- CEP (2021). Our vision of a circular electronics industry. https://pacecircular.org/sites/default/files/2021-03/cep-vision.pdf
- GeSI (2022). Vision of the Global eSustainability Initiative. https://gesi.org/mission-and-vision

PR.6 Develop a value chain vision

Eco—i Electronics

LEARNING CASE STUDY OF A VALUE CHAIN VISION FOR THE REFRIGERATOR SECTOR (IN 5 YEARS)

Opportunities

- Demand for refrigerators in emerging regions grows as household incomes increase.
- Demand for more eco-innovative products as public and private procurement initiatives prefer more sustainable products and services.
- Changes of lifestyles with smaller households, increased capacity to manage more advanced technologies (such as IoT) and increased accessibility of low-cost and new technologies.
- Increasingly aware consumers seek energy efficient, environmentally friendly products.
- Through regulations and standards, importing countries are imposing more restrictions to products containing chemicals of concern. This results in an increased motivation to substitute the latter with environmentally friendlier alternatives with lower health impacts.
- Increased energy efficiency renders refrigerators more sustainable and lowers energy cost during use.

Threats

- Products containing HCFC not accepted in main markets.
- Tighter restrictions on products with low energy efficiency or containing (H)CFC.
- Challenges recycling refrigerator plastic and properly managing insulation foams – that pile up in landfills or illegal dumping sites in countries with limited waste infrastructure.
- Cheap competitors use low labor costs, and high materials and components availability in their countries and poor environmental compliance to undercut your product.
- Global supply chain disruptions poses a threat to Silicon Latina SA which is sourcing most of components from abroad.

Vision (on how the sector has addressed the threats; see on the left)

Energy efficient refrigerators dominate the market with customers considering whole-of-life cost when purchasing. The average refrigerator is 30% more efficient than today.

Beyond legal compliance (in developing countries, 67.5% of HCFC will have been phased out by 2025 and 10% of HFC by 2029), in 2030 refrigerators will use only environmentally friendlier alternatives to HCFC and HFCs.

Prices of refrigerators have come down thanks to production efficiencies and technological advancement. This has helped boost demand in low-income countries, providing more homes access to this important appliance.

Better-informed consumers in smaller households have improved their refrigeration practices, reducing food waste and energy consumption. This has been achieved through education programs and smart features that adjust settings and trigger proactive maintenance.

The sustainable refrigerators market segment has grown to 10%. These energy efficient products, contain no (H)CFCs (if containing HFCs, replacements are being investigated), incorporate cutting edge technologies (such as IoT) to improve performance and the user experience. They come in recyclable packaging and are designed for repairability and recyclability at end-of-life. Sustainable models face no restrictions to exports and are favored in private and public procurement processes.

Through partnerships, repair and refurbishing of refrigerators is the norm, with a focus on keeping energy efficiency high and only switching to newer models when there is a significant improvement in efficiency.

An equivalent of 50% of refrigerators sold are collected at end-of-life via take-back systems, ensuring proper recycling of metals and plastics and environmentally sound disposal of problematic materials (such as foams).

Emerging business models such as ‘refrigeration as a service’ cuts up-front costs to consumers, competing with cheap, low-quality imports.

Partnerships

- Investors (such as international development banks or ethical investors)
- Education sector
- Standards and label organisations
- Key suppliers of components such as of alternatives to HFCs and of packaging materials
- Retailers
- Repairing and refurbishing companies
- National private or public take back systems
- Research institutions
- National cleaner production centres
- National trade organisations
- Policy-makers from the government authorities.

Clients

- Households with low income interested in smaller and cost-efficient appliances
- Environmentally aware households willing to pay a premium for cutting edge and more efficient technologies
- Public and private procurement initiatives (like public hospitals) adhering to sustainable procurement practices.

PR.6 Develop a value chain vision

Eco—i Electronics

LEARNING CASE STUDY OF A VALUE CHAIN VISION FOR PLASTIC COMPONENTS IN FLAT PANEL DISPLAYS (IN 5 YEARS)

Opportunities

- Demand for LCD flat panel displays has grown in emerging regions, as consumer incomes increase and businesses, educational organisations, and all types of organisations seek integrate newer technologies.
- The use of flame retardants (such as PBDEs and PBBs) under restriction is declining; their use is still needed at least in few parts such as power units (that experience higher temperatures than the rest).
- Public and private procurement initiatives favor more sustainable products free of chemicals of concern.
- Increasingly aware consumers seek information on the environmental footprint and other impacts of products.

Threats

- Restrictions are imposed to imports/exports of products containing chemicals of concern such as hazardous flame retardants.
- Companies not adhering to recent development on alternatives and international requirements take a hit to their reputation and lose market share.
- Higher recycling costs for devices containing flame retardants and other chemicals of concern.

2025 Vision (on how the sector has addressed the threats; see on the left)

The flat panel display market has limited the use of flame retardants to plastic components that experience higher temperatures (such as power units) in line with legal and international requirements and out of concern for potential health impacts on their customers.

Plastic components for electronics have higher recycled content along with the global pressure and enforcement of policies improving the circularity of plastics.

Sustainable flat panel displays face no restrictions to exports and are favored in private and public procurement bids.

Labels and environmental product declarations are used to effectively communicate the type of plastics and any type of flame retardants contained in the components.

Through partnerships with extended producer responsibility schemes and plastics recyclers, a smooth substitution of new with recycled plastic in electronics components has taken place.

Partnerships

- Standards and label organisations
- Key suppliers of alternatives to hazardous flame retardants
- Retailers
- National private or public take back systems
- Research institutions
- National cleaner production centres
- Plastic recycling facilities.

Clients

- Consumers environmentally aware and concerned about health issues.
- Public and private procurement initiatives (public schools, universities and government offices) adhering to sustainable procurement practices
- Health care sector.

SET STRATEGY

The aim of the SET STRATEGY phase is to use your knowledge of the company's strengths, weaknesses, opportunities and threats to propose a new business strategy that places eco-innovation at the core of the company's business strategy to ensure progress towards a sustainable future for the company.

Eco—i Electronics

ST.1
Plan my data gathering strategy



This activity helps you to plan your data collection activities for the Preliminary Assessment and also consider the option to combine this activity with the In-Depth Assessment.

ORIENTATION

A significant proportion of your time during the *SET STRATEGY* phase will be used gathering data as part of the Preliminary Assessment. This activity supports data collection needed to propose a new business strategy for the company. Through reviewing the sustainability hotspots for the value chain (activity *PR.4 Identify sustainability hotspots across the value chain*) and going through the list of possible data types in the Data Gathering Checklist, you can decide if they are necessary to collect, followed by reviewing with the focal point of the company to confirm how and when you will gather the data you require.

Tips will be provided on key performance indicators (KPIs) whose proper definition is fundamental for properly understanding progress towards the expected goals and results.

Template of Data Gathering Strategy

Type of data	Do I need it?
	☐
	☐
	☐
	☐
	☐

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- A detailed list of the types of data you need to gather which has been reviewed and agreed with the company Focal Point. This output is not specifically used later in the process but is important to ensure effective and efficient data collection.

ST.1 Plan my data gathering strategy

Eco—i Electronics

LEARNING CASE STUDY OF A DATA GATHERING STRATEGY FOR ELECTRONICS

The following table introduces the potential sources for data types (see cells with a 'Yes').

Type of data	Data needed: Potential sources		
	Desktop research (ST.3)	CEO interview (ST.2)	Workshop with key personnel (ST.3)
Current company vision	Yes	Yes	
Current strategic goals, key performance indicators		Yes	
Current products, markets (types and size) and selling points	Yes	Yes	
Current business model		Yes	
Organisational model (organigram) and structure (gender balance)		Yes	
Number of employees including breakdown by role/department		Yes	
Main competitors and what they offer			Yes
Flow diagram of main internal production steps and areas with biggest challenges or most promising growth potential			Yes
Biggest contributors to production costs			Yes
Biggest contributors to materials and water consumption (for company and for value chain)			Yes
Biggest contributors to energy consumption (for company and for value chain)			Yes
Chemicals used in different parts of the value chain (identifying any chemicals of concern)			Yes
Sales revenue data for last three years. Details of export markets.			Yes
Materials and areas with highest circularity rates			Yes
Profit and loss data for last three years			Yes
Details of key suppliers, supply risks (e.g. through COVID-19) or bottlenecks			Yes
Details of logistics processes and possible losses or issues during transportation			Yes
Details of key partners and nature of partnership			Yes
Details of environmental, health & safety and social management system or policies in place			Yes
Understanding of how the company is viewed by the local community, suppliers and customers			Yes
Details of the company's policies and practices to promote optimization and innovation			Yes
Details of facilities and resources to support product research and development. Example of most significant in innovation made.			Yes
Understanding of procurement policies and practices to promote quality and sustainability			Yes

Table ST.1-1: Data required and potential sources

ST.1 Plan my data gathering strategy

Eco—i Electronics

TIPS & TRICKS

ADDRESS SUSTAINABILITY IN THE KEY PERFORMANCE INDICATORS (KPIS).

Start with the KPIs identified for your value chain during the sustainability hotspot identification (PR.4). Balance economic and environmental KPIs with social KPIs. The following table provides a selection of possible performance indicators for technology-related services and electronics products (consolidation based on Chepul (2022), Sjåfjell (2018), TCO Certified, EPEAT, Ian Graham et al. (2015), Socialbakers (2013), Zero Waste Scotland (2016) and UNEP (2020)). When starting with the definition of KPIs you can use Table ST.1-2 as a general reference.

Area	Aspect	Example indicators		
ENVIRONMENTAL PERFORMANCE Do you ensure that energy consumption, chemicals of concern and resources use as well as emissions and wastes are minimized along the life cycle? Do you have measures to improve the circularity of the products?	Energy efficiency	• Energy Consumption per 1000 hours of product use		
	Chemicals of concern	• Chemicals of concern used by weight during the production	• Chemicals of concern contained by weight	Chemicals of concern phased out or substituted (%)
	Resource use	• Conflict minerals use • Recycled / new material used ratio • Recycled material used by weight • Responsibly sourced materials (kg) • Water consumed per product unit • Recycled water (%) • Expected lifetime • Repairability index	• Recyclability rates of products and components • Re-manufacturability rates at end-of-first-life • Product reliability (%) • Conformance to specifications (%) • Rework rate (%) • Reject rate (%) • Disposal rate (%)	• Safety and quality assurance of any reused, refurbished or remanufactured products • Packaging with recycled content (%) • Packaging with reusable/recyclable content %) • Redundant product (if any) that was not wasted (% of total redundant product)
	Emissions and waste generation	• Green House Gas emissions (CO_2) • Emissions to air	• Wastewater (m3, quality parameters) • Average packaging waste per product unit	• Hazardous waste (kg/type) • Non-hazardous waste (kg/type) • Wrapping waste (kg/type)
SOCIAL PERFORMANCE Are your workers and suppliers engaged and delivering results? Are your workers excited about the future? Do you consider and respond to the interests and concerns of your neighbours and local community?	Workers	• Capacity development: Skills development, Training, R&D	• Working arrangements and job satisfaction: fair salary, staff retention rate, top players retention rate, worker net promoter score	• Gender salary gaps for same positions • Health & safety: Incidents rates
	Suppliers	• Due diligence • Mutual commitment	• Reliance, quality	• Initiative and wider support • No support of child labour
	Local community	• Local employment	• Public commitment to sustainability with positive impacts on the community	

ST.1 Plan my data gathering strategy

Eco—i Electronics

TIPS & TRICKS

Area	Aspect	Example indicators		
GOVERNANCE PERFORMANCE Do you lead and manage with business ethics?	Company values	• Transparency policy and practices • Data protection	• Board, independence, diversity, and structure • Bribery and corruption	• Executive pay • Risks of human rights issues (e.g., child labour)
MANAGERIAL PERFORMANCE Do your customers love, appreciate and refer you? Do you have the right product/service offerings and marketing/sales strategies to support your current and future revenue goals? Do you have robust operations and disciplines that you can scale for the future?	Consumers' satisfaction	• Customer retention/Churn • Customer referrals (feedback mechanism and complaining rates) • Customer Net Promoter Score	• Transparency on materials contained • Labelling in products • On time delivery rates	• Customer intimacy relationship quality • Life cycle management and end-of-life responsibility
	Economic	• Economic stability • ROI for online and for overall sales (%) • Productions costs ($) • Overhead costs ($)	• End-of-life costs ($) • Material costs ($) • New components cost ($)	• Inventory costs ($) • Labour costs ($) • Unit costs ($)
	Processes	• Mean Time to Recover (MTTR) • Ticket Resolution Time	• On-time delivery • A/R Days	• Expenses • Margin

Table ST.1-2: Selected key sustainability indicators for technology and electronics related products

References:

- Chepul T. (2022). Top 22 KPI Examples for Technology Companies (Updated for 2022). https://www.rhythmsystems.com/blog/top-22-kpi-examples-for-technology-companies
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ST.2
Interview the CEO



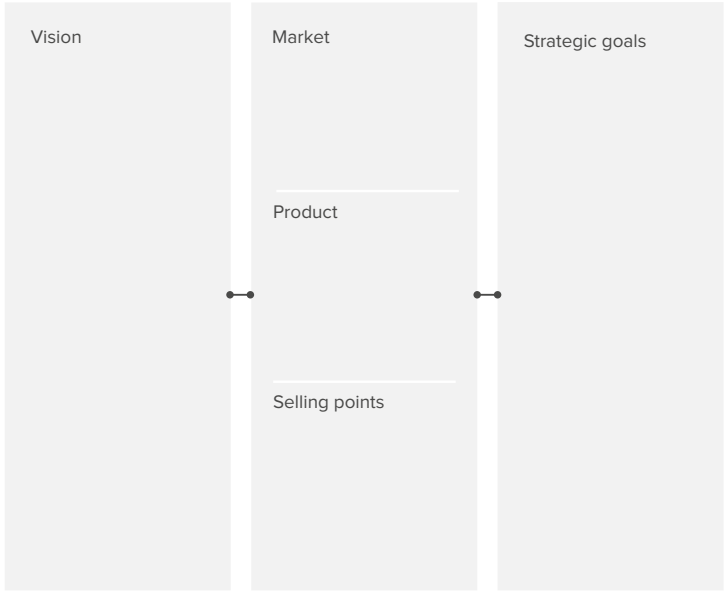
In this activity you will try to build an understanding of the current company strategy by reviewing any formal strategy documentation and through an interview with the CEO.

ORIENTATION

Interviewing the CEO (and other top management executives) will give you first-hand insights of the business strategy and is a good opportunity to validate the desk research that you completed during the PREPARE phase. This allows you to make a better assessment of the context in which changes will take place.

The CEO should be able to confirm if the hotspots, threats and opportunities that you have identified are relevant to the company (from the activity *PR.5 Identify the general opportunities and threats across the value chain)* and may lead to discussions about other threats and opportunities that are more specific to the company.

Template of Business Strategy



EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Current business strategy used in the activity *ST.7 Do a SWOT analysis*
- Findings and main expectations from CEO's perspective.

ST.2 Interview the CEO

Eco—i Electronics

LEARNING CASE STUDY OF BUSINESS STRATEGY

Current business strategy for Silicon Latina drafted after interviewing its CEO and based on data gathered from the company is presented in the following diagram:

Vision

Silicon Latina's general vision statement states that they wish to become Brazil's biggest supplier and have a reputation for bringing the best innovations focusing on sustainability from the world to Latin America.

Market

Latin America & Caribbean (LAC) worth at least US$ 80 million.
Brazil, Mexico and Colombia main markets.

- B2C: All types of customers, from low to high income customer segment. Special focus on the customers attentive to their health, the health of their families & children, or to sustainability.
- B2B: Public Procurement requiring appliances for hospitals, elderly care centers, public offices, educational organisations, building, etc.

Products

Fridges/refrigerators in several sizes (use of HFCs).
LCD flat TV and computer screens with 0% of recycled plastic.

Selling points

Affordable appliances with repairability features. Well-known technology by retailers and repair services in the LAC region.

Strategic Goals

- Increase sales (at least +20% within 3 years) through one or more new product with new features appealing to consumers looking for improved sustainability (sales were last year US$15 million)
- Become the second most demanded brand in LAC, based on success of new appliances with sustainability features

ST.2 Interview the CEO

Eco—i Electronics

TIPS & TRICKS

INSPIRATION EXAMPLES

It will be useful to be aware of business strategic elements found in the electronics sector before interviewing the CEO. The following examples from around the world can be used as strategic elements of a business model.

Strategic element	Example
Responsible supply chain management Bottom-up approach for co-generating eco-innovation measures with most potential economic, environmental and social benefits.	HP's supply chain responsibility program seeks to protect & empower workers to reduce global and community environmental impacts while creating benefits for HP and its customers. The OEM believes this mission is complementary to its business objectives offering a competitive advantage while it helps alignment with UN Guiding Principles on Business and Human Rights for companies' due diligence. The approach involves four interconnected elements: Policies and standards, sensing risk, addressing risk and transparency.
Design for dismantling and disassembly Disassembly has the potential to significantly increase the recycling yield and purity for precious metals, critical metals and plastics.	Fairphone created the first modular phone that is designed to be taken apart for simple upgrade and repair. They are also working on developing software that can be supported for over 5 years to design longevity directly into their smartphones.
Electronics as a service Leasing and rental services	GreenVolution is an Indian leasing service of printers in India (New Delhi and Mumbai) which offers multiple brands to choose from.
Bundling Packaging related goods and services together, for example, in addition to the product free regular maintenance and training for installation, use and/or maintenance.	Through product services packages, IT firms offer their clients a "turnkey solution" (see example in the medical sector in Marceau & Martinez (2002)). In addition to selling their actual product, they 'bundle' services like customisation, installation, training, maintenance, technical support and upgrades, with pre-packaged and customised software and hardware. This is common with sophisticated medical equipment, sold as a bundle with installation and training of medical staff.
Certification of products This allows reaching market segments requiring proven track-records.	See TCO certified and The Electronic Product Environmental Assessment Tool (EPEAT) labels in BM.8.
Pay as you go Charge for actual metered usages applied to energy used, for example, in refrigerators.	Youmma's Pay-as-You-Go Solar Fridges works alongside a pay-as-you-go system to support families with limited budgets. They are efficient enough to run on just a single solar panel.

ST.2 Interview the CEO

Eco—i Electronics

TIPS & TRICKS

Strategic element	Example
Disintermediation. Sourcing direct from suppliers, sidestepping traditional middlemen.	Dell and Apple are the most notable examples of disintermediation in the electronics industry, with emerging innovators such as Fairphone.
Repair services by brands networks. Big brands offer repair services which is supported with own or shared infrastructure. Retailers also provide buyback services, accessories and activation plans for the consumer devices.	The Repair Centres of Fujitsu provide technical repair services to maximise the lifespan of both Fujitsu proprietary products and third-party broadband technology equipment, through an intelligent repair cycle. Fujitsu recovers as-new stock from products otherwise destined for disposal, and reduces waste by extending product lifetimes. Working closely with the OEMs, Fujitsu ensures repairs are carried out in-line with their requirements. This includes the use of original manufactured components to maintain a high standard of repairs.
Repair services by independent SMEs networks. Repairing and refurbishing hubs of SMEs are booming especially in developing countries providing all types of quality services to extend the lifespan of electronics.	The Compupalace Centro Comercial Tecnologico in Peru is a physical and online market place with hundreds of SMEs dedicated to offering all types of electronics repairing and refurbishing services.
B2B: Wholesale for second hand products. A growing number of users (companies and individuals) are (re)selling and buying used devices - providing huge savings for products. Retail and online stores act as intermediaries, often including guarantee services (although for short periods, i.e. 6 months instead of 2 years).	Local wholesale online retailers such as Indiamart (India), Alibaba (China)
C2B: Consumer BuyBack for end-of-life products. Used electronics have a value in the market which results in new businesses around their repairing, refurbishing or recycling. This facilitates their selling C2B of individual devices and is eased via e-commerce.	Back Market connects individuals interested in electronic products with experts in refurbishing selling repaired devises.
Take-back systems. This is a B2B approach where a group of electronic companies is supported logistically to collect their end-of-life products and channel them for recycling.	Red Verde offers in Colombia a Take-Back system of electronics which are afterwards properly dismantled and recycled or disposed of.

References:

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ST.3
Capture the current business model



This activity provides guidance on how to capture the current business model of the company through desk research and a workshop with key personnel.

ORIENTATION

The Business Model Canvas allows you to capture the essential elements of a business model on one sheet of paper. Logical and easy to explain and discuss with others, it serves as a framework for exploration of eco-innovation opportunities and how they might drive changes to your client's business model. This will be central to the activities in the entire Set Business Model phase (Phase 3).

The intention of this activity is to bring together the findings you have gathered through desk research and a workshop with key personnel to articulate and understand the current business model of your client. To assist you, examples of strategic elements of business models operating in the electronics sector are provided. The contents can provide helpful perspective in the event that the selected company fills another role in the value chain.

Template of Business Model Canvas

Key Partners	Key Activities	Value Propositions	Customer Relationships	Key Partners
8	7	2	4	1
	Key Resources		Channels	
	6		3	
Cost Structure		Revenue Streams		
9		5		

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- A completed business model canvas for the company (learning case study) used in the activity *ST.7 Do a SWOT analysis.*

ST.3 Capture the current business model

Eco—i Electronics

LEARNING CASE STUDY OF BUSINESS MODEL CANVAS – REFRIGERATORS & FLAT PANEL DISPLAYS

The following is an example of canvas developed together with key personnel of Silicon Latina in a workshop. This canvas reflects the main aspects of the current business model for the two products: refrigerators and flat panel displays.

<table>
<tr><th>Key Partners</th><th>Key Activities</th><th>Value Propositions</th><th>Customer Relationships</th><th>Customer Segments</th></tr>
<tr>
<td rowspan="2">- Retailers in Brazil and LAC countries
- Providers of HCFCs and substitutes
- SELCo providing LED flat panel display components
- PakChi providing packaging materials for the delivery
- Climatization systems design in Brazil
- Material research centre in Brazil</td>
<td>- Customer relationship management
- Purchasing of resources (raw materials, components etc)
- Assembly of flat panel displays
- Production of refrigerators casing and of the cooling system, and assembly of components
- Packaging of products for delivery locally and for export
- Repairing services of refrigerators in cooperation with retailers
- EoL management linked to the take-back schemes</td>
<td rowspan="2">Affordable appliances with top functionality features enabling savings during their use (such as less food waste and energy use).

Big size fridges are for leasing.

Plastics components are circular.

Technology with repairability features and well-known by retailers and repair services of fridges and flat panels in the LAC region.

Products are offered with after-sales services locally (in main LAC cities).</td>
<td>- B2C and B2B relationships management systems
- Certain decentralisation through local retailers in main LAC cities</td>
<td rowspan="2">Direct customers:
- Retailers
- Distributors

End customers:
- Households (differentiation between low, middle and high income households)
- Educational institutions
- Health facilities
- Businesses</td>
</tr>
<tr>
<td>Key Resources

- Franchise with SELCo for assembling LED flat panel displays based on kits delivered
- Longstanding business relationship with suppliers of main components (materials for refrigerators casing, compressors, cooling system components)
- Integrated IT system for orders, production and inventory control
- Motivated senior and middle management teams with reasonable understanding of sustainability as a business imperative
- Quality Control
- Production equipment</td>
<td>Channels

- Shops, supermarkets
- Online sales
- Local distributors (shops or chains)
- Commercial agents (self-employed intermediaries)
- Sales force
- Newsletters to customers
- Trade centres</td>
</tr>
<tr><th colspan="4">Cost stucture</th><th>Revenue streams</th></tr>
<tr>
<td colspan="4">- Technical facilities
- Franchise (for SELCo)
- Supply chain / materials
- Production costs

- Labour and labour training time
- Fixed costs (salaries, rents, utilities)
- Logistics (e.g., transportation & distribution)

- Marketing, communication & branding creation
- Customer support
- Repair infrastructure, equipment and personnel costs</td>
<td>- Sales of refrigerators and flatscreens in Brazil and across Latin America and the Caribbean</td>
</tr>
</table>

ST.3 Capture the current business model

Eco—i Electronics

TIPS & TRICKS

CLASSIFY THE COMPANY'S BUSINESS MODEL(S) FOCUS: PRODUCT OR CUSTOMER

Classify the focus of the company's business model: product focus via product leadership or customer focus through customer intimacy.

For each business focus, a selection of business model elements applied in the electronics sector is shown in the 'Background Information'. This helps better understand the business models' key elements, how the company interacts with its customers and end markets as well how it differentiates its products in the marketplace (e.g. low-cost or differentiation).

BACKGROUND INFORMATION

Electronics products, components and services differ in functionality, price, after-sales services, availability and other attributes reflected in a business model. The diagram of archetypes of groups of business elements in Table ST.3-1 can help in the preliminary assessment of the company you are working with. Take one or more business elements to further develop in a business model.

The business model focus (in the first column on the left) either on product leadership or customer intimacy will lead to variations of the two main strategy approaches typically applied in the electronics sector. If the business has a customer intimacy focus, the value chain integration strategy will focus on setting up key partnerships among relevant actors such as retailers, post-consumer services and financial services for increasing customer intimacy. On the other hand, pricing schemes will be designed to serve customer financial needs (i.e. prepaid services of electronics products).

Once the strategy approaches have been defined, you may recommend, for example, based on the competitive advantage and high potential level of supply chain integration of the company, a less ambitious strategy such as 'market penetration' (selling more of almost the same to the same type of segments) or more ambitious approaches such as 'product development' and 'market diversification' (where clearly improved products and new products, are put into new markets).

Later, in ST.9, when discussing the new business strategy, consider recommending both customer relationships options – customer intimacy and product leadership – or focus on one to prioritize the strategic elements in the business model for eco-innovation. For example, an assembler of components may focus on low-cost business model based on low integration of suppliers, whereas a start-up designing new products and services may focus on innovation of the functionality (business model innovation of extended custom design).

ST.3 Capture the current business model

Eco—i Electronics

TIPS & TRICKS

Customer or product focus	Strategic value-chain- and pricing-related moves (iv)	Strategic intents (iii)' choices – Levels of ambition			Strategic elements (v) (any business model considers one or more strategic elements)
		Market penetration through low cost	Product development	Diversification of products and markets	
		Current products (A)	Improved product. Example: Eco-FPD (B: beyond A)	Newly innovated product. Example: Eco- refrigerators (smart) (C: beyond B)	
Customer Intimacy (i)	**Value chain integration strategy for increasing customer intimacy** Integration (or establishment of partnerships) among distributors, repairment networks and lines of financial services/ credit lines	**Through low suppliers' integration** Example of strategic elements: • Take-back systems for WEEE	**Through medium value chain / partners integration** Examples of strategic elements: • Disintermediation • B2B wholesale for second-hand products • Designed for repair or refurbishment • Take-back systems for WEEE • C2B buyback of end-of-life (EoL) products • Repair services • Key suppliers management	**Through high value chain / partners integration** Examples of strategic elements: • Electronics as a service (leasing) and pay-as-you go • Increased services portfolio (IoT) • Transparency (chain of custody approach, eco-labels, live data on how much you save on energy) • Assistance (training) for optimal use • Bundling (incl. maintenance and repairing services) • Key value chain actors management • Designed for repair or refurbishment • C2B buyback of EoL products	
	Pricing strategy for increasing customer intimacy	**Medium or high value pricing of customer services** Examples of strategic elements: • Freemium (basic product or service is provided free of charge, but money (a premium) is charged for additional features, services) • Accessible distribution network • Friendly payment types • Loyalty programs • Consumer protection programs • Accessible helpdesks • High value pricing can target special services for high-income consumers			

ST.3 Capture the current business model

Eco—i Electronics

TIPS & TRICKS

Product leadership (ii)	**Value chain integration strategy in support of the product leadership** This has a focus on R&D on the product and includes collaborative innovation	**Through low suppliers' integration** Examples of strategic elements: • Product design focused on eco- and cost-efficiency (e.g. energy efficiency) • Less packaging	**Through medium value chain / partners integration** Examples of strategic elements: • Free from chemicals of concern • Use of recycled plastic content • Multi-functionality (with plugs-in) • Design for dismantling, repair & recycling • Materials and design disclosure • Supply chain management and engagement in eco-innovation	**Through high value chain / partners integration** Examples of strategic elements: • Smart eco-efficient design (energy efficiency, HCHC-free, responsible sourcing of materials and with good life cycle performance) • Targeted design (i.e. downsizing of fridges for smaller spaces or uni-personal households) • Smart IoT designed • Bundling (incl. maintenance and repairing services) • Value chain management and engagement • Design for dismantling, repair & recycling • Materials and design disclosure	**Strategic elements (v)** (any business model considers one or more strategic elements)
	Pricing strategy in support of the product leadership	**Low cost-plus pricing** Example of a strategic element: • Product design focused on eco- and cost efficiency (e.g. energy efficiency) • Less packaging	**Medium cost-plus pricing** Examples of strategic elements are the same as above. These go beyond cost-efficiency and are designed and applied individually or are articulated with other measure.	**High cost-plus pricing** Examples of strategic elements are the same as above. These are designed and applied in an integrated and articulated ways achieving maximum eco-innovation potentials.	

Table ST.3-1: Business focus, strategic intents (vision) and strategic approaches for identifying strategic elements of a business model

(i) Customer intimacy involves learning as much as possible about customers (as individuals or as very small segments of the market) and meeting their specific needs. It is both a way of inserting value into the market, and a measure of the awareness of (and alignment with) customers' needs and values. A company that delivers value via customer intimacy builds bonds with customers like those between good neighbours. Customer intimate companies tailor their products and services to the customer so as to offer the 'best total solution' and customer loyalty is their greatest asset.

(ii) Product Leadership means consistently striving to provide customers with leading-edge products or useful new applications of existing products or services. They do this by being creative, agile and fast. Their strength lies in reacting to situations as they occur, avoiding bureaucracy that slows down the commercialisation of their ideas.

(iii) Strategic intent is about how the company envisions its future business direction which is based on its level of ambition. The following strategic intent choices were identified for the electronics products: Market penetration through low cost and slightly improved product, product development, and diversification. The higher the level of ambition, the longer-term the time-scale for reaching market penetration.

(iv) Strategic moves or approaches refer to types of interventions in line with the vision expressed in the strategic intent. Two approaches for the electronics sector will be highlighted: Integration strategy of the value chain, and pricing strategy. The marketing strategy is an additional commonly relevant set of strategic approaches. This is not elaborated further in Table ST.3-1. Marketing approaches will be considered when finalising the business model (canvas).

(v) Strategic elements cover specific measures consistent with the strategic approaches and intents (based on levels of ambition) defined. Business models adopt one or more strategic elements which are introduced in a canvas.

ST.4
Do a Walk-Through Audit



This activity will help you to better understand the operational activities of the company and identify some strengths and weaknesses through a tour of the main facilities.

ORIENTATION

The prompts in the Manual's Learning Case Study provide a useful starting point for your walk-through audit. The overall guidance for this activity is to add your own questions so that you get the answers you need. The overall aim is to gather data on the operational strengths and weaknesses of the company, based on the Data Gathering Checklist from activity *ST.1 Plan my data gathering strategy*, so that they can be taken into account in the strategic analysis and the development of new business strategy proposals.

The learning case study in this section provides an illustrative example of additional questions aligned with the audit categories in the template.

Template of Walk-through Audit Guide

Key discovery questions		Page 2	
Getting started on tour	Production — main processes	Production — goods out	Design & Engineering
Production — goods in	Purchasing	Sales & Marketing	Management

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- At least five examples of both 'strength' and 'weakness' factors within the operational performance of the company. This output is used in the activity *ST.7 Do a SWOT analysis*.

ST.4 Do a Walk-Through Audit

Eco—i Electronics

LEARNING CASE STUDY WALK-THROUGH AUDIT PROMPTS FOR SILICON LATINA

The following questions were used for the walk-through audit at Silicon Latina. They complement the ones suggested in the Eco-I Manual. Questions highlighted in blue are more specific to electronics and Silicon Latina.

General aspects	**Production — goods in**	**Production — main processes**	**Production — goods out**
Ask for the following to be provided prior to the walk-through: • An organigram • Data on turnover, exports countries, number of workers, gender balance (current numbers and growth projections) • A process flow sheet per product line • What area of company operations is the biggest challenge at the moment? • What area of company operations has the most promising growth potential? • What has been the most significant innovation in the company in the last 5 years? Who was involved? • How do you manage compliance with the regulations on chemicals of concern in electronics? • Who are your two main competitors (for refrigerators and screens)? • What is the average obsolescence period of the electronics you produce and how do you manage obsolescence and remain competitive?	• What are the main raw materials and components you receive? • Do you have a quality control system to inspect goods as they arrive? • Do you know what type of plastics are used for the plastics components? Do you know their flame retardants content and other chemicals of concern? Does the supplier provide you with this information when requested? • How do you check compliance with requirements of components / materials received? • Do you source plastics or metal casings for the refrigerators and FPD with recycled content? • What is the rate of broken / non-compliant electronics or plastics components in your production lines?	• Let's discuss together about the life cycle stages and inventories of the refrigerators and flat panel displays • Which of the production process steps use the most materials/ energy/ water/ chemicals (refer to the life cycle inventories of refrigerators and flat panel displays)? • Do you know which chemicals of concern you use? Do you have their health and safety datasheets accessible? • Which parts of the production process are the most problematic? Why? And which ones are the best performing? • Do you apply resources (time, materials) optimisation in production workflow? • What are the main contributors to production costs? • What happens to components that are broken or do not fulfil the requirements? • What happens to wastes generated?	• What packaging materials are used for delivering the products to the end user? • By which transportation means do you deliver the products and which average distances are covered? • Does the company have its own distribution system or does it rely on a third-party provider? • What is the return rate of defect refrigerators and flat panel displays that could not be repaired? What is done with this defect products? • What is the period without failures during the products use?

ST.4 Do a Walk-Through Audit

Eco—i Electronics



Sales & Marketing	Design & Engineering	Purchasing	Management
• Which are the most important product lines and markets for the company? • How are the product lines of refrigerators and flat screens performing at the moment? • Who are the most important customers within those markets? • How do you market and sell your products? How relevant is the share of sales online? • Does the company publicly communicate aspects related to its products (e.g., through labels such as EPEAT or TCO?). Do you also communicate sustainability aspects? If yes, how do you do it? • What is the market share of B2B and B2C products handled? • Do you have any internal survey on why customers prefer your electronic products and customer intimacy levels?	• Do you have design records of your own components to produce refrigerators and flat panel displays? If yes, are sustainability criteria considered? • Do your products contain recycled content? • Do you have a dedicated Research & Development area or related engineering expertise on-site? • Do you have capacities in-house on IoT use and metals and plastic casings of electronics? • Any experience of innovation in packaging design?	• Who are the most important suppliers for the company in terms of volumes on USD or in unit quantities? • Are there any problems, risks or bottlenecks with these suppliers at the moment? Did you have any difficulties in securing your supply during the COVID-19 pandemic? • Is sustainability performance a consideration in your purchasing decisions? For example, when purchasing components or materials? If yes, which criteria do you base on? Do you know the TCO Certified and EPEAT criteria for electronics?	• Does the company have any environmental management system in place (e.g., acc. to ISO 140001 or equivalent? Who in the company is responsible for managing sustainability issues? • Do you intend to apply circular economy actions in the company? • What actions are you currently taking to address the Silicon Latina's sustainability impacts? • Any metrics (key performance indicators) in place to assess sustainability performance? • Do you operate an environmental management system? • Do you operate a health & safety management system? • Are there ways in which staff can raise concerns about health and safety issues or general working conditions? • Do you operate a quality management system? • Do you have records available of worker injuries, materials and electricity consumption, wastes generation and worker injuries in the last 12 months? • What is the gender balance within the senior management team? • What policies do you have in place to raise awareness of gender issues within the workforce and promote gender equality? • How is the company viewed by the local community, your neighbours? • Who are your main partners with and what is the nature of the partnership?

ST.4 Do a Walk-Through Audit

Eco—i Electronics

LEARNING CASE STUDY WALK-THROUGH AUDIT RESULTS FOR SILICON LATINA

Key Observations			
General aspects Basic data sources available include: • HR organigram (HR structure, positions, gender distribution and workforce numbers). • Process flowsheet. • Economy and resource consumption-based company specific KPIs (such as energy and water use). Data are missing for: • non-compliance rates for parts received and produced. • economic losses for non-well performing repairing services. • consumption and losses of energy of products during their use.	**Production – goods in** • 5% of electrical components from SELCo are non-functional on arrival (due to cracks in casings). This is suspected to be caused by poor packaging, inferior materials used for component manufacturing at SELCo and handling in transit when shipped from Korea. • It is not clear what types of plastic the components are made from. The components do not hold any mark with this information. Health and safety data sheets of the components are only sent by SELCo upon demand.	**Production – main processes** • Production teams are well managed and performance on each line is tracked. However, there is no clear ergonomic considerations for women working in the lines (e.g., pregnant women). • Re-testing, rework & repair of non-functional electrical parts impact FDP production outputs (80% are salvaged & 20% end up as e-waste inhouse). • Production line 7 is used for both fridge and FPD assembly. This bottleneck slows down output rates and increases assembly errors for both products. • Packaging of finished product to dispatch standard is time-consuming. • The cleaning process of components with solvents is performing well with minimum incidents (losses or health issues). • The personnel is not aware of the chemicals of concern used in the product or during the assembly at Silicon Latina.	**Production – Goods out** • All finished products are sent out to 13 key distributors in LAC via rail or road, facilitated by an in-house logistic department. • Product packaging cost are high and in-house packaging waste is significant.

ST.4 Do a Walk-Through Audit

Eco—i Electronics

Key Observations			
Sales and marketing	**Design & Engineering**	**Purchasing**	**Management**
• B2B vs B2C is 90:10% for flat panel displays and 98:2% for fridges. • B2B: Direct sales to distributors (including largest retail chains in LAC). • B2C: Directly to the public via factory shop for refrigerators and online for FPDs. • Marketing and branding of Silicon Latina at all retailers and take-back points. Sticker with customer care number on product packaging provides information on all take-back points across LAC. • Bestsellers are the 45inch Slimliner flat panel display (65% of FPD sales) and the E-cool Fridge Master (73% of refrigerator sales).	• Most fridge assembly components are imported. The metallic outer cabinet and door are manufactured inhouse and include 15% secondary metal (supplied by local smelter) • 100% of flat screen assembly components are imported. Plastics components contain FR and additives (chemicals of concern) • Primary packaging of all finished goods is layered: shrinkwrap, polystyrene corners/ cases, cardboard box/container.	• All packaging materials sourced from PackChi. • Local smelter is the only supplier for metal sheets (for fridge cabinet and doors). No sheets – no fridges. • SELCo is the only supplier of the FPD components. No SELCo, no FDPs. • COVID-19 saw both suppliers close down temporarily hence no production output from Silicon Latina. • Alternative suppliers for FDP and fridge components are being identified and cost, quality and resilience impacts assessed.	• Effective management system is in place for Environmental, Health and Safety practices. Data on training, work injuries and other safety aspects are recorded as part of a management plan, and compliance is strong. Next improvements targeted are (a) exposure of workers to volatile organic compounds during refrigerator production and (b) better management of resource consumption per product (baseline recording, evaluation and monitoring). • Sustainability achievements and equitable (e.g., gender balanced) working conditions are not widely communicated.

Operational Strengths	**Operational Weaknesses**
• Stable network of product distributors across LAC. • Robust basic data sources are available. • State of the art take-back system at major retailers all over LAC has garnered wide public support and recognition. • Strong position in the local market and loyal clientele. • Good communication between management and operational staff. • Excellent environmental, health and safety track record. • Willingness to embark on new circular practices e.g., regarding alternative product designs including their packaging.	• Component quality of SELCo parts causes high rework and waste management costs – no direct communication lines SELCo to manage the issue. • Overly dependent on a few suppliers, greatly disrupting production during the COVID-19 pandemic. Lack of key information from SELCo such as on chemicals of concern used. • Restricted and inefficient workflow on production line 7 hinders expansion to enter more product lines (lacking capital for new line). • High packaging costs and packaging waste volumes - practice needs to improve or completely change.

ST.4 Do a Walk-Through Audit

Eco—i Electronics



TIPS & TRICKS

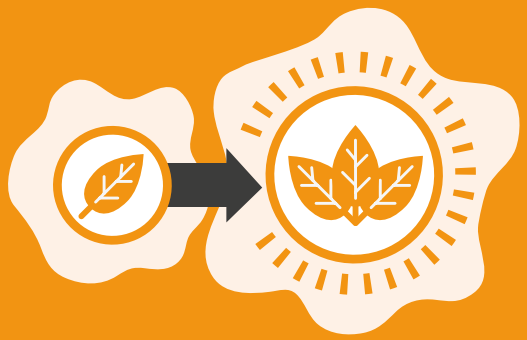
LOOK FOR INPUTS AND OUTPUTS IDENTIFIED IN THE HOTSPOT IDENTIFICATION.

Use the proxy mapping of input and output materials and fractions per component (tables PR.4-3 and PR.4-4 in PR.4) covering used substances, contained valuable materials and emissions to develop a checklist. This will help you to screen specific inputs and outputs per component. Both tables can be refined and complemented based on the audit results. These specific insights will help you prepare the life cycle inventory of the company and subsequently update the sustainability hotspot assessment.

IDENTIFY CHEMICAL-RELATED RISKS AND HAZARDS.

Information on hazards and risks related to chemicals used/handled and/or stored at the production site (e.g. cleaning agents, paints, lubricants, etc.) should be available on hazard/risk labels and in Safety Data Sheets (SDS) made available by the company's suppliers. This information can help you to understand and identify any safety or occupational health related issues to be considered to improve the situation of workers and other value chain stakeholders (transporters, customers, communities).

ST.6
Update the sustainability hotspots



This activity involves taking the analysis of the sustainability impacts and hotspots identified for the market and updating it with the company-specific impacts you have identified.

ORIENTATION

At this point, additional insights gained from data gathering, business model mapping and walk-through audit activities are analysed to identify any significant environmental, social or economic impact risks that were not detected in the PREPARE phase.

Based on the sustainability impacts and hotspots identified for the market in activity *PR.4 Identify sustainability hotspots across the value chain* the aim of this activity is to update it with company-specific impacts identified.

Template of Life Cycle Thinking

	Environmental impacts	Social impacts	Economic impacts
Materials			
Production			
Transportation			
Use			
End-of-life			

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- An updated, company-specific list of sustainability impacts with environmental, social and economic hotspots identified used for the activity *ST.7 Do a SWOT analysis*.
- Assessment of trade-offs.
- Proposed option for addressing the hotspots.

ST.6 Update the sustainability hotspots

Eco—i Electronics

LEARNING CASE STUDY OF LIFE CYCLE INVENTORIES FOR SILICON LATINA

The following examples in Figure ST.6-1 for the refrigerators and Figure ST.6-2 for the flat panel display lines are updated versions of the 'Template of Life Cycle Inventories' prepared in PR.4 which complement the Life Cycle Thinking templates in Tables ST.6-3 and ST.6-5. The elements in red are the specific hotspots you identified for Silicon Latina based on the audit results (ST.4), the CEO interview (ST.2) and your own research.

ST.6 Update the sustainability hotspots

Eco—i Electronics

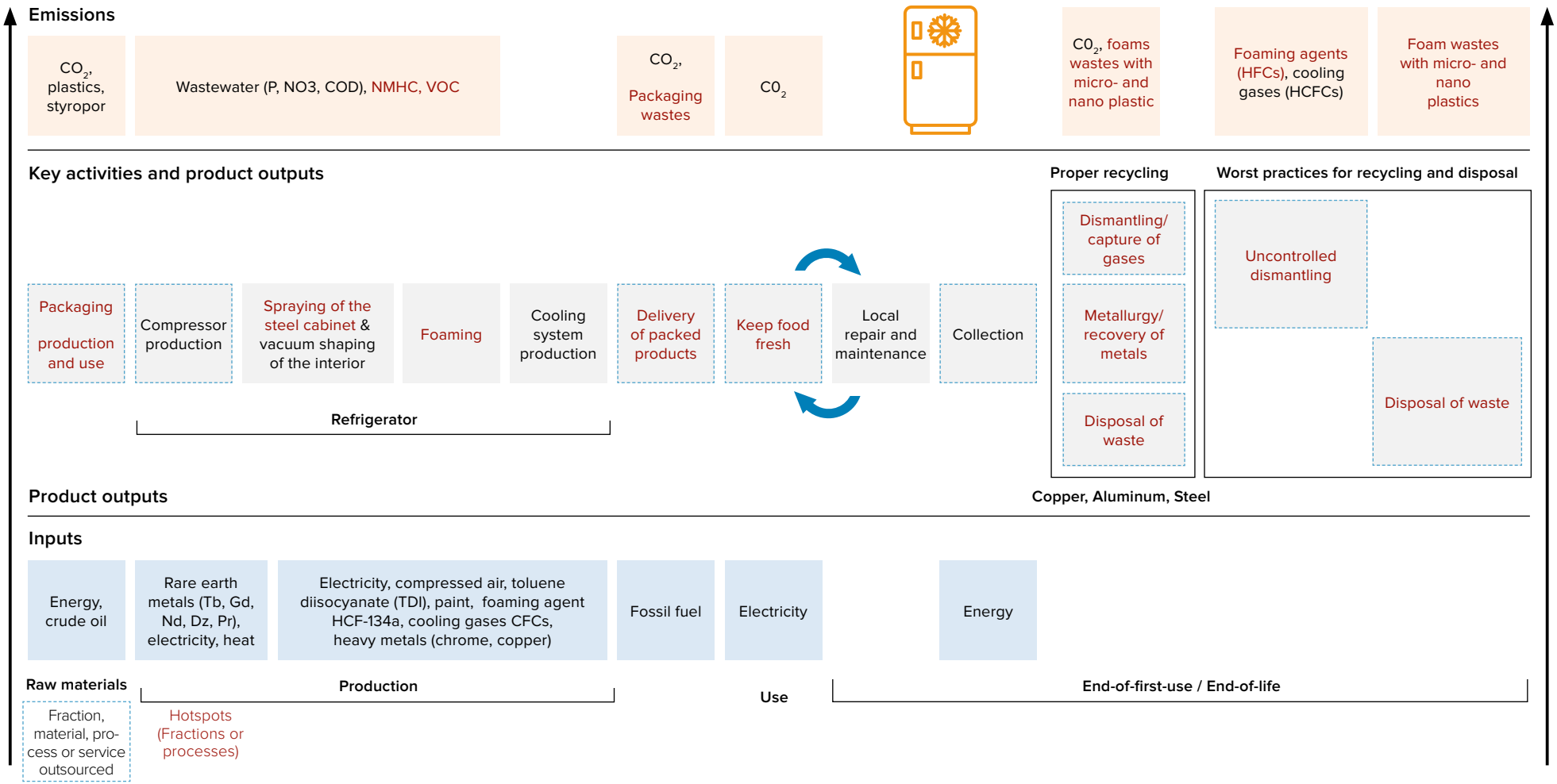


Figure ST.6-1: Life cycle inventory for refrigerator production and assembly at Silicon Latina

ST.6 Update the sustainability hotspots

Eco—i Electronics

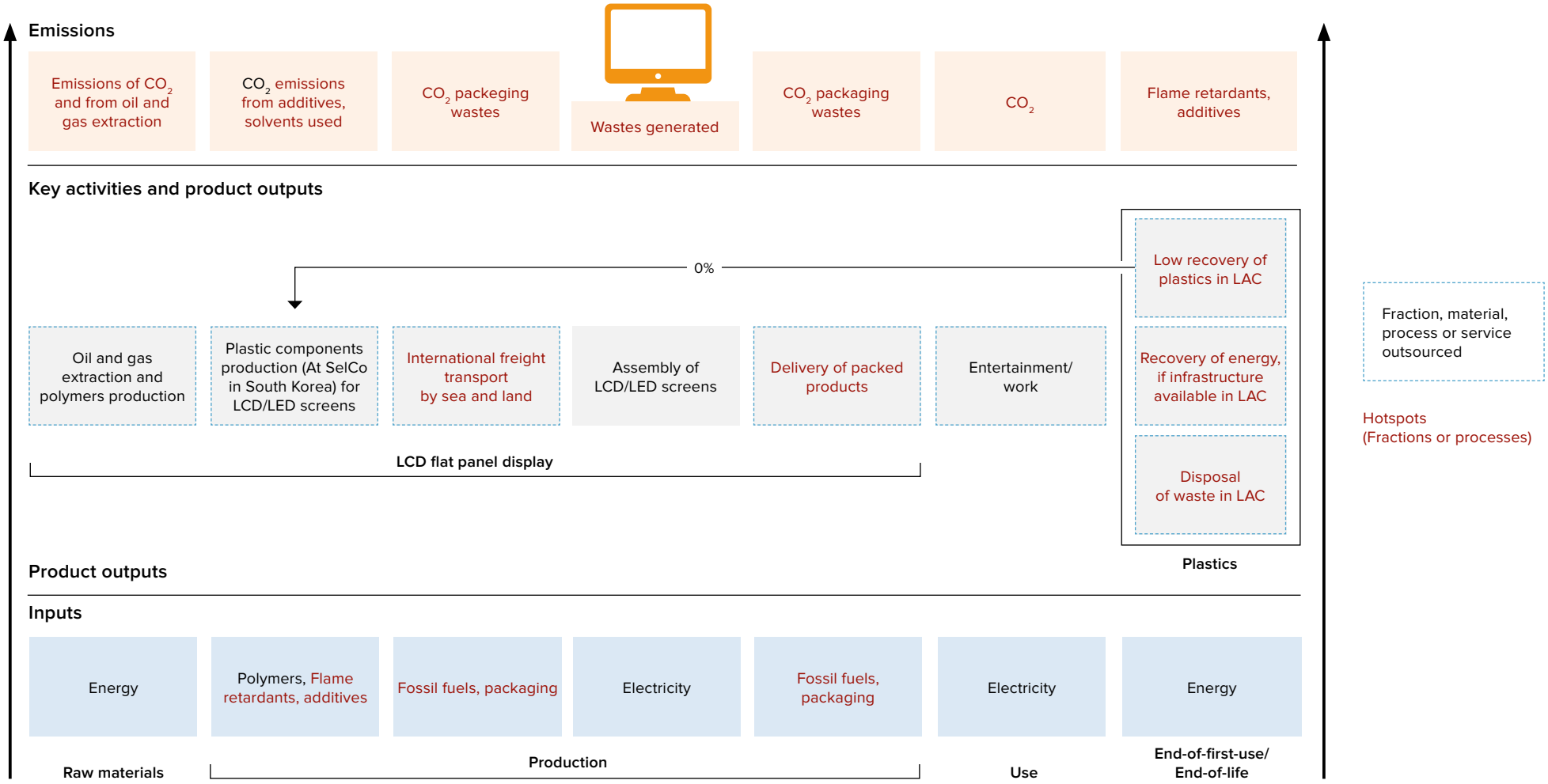


Figure ST.6-2: Life cycle inventory for flat panel display assembly at Silicon Latina

ST.6 Update the sustainability hotspots

Eco—i Electronics

LEARNING CASE STUDY OF LIFE CYCLE THINKING FOR SILICON LATINA

An important part of understanding the operational performance of the company is to assess the sustainability impacts of their products across the whole life cycle. Here we update the Life Cycle Thinking template completed in PR.4 to focus on company specific hotspots. Updated Life Cycle Thinking templates for Silicon Latina are presented in Tables 8 (refrigerators) and 10 (flat panel displays). The sustainability hotspots identified are presented in Tables ST.6-3 and ST.6-5, along with some of the key stakeholders and ideas for how they could help to address these hotspots.

*H (in red) = high negative impact, H (in blue) = high positive impact, M = medium impact, L= low impact

Life cycle stage	Activity	Input	Product output	Emissions or wastes	Environmental impact*		Social impact*			Economic impact*
					Resource use	Ecosystem quality	Workers	Consumers	Stakeholders	Profitability
Raw materials	Production of plastic for the cabinets & packaging materials such as cardboard, expanded polystyrene	Energy, crude oil, natural gas, hard coal cardboard pulp	Plastics, cardboard & expanded polystyrene	Negligible	Depletion of fossil resources & other natural resources (H)	Impact on ecosystems due to over-exploitation of natural resources with habitat reduction and due to leakages of CoC (H)	Negligible	Negligible	Negligible	Negative economic impact due to stricter legal requirements (with increasing costs) for natural resources use (H)
	Extraction of critical raw materials	Rare earth metals (Tb, Gd, Nd, Dy, Pr)	Metals treated for producing compressors	Wastes & recoverable metals in tailings	Dedpletion of critical raw materials (H)	Negligible	Health issues if poor working conditions (M)	Negligible	Impact on the community due to resources used at the cost of limiting the access to other resources such as water (M-L)	Negative economic impact due to increasing prices of critical raw materials (H)

ST.6 Update the sustainability hotspots

Eco—i Electronics

*H (in red) = high negative impact, H (in blue) = high positive impact, M = medium impact, L= low impact

Life cycle stage	Activity	Input	Product output	Emissions or wastes	Environmental impact*		Social impact*			Economic impact*
					Resource use	Ecosystem quality	Workers	Consumers	Stakeholders	Profitability
Production	Spraying of steel cabinet	Electricity, compressed air, paint	Refrigerator	VOC, CO_2	Negligible	Adverse impact on ozone layer depletion (L)	Health issues if poor working conditions (M)	Negligible	Smog formation (M)	Negligible
	Vacuum shaping of the interior	Electricity, heat, cooling gases (HCFCs)		NMHC (non-methane hydrocarbons)	Negligible	Adverse impact on climate change (L)		Negligible	Possible human toxicity through air pollution (M)	Negligible
	Foaming	Electricity, compressed air, toluene diisocyanate (TDI), foaming agent (HFC-134a)		Wastewater (P, NO3, COD) Foam wastes (low amounts of HFC-134a) General wastes	Depletion of resources (M)	Adverse impact on climate change (M), eutrophication (M), fresh water toxicity (M), land due to non-recyclable waste (H)	Health issues for women due to poor ergonomic conditions (M)	Negligible	Negligible	Increasing costs due to stricter legal requirements for foam waste management (L)
Delivery	Transport	Fossil fuel	–	CO_2 Particulates	Depletion of fossil resources & other natural resources (M)	Adverse impacts on ecosystems due to air pollution (M)	Health issues due to excessive lifting weight (M)	Negligible	Negligible	High transportation costs due to the high rate of components imported (H)
Use	Keeping food fresh	Electricity	–	CO_2	Impact on climate change and on depletion of fossil fuel (H)	Adverse impacts on ecosystems due to air pollution (M)	Negligible	Less food waste cuts costs (H)	Negligible	Higher energy costs for consumers (L-M)
Repairing	Repairing of refrigerators	Electricity, new components	Repaired refrigerator	Components broken – waste	Negligible	Negligible	If uncontrolled use of solvents during the cleaning process, adverse working conditions (H)	Improved refrigerator performance (H)	Green jobs created (H)	More loyal customer base – extends client relationship past the initial sale. Positive economic impact for customer (who doesn't have to buy new fridge unnecessarily) (H)

ST.6 Update the sustainability hotspots

Eco—i Electronics

*H (in red) = high negative impact, H (in blue) = high positive impact, M = medium impact, L= low impact

Life cycle stage	Activity	Input	Product output	Emissions or wastes	Environmental Impact*		Social impact*			Economic Impact*
					Resource use	Ecosystem quality	Workers	Consumers	Stakeholders	Profitability
Collection	Collection via: (i) Silicon Latina take-back system (ii) local recycling systems or (iii) informal sector (with no consent or knowledge by the company)	Used refrigerators	Used refrigerators with recoverable parts or components	Wastes (broken parts)	Negligible	Adverse impacts on land used from informal collection (L)	Adverse working conditions of informal collectors (M)	Negligible	Adverse impacts on local communities around the informal collection (M)	a. Positive economic impact for the company as collection costs are shared through a take-back system b. Positive immediate economic impact for informal waste management workers, however, at the cost of their health (M-H)
Proper recycling and disposal	Dismantling	Used refrigerators with recoverable parts or components	Components	Broken parts, waste polyurethane foam and plastics	Negligible	Adverse impacts on land used due to spillages and leakages (L)	Negligible	Negligible	Negligible	Positive economic impact from selling valuable components recovered (M-H)
	Metallurgic processing	Energy, components with recoverable metals	Metals recovered	Air emissions, CO_2, chemicals emitted depending on the metals processed	Depletion of mineral and fossil resources (L)	Climate change, air pollution (L)	Negligible	Negligible	Negligible	Profitable recycling and recovery of metals (H), contribution to a continued supply of critical raw materials (M)
Uncontrolled dismantling	Dismantling	Used refrigerators with recoverable parts or components	Components	Wastes (broken parts), waste polyurethane foam and plastics, cooling gases (HFCs, HCFCs)	Negligible	Adverse impacts on land used due to non-recycled waste such as foaming (H)	Adverse working conditions of informal workers lead to injuries and health issues from toxic emissions (H)	Negligible	Adverse impacts on the local communities around non-controlled dismantling practices (M)	Reputational risk could impact company profits (M-H)
Disposal	Disposal of waste	Waste foam, plastics and other non-valuable materials or components for recovery	–	Waste foam, plastics and other non-valuable materials or components disposed of	Extensive areas of land used for disposing high volumes of foaming (H)	Adverse impacts on soil due to non-recycled waste such as foaming (H)	–	–	Landscape degradation and emissions decrease livelihoods (H)	Fines from illegal disposal vary in each location. These can be extremely high, up to closure of the business for this activity considered as 'environmental crime' (L-H)

Table ST.6-3: Qualitative life cycle inventory for refrigerators (hotspots with negative impacts are in red and key positive impacts in blue)

ST.6 Update the sustainability hotspots

Eco—i Electronics

Sustainability hotspot	Stakeholder and how they could help
Raw materials: Significant resources are consumed for producing refrigerators (including plastics for the casing and packaging) some of which are non-economically recoverable (e.g. expanded polystyrene) with high handling and disposal costs. Extensive areas of land are used for disposing high volumes of plastics and foaming.	**Casing and packaging materials suppliers and designers** can re-design packaging, to minimise non-recyclable materials and investigate options for reuse.
Economic impacts on consumers: Homes with inefficient equipment suffer from high running costs.	**An expert designer** can propose improvements to the models of refrigerators for improving energy efficiency and, thus, reducing costs. **Local governments or not-for-profits** can run programs to increase financial literacy, helping consumers to make purchase decisions based on whole of life costs rather than upfront purchase price. Silicon Latina can provide data and finance (sponsorship) to support these.
Economic impact on consumers due to value loss from over-consumption (over sizing of products) and low repairability levels due to poor dismantling features.	**Company can provide technical advice on the right size** of the refrigerator linked to energy savings. **Design experts** can propose improved design of the components for dismantling, hence, repairing and extending the lifespan of the product.
Impacts on climate change during the use phase: Using refrigerators inefficiently and poor maintenance can increase energy use by 30%.	**Retailers and sales force** could pro-actively educate consumers on the optimal use of the refrigerators. **The design team can work with consumers** to integrate smart features and other design changes adapted to the market that reduce the risk of inefficient operation. This can include improving default settings and using the internet-of-things to automatically adjust setting and trigger proactive maintenance.
Impacts on the health of poorly equipped workers due to chemicals of concern: Volatile organic compounds during the spraying of the steel cabinet have been identified as a hotspot.	**The health and safety department** at Silicon Latina can improve procedures, infrastructure (e.g. purchase of adequate personal protection equipment or designated spray cabinets with ventilation and filters) and training in the production facility. This includes careful attention to the ergonomic aspects of the different tasks and how these can be adapted, for example, for different women conditions.
Health issues for working women due to poor ergonomic conditions: These impacts are critical depending on women conditions (e.g. pregnancy).	
Impacts on climate change from informal waste management: In countries lacking formalised and controlled waste management infrastructure, improper dismantling of old equipment for metal recycling can cause the release of HFCs and HCFCs which are very impactful greenhouse gases.	**Repairers, collectors and the take-back system team** can ensure that proper practices for dismantling are adequately communicated to the recycling facilities. Fact sheets should be disseminated in case dismantling is attempted by informal workers. **Recyclers** can offer competitive conditions for informal workers to bring the equipment to their facilities where valuable components can be dismantled under supervision.
Impacts on the environment and on the health of waste management workers from open dumping of wastes in countries lacking appropriate infrastructure with predominance of informal sector.	**Municipalities** can promote inclusive and sustainable waste management and close illegal dumping sites.

Table ST.6-4: Sustainability hotspots for refrigerators produced by Silicon Latina

ST.6 Update the sustainability hotspots

Eco—i Electronics

*H (in red) = high negative impact, H (in blue) = high positive impact, M = medium impact, L= low impact

Life cycle stage	Activity	Input	Product output	Emissions or wastes	Environmental impact*		Social impact*			Economic impact*
					Resource use	Ecosystem quality	Workers	Consumers	Stakeholders	Profitability
Extraction	Oil and gas extraction, and polymers production	Energy, crude oil, natural gas	Polymers	Emissions to air from gas leakages (H) Polymers waste CO_2, air emissions	Depletion of fossil resources (H) Deforested area (H)	Leakages and spillage on land, freshwater sources and/or ocean (H)	Job creation (M) Difficult working conditions at the extraction stage, e.g., with no facilities for families (H) Health issues due to CoC associated to the polymers production (H)	Negligible	Indigenous areas and their modus vivendi affected during the extraction stage (H) Possible human toxicity through air pollution (M)	As long as environmental costs (externalities) are not internalized, the extraction of fossil fuels remains profitable (H) Negative economic impact due to stricter legal requirements (with increasing costs) for natural resources use (H) Potential savings if recycled plastic is used to produce new polymers (H).
Production	Manufacturing of plastics components	Polymers, energy, crude oil, natural gas, chemicals (e.g. brominated flame retardants, plasticizers & pigments)	Different plastic components in different plastic types (ABS, PS, PC & PVC)	Plastics waste	Depletion of fossil resources (H)	Impact on land from plastic waste (H)	Health issues due to solvents released (H)	Negligible	Possible human toxicity through air pollution (M)	Potential savings at the latter recovery stage if material declaration sheets are available (plastics are marked as well) (M).
	Assembly of plastics components	Electricity, heat, flame retardants (FR), additives	Plastic casings and other plastic units for LED flat panel displays	CO_2	Negligible	Negligible	Negligible	Negligible	Negligible	Costs of FR in components not needing them (H);
Transport to and from the company	International freight transport by sea and land	Fossil fuels	–	CO_2	Fossil fuels	Leakages and spillage on land and/or ocean (H)	Job creation (H) Difficult working arrangements for workers with families (H)	Negligible	Negligible	Potential savings if weights of packaging and products are reduced (H)

ST.6 Update the sustainability hotspots

Eco—i Electronics

*H (in red) = high negative impact, H (in blue) = high positive impact, M = medium impact, L= low impact

Life cycle stage	Activity	Input	Product output	Emissions or wastes	Environmental impact*		Social impact*			Economic impact*
					Resource use	Ecosystem quality	Workers	Consumers	Stakeholders	Profitability
Use	Entertainment/ work	Energy source in general	–	CO_2	Negligible	Negligible	Negligible	Negligible	Negligible	Impact from the consumer's perspective, if for a product in need for repair, the costs are higher than buying a new one due to poor dismantling options (H) From the company's perspective, reputational risk and impact on the market with reduced sales as sustainability aspects are not addressed (H)
Recovery and disposal	Disposal of waste (60%) and co-processing of energy (40%). No plastics are recycled.	Plastics with FR, colorants, stabilizers and catalysts containing heavy metals like cadmium and lead	Energy recovered	Controlled air emissions	Negligible	Negligible	Negligible	Negligible	Negligible	Economic impact for the company from low return rates of obsolete products preventing full-scale and reduced costs operation (H) Income for the company from the energy recovery from plastics (L)
			Plastic wastes	90% of wastes disposed of in a non-controlled way (by informal sector)	- Land used for disposal sites (H) - Recyclability of plastics reduced due to the presence of flame retardants and additives such as cadmium (among others) (H)	- Severe impacts on ecosystems (decreased livelihoods) from waste managed by the informal sector (H)	Health issues due to poor working conditions in the informal sector (H)	Negligible	- Landscape degradation from the wastes - Health issues (H)	Economic impact for the company and recyclers due to the lack of information of substances contained in the plastics wastes which promotes downgraded recycled plastics (H) Externalities affect the population if non-controlled disposal or end-of-life (H)

Table ST.6-5: Qualitative life cycle inventory for plastics components of LED flat panels display produced at Silicon Latina (hotspots with negative impacts are in red and key positive impacts in blue)

ST.6 Update the sustainability hotspots

Eco—i Electronics

Sustainability hotspot	Stakeholder and how they could help
Raw materials: Significant resources are consumed for producing plastics components most of which is currently not recycled, with high handling and disposal costs. Extensive areas of land are used for disposing high volumes of plastics and foaming.	**Plastics materials suppliers and experts** can support the identification of components with less impacts and higher circularity potential.
Flame retardants that can be avoided by removing their use when not needed. This would not only reduce risks to health of workers but also the costs.	**An expert on plastics' additives and flame retardants** can propose improvements to the plastics components for reducing costs.
Circularity of plastics compromised due to the presence of flame retardants and additives such as cadmium.	
Impacts on the health of workers producing plastics components due to flame retardants emitted if non-controlled plastics extrusion operations.	**The health and safety department of the suppliers** of plastic components can ensure a healthy working environment when products plastics components.
Impacts on the health of poorly equipped workers in the informal sector due to chemicals emitted.	**The health and safety department** at Silicon Latina S.A. can communicate the hazards and risks of incorrectly dismantled products – partnering with external organisations like waste associations, local governments and not-for-profits.
Impacts on the environment and society from the uncontrolled disposal of waste plastics.	**Municipalities** can promote inclusive and sustainable waste management and close illegal dumping sites.
Economic impact for the company and recyclers due to the lack of information of substances contained in the plastics wastes which promotes downgraded recycled plastics with lower value.	**Labels or certification partners** can certify the content of the components and validate the material fact sheets for further consultation, when needed, along the life cycles of the product concerned.
Economic impact on consumers due to value loss from poor repairing possibilities because of non-existing dismantling attributes of equipment's components.	**Design experts** can propose improved design of the plastic components for dismantling, hence, repairing and extending the lifespan of the product.
	Retailers and post-venta services on maintenance offer and use spare parts from plastic in refurbished or repaired electronics products.

Table ST.6-6: Sustainability hotspots for flat panel displays produced by Silicon Latina focusing on plastic components

ST.7
Do a SWOT analysis

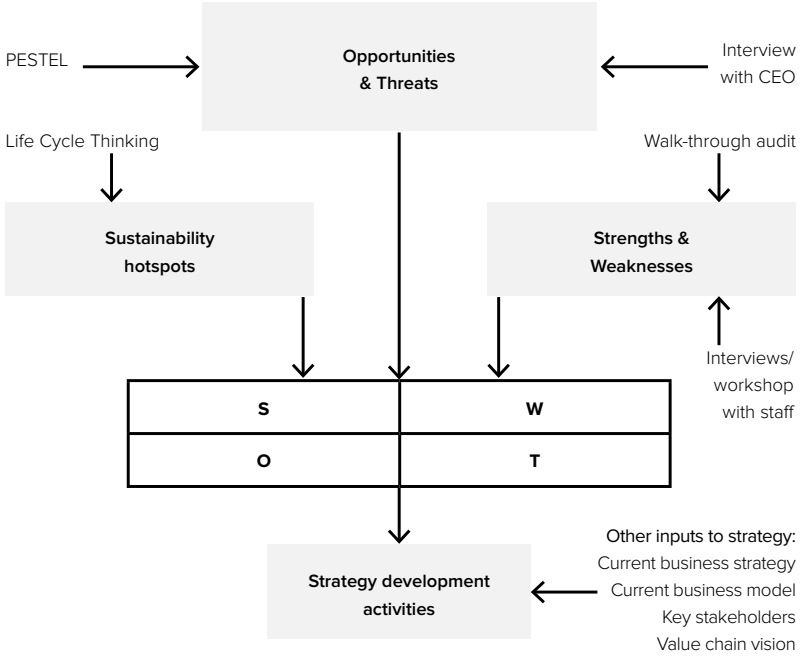


This activity provides guidance on how to perform a strategic analysis of the company using the data you have gathered during the Preliminary Assessment and the SWOT template.

ORIENTATION

Identifying the key strengths and weaknesses of your target company - along with the predominant threats and opportunities of the external environment - will provide the context you need to generate fresh, strategic ideas that tackle sustainability. This activity involves bringing together the large amount of data you have gathered during *PR.3, PR.5, ST.2, ST.4 and ST.6* as well as business intelligence and understanding of the market to examine the company's Strengths, Weaknesses, Opportunities and Threats in a SWOT analysis.

Data sources and process for the SWOT analysis.



EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Categorised set of strategic factors to support strategy development. This output is used in the activities *ST.8 Develop a vision for the company and ST.9 Define the strategic goals.*

ST.7 Do a SWOT analysis

Eco—i Electronics

LEARNING CASE STUDY: SWOT OF SILICON LATINA

	Helpful to becoming more sustainable	Harmful to becoming more sustainable
Internal origin (attributes of the company)	**STRENGTHS** **General:** • Stable network of product distributors in LAC • Availability of business data and basic management systems in place • Strong brand recognition associated with take-back system at retailers across LAC • Strong position in the local market and loyal clientele • Communication between management and operational staff • Environmental, Health and Safety track record (except VOC emission controls) • Motivation to embark on innovative circular and sustainable practices	**WEAKNESSES** **General:** • Fragility of supply chain, as demonstrated during the COVID-19 pandemic • Lack of key information from SELCo such as on chemicals of concern used • Lack of capital to expand production lines, improve operational efficiency and add innovative features to products **Refrigerators:** • Overuse of packaging (including non-recyclable materials) with high associated material, handling and waste management costs, and poor perception with consumers and distributors • Chemical emissions (notably VOC during spraying of cabinets) potentially impacts the health of workers **Flat panel displays:** • Flame retardants may not be needed in all components and these materials costs can be avoided by removing their use when not needed • Use of chemicals of concern in plastic components • High wastage and cost from poor quality imported components

ST.7 Do a SWOT analysis

Eco—i Electronics

LEARNING CASE STUDY: SWOT OF SILICON LATINA

	Helpful to becoming more sustainable	Harmful to becoming more sustainable
External origin (attributes of the environment)	**OPPORTUNITIES** **General:** • Through increasing restrictions by importing countries to products containing chemicals of concern in regulations and standards, there is an increased motivation to substitute these chemicals with environmentally friendlier alternatives with low risks to health • Growing demand for both refrigerators and flat panel displays • More aware consumers seeking sustainable products • Interesting technological advances and alternative materials are developing fast and increasingly available to a global market **Refrigerators:** • Capacity to manage -and appetite for- more advanced technologies (such as IoT) in refrigerators are increasing • Consumers seeking efficient equipment to reduce running costs – and considering whole life cost when making purchase choices **Flat panel displays:** • New labelling for plastics compliant with substance of concern practices will be a differentiator in the market for early adopters	**THREATS** **General:** • COVID-19 (and any future pandemics) capable of disrupting global supply chains • Competition from low-cost competitors **Refrigerators:** • Restrictions on products with low energy efficiency or still containing (H)CFC which are already banned in developed countries • Problems managing waste refrigerator insulation foam **Flat panel displays:** • Restrictions on products containing chemicals of concern such as certain flame retardants • Recyclability of plastics compromised due to the presence of flame retardants and additives such as cadmium (among others)

ST.8
Develop a vision for the company

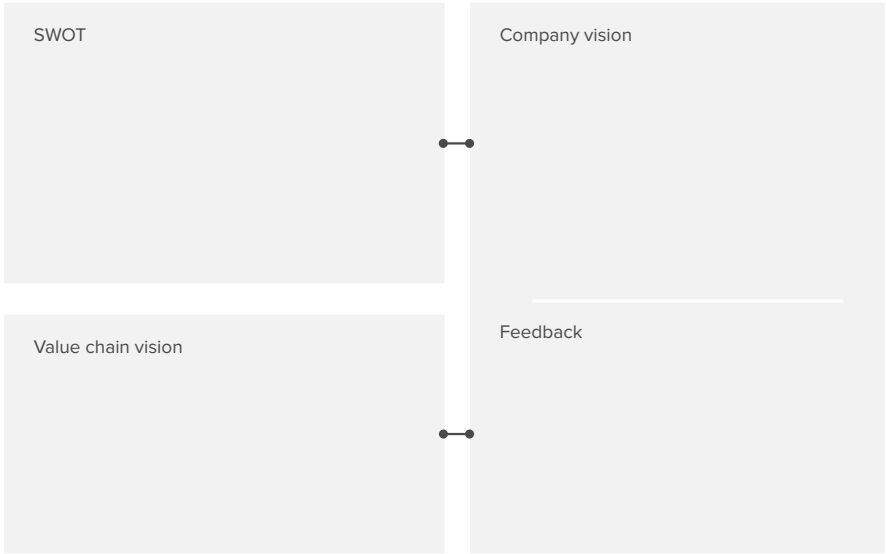


This activity guides you through the process of defining a vision for the company that is aligned with the value chain vision and the high priority strategic factors previously defined.

ORIENTATION

This activity serves to shape an initial vision and provide a backdrop for identification of new strategic ideas and goals. The company vision should align with the earlier, broader vision of the value chain, as previously outlined in *PR.6 (Develop a value chain vision).* It should also take into account key insights from the SWOT analysis *(ST.7)* and list of key stakeholders from activity *PR.3*. Note, you may need to return to the company vision as you iterate through the eco-innovation process.

Template of Company Vision



EXPECTED OUTPUTS FROM THIS ACTIVITY:

- A short description of what the company is like in a more sustainable future used in the activities *ST.9 Define the strategic goals* and *ST.10 Generate ideas for new products, markets and selling points.*

ST.8 Develop a vision for the company

Eco—i Electronics

LEARNING CASE STUDY: SILICON LATINA'S 5-YEAR COMPANY VISION

The new vision of Silicon Latina expresses how the sustainability hotspots will be addressed and how the company will be performing from a commercial perspective (growth, profitability, market position). It also gives an idea on how customers will feel about the company and the perception from other people when they hear the company name. The vision has been revised by team providing consultancy service to the company to ensure clarity and inspirational text.

SWOT (ST.7)

- Strong distribution network, brand, procedures and team
- Growing markets
- Fragile supply chain with quality issues
- Lack of capital for expansion
- Overuse of packaging
- Competition from low-cost competitors
- Tighter restrictions on products containing chemicals of concern (incl. the banning of HCFC in developed countries)
- Energy efficiency of products key point of competition
- Challenges recycling certain materials

COMPANY VISION

Silicon Latina is a leading producer of quality and sustainable products. We aim to provide products that are energy efficient, repairable and recyclable.

To do this we work with our suppliers to improve their sustainability practices and source the best materials and technologies available.

The well-being of our customers and attention to their interests is our primary focus. By managing our processes effectively we keep our products affordable, and the efficiency of our products translate into savings for our customers throughout the lifetime of their purchase. We add value to our products through after-sale repair services and extended producer responsibility activities that promote reuse, refurbishment and recycling.

We strive to treat our staff, suppliers and partners, fairly and cooperate to build an inclusive and sustainable value chain.

VALUE CHAIN VISION

- See PR.6

FEEDBACK (to be gathered)

ST.9
Define the strategic goals



This activity guides you through the process of defining strategic goals for the company that are aligned with the value chain vision and the high priority strategic factors.

ORIENTATION

The process for formulating new strategic goals is essentially laid out in two steps. The first is to brainstorm a list of potential strategic ideas that address hotspots and threats. The second is to select the most promising ideas as the drivers for new strategic goals.

The TOWS (threats, opportunities, weaknesses and strengths) template and approach is a helpful way of turning your SWOT analysis 'inside out' to generate strategic ideas relating to the strengths, weaknesses, opportunities and threats you identified for your target company. Using the list of ideas assembled in the TOWS template, prioritised ideas are then transitioned into the Strategic Goals template for further shaping.

This section illustrates the process, using a TOWS template populated for the learning case company, followed by the related Strategic Goals templates. A simple table is provided to help you visualise the link between hotspots and strategic ideas placed in the TOWS template.

Template of TOWS

	Strengths	Weaknesses
Opportunities		
Threats		

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- A set of strategic goals that address the high priority strategic factors used in the activity *ST.10 Generate ideas for new products, markets and selling points.*

ST.9 Define the strategic goals

Eco—i Electronics

LEARNING CASE STUDY OF TOWS – STRATEGY IDEAS FOR SILICON LATINA

This exercise is aligned to the SWOT developed in ST.7. Following an internal brainstorming with your team **and the company**, strategy ideas are generated.

Strengths

- Network of distributors
- Basic data and management systems
- Strong position in the local market
- Good internal communication
- Excellent Environmental, Health and Safety track records
- Motivation to embark on innovative circular and sustainable practices

Weaknesses

- Fragility of supply chain
- Lack of capital for improvements
- Over packaging (cost of material and waste, and reputation damage)
- Health issues due to VOC emitted during production
- Women health issues due to the lack of ergonomic considerations for women under pregnancy conditions
- Chemicals of concern (flame retardants) in plastic components
- Variable component quality for FPDs

Opportunities

- Growing demand for both refrigerators and flat panel displays
- More aware consumers seeking sustainable products
- Technological advances & alternative materials are developing fast
- Integration of new tech in refrigerators (e.g. IoT)
- Consumers seeking efficient equipment to reduce running costs
- New labelling for plastics compliant with substance of concern practices

STRENGTHS-OPPORTUNITIES strategy ideas

- Branch into more sustainable product range based on strong existing market position
- Upgrade the existing take-back system to include after-sales services (repair)
- Communicate clear information on running costs, recyclability and other key sustainability issues to consumers
- Use recycled plastics in products as a differentiator
- Extend the lifetime of products through product design and business models

WEAKNESSES-OPPORTUNITIES strategy ideas

- Approach investors (interested in sustainability) to access capital for improvements based on a solid business case for sustainability
- Improve packaging and chemical practices, and integrate these new sustainable features in communication to appeal more aware customers seeking sustainable products
- Ensure healthy and safe working conditions for women and workers overall

ST.9 Define the strategic goals

Eco—i Electronics

Threats

- Supply chain disruptions (e.g., caused by COVID-19)
- Competition from low-cost competitors
- Restrictions on products with low energy efficiency or containing HCFC (incl. the banning of HCFC in developed countries)
- Management of refrigerator insulation foams (not economically recyclable)
- Restrictions on products containing chemicals of concern (such as certain flame retardants)
- Recyclability of plastics compromised due to the presence of flame retardants and additives such as cadmium (among others)

STRENGTHS-THREATS strategy ideas

- Develop measures to prevent logistical disruptions such as more local and diverse suppliers. Consider feedback and advice from current suppliers
- Appoint a dedicated person to carefully identify current and emerging local and international requirements and follow up compliance, if need be, linked with an international certification and communication (label)
- Create a project team led by a project manager to champion changes towards implementing increased eco-innovation measures
- Build on the excellent safety record, to strengthen health and safety management by appointing a person dedicated to developing improvement measures and follow up on compliance

WEAKNESSES -THREATS strategy ideas

- Build a resilient supply chain – starting with identification and assessment of potential new suppliers
- Develop an internal process to reduce and manage the use of chemicals of concern (like flame retardants) and identify the replacements of HCFC and HFCs in cooperation with upstream suppliers to support the traceability of such substances
- Develop the 'downstream' supply chain to better manage recycling and effective disposal of tricky materials (such as plastic components and insulation foams), at the same time as improving design (e.g., the design of packaging in cooperation with local researchers)

Hotspots identified in *ST.4* are addressed in the following sheets which will be consistent with the strategy ideas previously generated. This is an iterative process, so make sure you allow for two or more rounds to complete this exercise.

ST.9 Define the strategic goals

Eco—i Electronics

STRATEGIC GOAL #1	
What hotspot or other SWOT issue does the goal help to address?	Fragile supply chain with quality issues
What is the desired change?	Establish a reliable and stable pool of suppliers that deliver components and materials according to the technical specifications with good quality service.
How will you know if the goal has been achieved?	- The number of non-compliant components and materials is reduced by 50% compared to business as usual. - Delivery delays are under 5% for each supplier, and limited to 5 days delay. Any issue with bureaucratic procedures (e.g., missing proofs of origin) is addressed as a priority with the supplier, and rectifications made immediately. - A supplier management system is in place to foster good collaboration. This helps manage situations like the quality issue with SELCo, and open the supplier relationship to identify innovations together. - A database of potential suppliers is in place, identifying at least one alternative supplier in LAC for each material or component sourced. - Suppliers indicate 90% satisfaction working with Silicon Latina, as expressed through formalised feedback surveys.

STRATEGIC GOAL #2	
What hotspot or other SWOT issue does the goal help to address?	Health issues during the assembly of refrigerators on women due to not ergonomic workplaces and on all workers (due to VOC emissions), and during the dismantling by waste management workers.
What is the desired change?	Provide safe and healthy conditions for anybody along the value chain in contact with our products or components.
How will you know if the goal has been achieved?	- Health-related incidents linked to emissions at the factory and at recyclers are recorded. Zero major incidents are observed and any minor incidences are managed appropriately. - Special attention is paid to a healthy work environment for pregnant women. - VOC concentrations in indoor environments where production and/or dismantling take place are within government-prescribed limits. If international treaties provide stricter thresholds, these should apply. - A proactive system is in place to receive complaints from repairers, refurbishers and waste management workers related to health-issues from disassembling the broken or used products. Complaints observed are close to zero, and any complaints received are followed up on appropriately. - Information is available for consumers (such as the declaration of chemicals of concern contained in products), and systems are in place to receive complaints from them. - Recorded number of incidents reduced (in production, dismantling and customers) by 30% after year one.

ST.9 Define the strategic goals

Eco—i Electronics



STRATEGIC GOAL #1	
When will the change be achieved?	18 months.
Final formulation of the goal:	A reliable and stable pool of good-quality suppliers that are managed effectively and satisfied working with Silicon Latina.

STRATEGIC GOAL #2	
When will the change be achieved?	12 months.
Final formulation of the goal:	We will provide healthy conditions for anybody along the value chain in contact with our products or components through active management of production and dismantling facilities, and communication with customers.

STRATEGIC GOAL #3	
What hotspot or other SWOT issue does the goal help to address?	Toxicity of, and resulting recyclability issues with, product components (notably plastics containing flame retardants and additives, and insulation foams). Over-packaging – leading to material, handling and waste costs, and reputation damage.
What is the desired change?	Reduce material costs across the life cycle and phase out chemicals of concern in product components for non-toxic products that can become circular.

STRATEGIC GOAL #4	
What hotspot or other SWOT issue does the goal help to address?	More aware consumers (individuals and governments) seeking sustainable products and enhanced capacity to manage more advanced electronic devices (such as IoT).
What is the desired change?	Being recognized as a company that delivers among the most sustainable products (Eco-refrigerators, TVs and computer screens) in the LAC market with an increase of our total sales.

ST.9 Define the strategic goals

Eco—i Electronics

STRATEGIC GOAL #3	
How will you know if the goal has been achieved?	- Purchasing, handling, transport and end-of-life costs are tracked per material. Targets for reduction ($ per kg) are established once the baseline is known and performance improved from year to year. - Recyclability of materials is tracked. Non-recyclable materials are decreased by 30% in both packaging and in products after 12 months. - Chemicals of concern (flame retardants and additives) are removed as much as possible in flat display plastic components, and new recycling programs for them at end of life are supported: 90% of plastic components originally containing FR are replace with FR-free components. - Product improvement process is in place to identify better materials and assess competitivity (reliability, performance, budget etc.), and undertake design for recycling initiatives. - Weight and % of materials and components replaced are tracked and confirm reduction over time. - Plastic components in TV and computer screens are composed of 30% recycled plastics through a specific partnership with recycling facilities including an upgraded take-back system.
When will the change be achieved?	24 months.
Final formulation of the goal:	Non-circular materials are reduced by 30% in both plastics components and products. Life cycle material costs are known and reduced (per unit) annually.

STRATEGIC GOAL #4	
How will you know if the goal has been achieved?	- Innovations that extend the life of products and reduce their impact on the environment* are tracked (impact measured) and communicated effectively (e.g., via any certification achieved) to customers (on website, on product communication and by well-trained sales partners). - Sales of best environmentally performing products increase to represent 30% of annual revenue (tracked also by country). - Overall sales for Silicon Latina increase by 10% annually. - Silicon Latina is recognised as best in class in incorporating smart technology in refrigerators that improve energy consumption and cut food waste. - Number of bid requests from green procurement programs and successful contracts increases annually. - Share of plastics recycled use in plastic components of flat panel displays showing clear company commitment. * including but not limited to increased energy efficiency, removal of chemicals of concern, reduced single-use packaging, and increased recyclability of components and packaging.
When will the change be achieved?	36 months.
Final formulation of the goal:	Total sales will increase by 10% per year and by year 3 at least 30% of total sales will correspond to our most sustainable products.

ST.9 Define the strategic goals

Eco—i Electronics



STRATEGIC GOAL #5	
What hotspot or other SWOT issue does the goal help to address?	Inefficient equipment in place, as well as inefficient use, improper management and/or short lifetime of the product impact the environment and translate into value and economic loss for the consumers.
What is the desired change?	Increase consumer demand for sustainable products with extended lifetimes and ensure sustainable use of products, through highlighting cost-benefit advantages.

STRATEGIC GOAL #6	
What hotspot or other SWOT issue does the goal help to address?	Reputational risks and loss of market shares if not adhering to international standards and restrictions to trades of products with chemicals of concern, HFCs or (H)CFCs. The latter is being fully removed earlier than 2030 (the deadline according to the Montreal Protocol).
What is the desired change?	Strive for a leadership role in the sector in the LAC region complying with international standards.

ST.9 Define the strategic goals

Eco—i Electronics



STRATEGIC GOAL #5	
How will you know if the goal has been achieved?	- Programs tracking electricity consumption and costs before and after replacement of refrigerators demonstrate clear savings for consumers. - Financial literacy programs run by non-governmental organisations or governments are supported in all operating countries, with a goal to help households to understand their energy and water bills and how they can reduce them. - Customers access best practices fact-sheet at purchase and download them from the website. - Number of inquiries from customers for enhancing their user practices and experience. - Lower and middle-income households represent at least 50% of the sales of efficient models, indicating accessibility beyond higher income. - Repair, upgrade and refurbishing services are well known, and their take-up increases across all operating countries annually, with a 40% increase in the first 5 years of a products' purchase. - Smart fridges estimate savings from automatic changes in settings, changes in user behaviour and repair, communicating this back to the user and enabling Silicon Latina to demonstrate overall performance improvements from year to year.
When will the change be achieved?	30 months
Final formulation of the goal:	Customers from all household-types understand the benefits for the environment and their budgets of Silicon Latina's refrigerators with extended lifespans, resulting in longer use of refrigerators and increase in demand for repair, upgrade and refurbishing services by 40% of users in the first 5 years of their purchase.

STRATEGIC GOAL #6	
How will you know if the goal has been achieved?	- Records of identification of CoC on international requirements and standards are tracked. - No purchases of HCFC and gradual replacement of HCFs with more ambitious targets than those set in the Kigali Amendment adopted by Brazil. - Zero major incidences of non-compliance are observed and any minor ones are resolved immediately. - Inspections/certifications show no trace of HCFC and targeted levels of HFC in refrigerators. - Clear channels for complaints on any issue related to the company from consumers and other stakeholders are in place and communicated. All complaints are dealt with effectively – and some spark collaborative.
When will the change be achieved?	42 months
Final formulation of the goal:	Strive for a leadership role in the sector in the LAC region and be known as a company that complies 100% with international standards and is concerned about consumers' interests.

ST.9 Define the strategic goals

Eco—i Electronics

TIPS & TRICKS

TURN CUSTOMER SATISFACTION GAPS INTO BUSINES OPPORTUNITIES.

Electronics is a sector that values optimised customer experience for retaining their loyalty. Think about the common problem or challenges faced by customers and users to identify new product offerings.

For example, an electronics company can offer extended warrantees and leasing arrangements to better control repair, remanufacturing and recycling of products, and enhance the user experience.

USE SCENARIO PLANNING TO MANAGE UNCERTAINTY.

Identify potential scenarios – considering trends identified during the 'prepare' (PR) phase – that you may be faced with such as:

- supply chain disruption (e.g., during COVID-19)
- price increases (or volatility) of critical raw materials (e.g., gold which is widely used in electronics)
- more stringent legal requirements requiring increased value chain performance disclosure of, or banning the use of certain materials (e.g., single-use plastics)

Prioritize the scenarios according to the potential impact (positive or negative) and probability of occurrence (see Fig. ST.9-1). Take care to avoid data availability bias (e.g. by relying on a limited geographical scope), focussing on detail early in the process and being overconfident in the future to increase effectiveness.

Consider these potential scenarios into account while generating the strategic goals to help make the company more resilient.

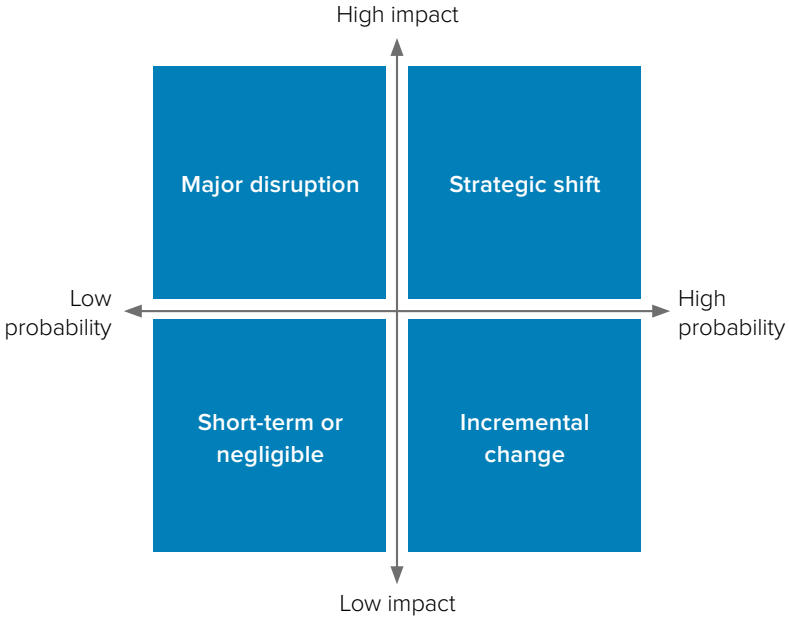


Figure ST.9-1: Impact probability matrix

References:

- Leney, T. et al. (2004). Scenarios Toolkit. Cedefop Dossier series; 8. https://www.cedefop.europa.eu/files/6009_en.pdf
- McKinseyCompany (2015). Overcoming obstacles to effective scenario planning. https://www.mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/overcoming-obstacles-to-effective-scenario-planning

ST.10
Generate ideas for new products, markets and selling points



The aim of this activity is to generate ideas for how to align the company's products, markets and selling points with the new company vision and goals.

ORIENTATION

This activity in the eco-innovation process continues toalign and build upon accumulated input and ideas from previous activities, namely the company vision *(ST.8)* and strategic goals *(ST.9)*, with an aim to frame an eco-innovation strategy proposal, e.g., in increasing recyclability of components and packaging.

Among other things, this activity serves to distill potential innovation based on ideas generated in the TOWS analysis within the categories of Markets (1), Products (2) and Selling points (3).

Template of Products, Markets and Selling Points

Company vision	Markets	Products	Selling points
Strategic goals	1	2	3
General ideas			

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Ideas for new company's market, products and selling points, used in the activity *ST.11 Evaluate ideas for new markets, products and selling points.*

ST.10 Generate ideas for new products, markets and selling points

Eco—i Electronics

LEARNING CASE STUDY OF IDEAS FOR NEW PRODUCTS, MARKETS AND SELLING POINTS GENERATED FOR SILICON LATINA

The following ideas for Silicon Latina's new markets, products and selling points for selected general ideas are proposed:

Company vision (ST.8)

- Leading producer of quality and sustainable products that are energy efficient, repairable and recyclable.
- Working with suppliers to improve their sustainability practices and source the best materials and technologies available.
- Well-being of customers is of primary focus: we keep our products affordable and efficient, and add value through after-sale repair services, and extended producer responsibility activities that promote re-use, refurbishment and recycling.
- Staff, suppliers and downstream supply chain partners are treated fairly and cooperate to build an inclusive and sustainable value chain.

Strategic goals (ST.9)

- A reliable and stable pool of good-quality suppliers that are managed effectively and are satisfied working with Silicon Latina.
- Provide healthy conditions for anybody along the value chain in contact with our products or components.
- Life cycle material costs are known and reduced annually. Non-recyclable materials are reduced.
- Total sales increase by 10% per year, and by year 3 at least 30% of our total sales will correspond to our most sustainable products.
- Customers from all household-types understand the benefits for the environment and their budgets of Silicon Latina's refrigerators with extended lifespans, resulting in longer use of refrigerators and increase in demand for repair, upgrade and refurbishing services by 40% of users in the first 5 years of their purchase. Lower and middle-income households represent at least 50% of the sales of efficient models.
- Strive for a leadership role in the sector in the LAC region be known as a company that complies 100% with international standards and is concerned about consumers' interests.

General ideas (ST.9)

- Branch into more sustainable product range based on strong existing market position.
- Upgrade the existing take-back system to include after-sales services (repair).
- Communicate clear information on running costs, recyclability and other key sustainability issues to consumers.
- Use recycled plastics in products as a differentiator.
- Extend the lifetime of products through product design and circular business models.
- Build a resilient supply chain.
- Develop measures to prevent logistical disruptions such as more local and diverse suppliers. Consider feedback and advice from current suppliers.
- Identify and assess potential new suppliers also of replacements of HCFCs and HFCs.
- Appoint a dedicated person to carefully identify current and emerging local and international requirements and follow up compliance, if need be, linked with an international certification and communication (label).
- Create a project team led by a project manager to champion changes.
- Approach investors (interested in sustainability) to access capital for improvements based on a solid business case.
- Improve packaging and chemical practices, and integrate these new sustainable features in communication to appeal to aware consumers.
- Ensure healthy and safe working conditions for women and workers overall.
- Develop an internal process to reduce and manage use of chemicals of concern (like flame retardants) and identify the replacements of HCFC and HFCs in cooperation with upstream suppliers to support the traceability of such substances.
- Develop the 'downstream' supply chain to better manage recycling and effective disposal of tricky materials (such as plastic components and insulation foams), at the same time as improving design.

ST.10 Generate ideas for new products, markets and selling points

Eco—i Electronics



Company vision (ST.8)	Strategic goals (ST.9)	General ideas (ST.9)
...	...	...

Markets

- LAC market very important as biggest market – worth at least US$ 80 million annually (50% for each product line)
- Lower income consumer market in LAC – access to refrigeration for better food safety conditions important
- Middle income consumer market inLAC – strong emerging market with interested in new technology
- Emerging consumer market interested in sustainability – prepared to pay a premium for sustainable products
- All types of customers, from low to high income customer segment with a special focus on the customers attentive to sustainability and after-sale services (interested in repairability, recyclability, extended product life times, upgradability).

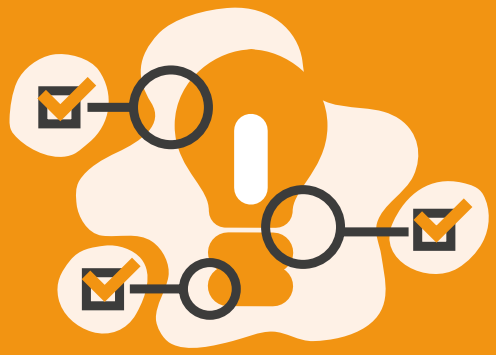
Products

- Eco-refrigerators in several sizes and with highest energy efficiency
- Circular plastic components in certified TV and computer screens
- Extended lifetimes in both cases with modularity options for upgrading them as innovations

Selling points

- Sustainability as a selling point: sustainable sourcing of materials
- Affordable (lower cost to consumers) thanks to energy efficiency and supported by consumer education about the decreased life cycle costs of the products (compared to competition)
- Enhanced customer experience – through repair, upgrade and recycling services
- Innovation: technology enabled – smart features help track energy consumption, adjust settings, trigger proactive maintenance and repair
- Reliable and local - technology already in place throughout LAC, made locally.

ST.11
Evaluate ideas for new products, markets and selling points



The aim of this activity is to evaluate in a systematic manner the ideas previously generated for new markets, products and selling points.

ORIENTATION

The eco-innovation methodology focuses on a risk profile along with a benefits profile for each of the selected strategy ideas. The method for rating risk in this activity is based on the ideas generated in the previous activity *(ST.10)* and whether the strategic idea is linked to a new or existing market, product or selling point, and anything new is associated with some degree of risk. As a complement to this approach, it is possible to identify risks included in the strategy idea evaluation.

Template of Products, Markets and Selling Points

Idea title	
Risk	**Benefit**
Product	Economic
Market	Environmental
Selling point	Social

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- An initial estimate of the risks and benefits associated with each new combination of product, market and selling point. This output is used in the activity *ST.12* Select which ideas for new markets, products and selling points to include in the strategy proposal.

ST.11 Evaluate ideas for new products, markets and selling points

Eco—i Electronics

LEARNING CASE STUDY OF STRATEGY IDEA EVALUATION

For assessing the ideas generated, the Template of Strategy Idea Evaluation provided in the Eco-i Manual is used. Based on these results, most promising ideas are selected (ST.12) for internal review (ST.13) before pitching them to the CEO (ST.14).

Idea title: Use 30% recycled material in plastic components for refrigerators and screens & remove use of flame retardants where not needed.

	RISKS		
Type of risk	**Description**	**Existing or new?**	**Risk score**
Products	Circular plastic components (with 30% recycled material in plastic components and 70% of plastic components recyclable i.e. not containing flame retardants)	New	1
Market	Domestic and export niche markets in LAC with a strong interest in sustainability	New	1
Selling point	Sustainability (sustainable sourcing and increased circularity of materials)	New	1
		Total	3
		Risk rating	Very High

BENEFITS		
Type of benefit	**Description**	**Fit with goals**
Economic	Estimated total available market of $40 million in 2020 and growing at 5% per year	**Strategic Goal 4**. Our total sales will increase by 10% per year and by year 3 at least 30% of our total sales will correspond to our most sustainable products.
Environ-mental	Generates recyclable plastic to be part of LAC's circular economy by removing chemicals of concern in flame retardants and additives. Reduces use of chemicals of concern and waste generation along the life cycle of the plastic components in refrigerators and screens.	**Strategic Goal 3**. Non-recyclable materials are reduced by 30% in both packaging and products
Social	Eliminates health risks associated with handling of chemicals of concern for manufacturing and waste management workers.	**Strategic Goal 2**. Provide healthy conditions for anybody along the value chain in contact with our products or components through active management of production and dismantling facilities, and communication with customers.

ST.11 Evaluate ideas for new products, markets and selling points

Eco—i Electronics

Idea title: Develop additional innovation options for lifetime extension of the refrigerators (such as modular design and enhanced connectivity).

	RISKS		
Type of risk	**Description**	**Existing or new?**	**Risk score**
Products	Eco-refrigerator	New	1
Market	Domestic and export niche markets in LAC with a strong interest in sustainability	New	1
Selling point	Sustainability and design product (electricity bill saving, low carbon footprint, sustainable sourcing, repairability and increased circularity of materials)	New	1
		Total	3
		Risk rating	Very High

BENEFITS		
Type of benefit	**Description**	**Fit with goals**
Economic	Estimated total available market of $40 million in 2020 and growing at 5% per year.	**Strategic Goal 4**. Our total sales will increase by 10% per year and by year 3 at least 30% of our total sales will correspond to our most sustainable products. **Strategic Goal 5**. Customers are educated on the whole-of-life costs of their appliances, and save money with Silicon Latina's refrigerators.
Environ-mental	Reduced depletion of natural resources such as critical raw materials (bauxite for aluminium). Improved energy efficiency and reduced CO_2 emissions (also through HFCs). Reduced waste generation along the life-cycle of the refrigerator.	**Strategic Goal 3**. Non-recyclable materials are reduced by 30% in both packaging and products. **Strategic Goal 5**. Repair, upgrade and refurbishing services are accessed by 40% of users in the first 5 years of their purchase.
Social	Creation of one healthy and safe job per 500 fridges sold. It will also professionalise this job through specialised training. Reduced risks of exposure to workers to chemicals of concern due to their removal, hence, healthier working conditions for workers.	**Strategic Goal 2**. Provide healthy conditions for anybody along the value chain in contact with our products or components through active management of production and dismantling facilities, and communication with customers.

ST.13

Do an individual/ group review of the business strategy



The aim of this activity is to review the business strategy that has been developed through the preceding activities.

ORIENTATION

After selecting most promising ideas for new markets, products and selling points for inclusion in the strategy proposal, you and your team will articulate a business strategy in the business strategy template for an individual or group review. This review process is key before presenting the proposal to the CEO for feedback. In this activity with support of your team you will propose and review a new business strategy of the company with inputs from the new company vision *(ST.8)*, new strategic goals *(ST.9)* and new markets, products and selling points *(ST.12)*, to include in the strategy proposal.

Template of Business Strategy



EXPECTED OUTPUTS FROM THIS ACTIVITY:

- New business strategy proposal ready to pitch to the CEO in ST.14 used in the activity *ST.14 Pitch the new business strategy to the CEO*

ST.13 Do an individual/group review of the business strategy

Eco—i Electronics

LEARNING CASE STUDY OF BUSINESS STRATEGY

Based on the assessment of ideas generated and with input of your team a new business strategy is proposed for presentation to the company and CEO.

Vision of Silicon Latina

- Leading producer of quality and sustainable products that are energy efficient, repairable and recyclable.
- Working with suppliers to improve their sustainability practices and source the best materials and technologies available.
- Well-being of customers is of primary focus: we keep our products affordable and efficient, and add value through after-sale repair services, and extended producer responsibility activities that promote reuse, refurbishment and recycling.
- Staff, suppliers and downstream supply chain partners are treated fairly and cooperate with to build an inclusive and sustainable value chain.

Market

- LAC market worth at least US$ 80 million annually (50% for each product line).
- Lower income – access to refrigeration for better food safety conditions important.
- Middle income – strong emerging market in LAC, appetite for new technology.
- Emerging green consumer – prepared to pay a premium for or sustainable products.
- All types of customers, from low to high income customer segment. Special focus on the customers attentive to sustainability and after-sale services.

Products

- Eco-refrigerators in several sizes and with highest energy efficiency (HFCF-free).
- Circular plastic components in certified TV and computer screens.
- Extended lifetimes in both cases with modularity options for upgrading them as innovations are developed.

Selling points

- Affordable (lower-cost to consumers) thanks to energy efficiency and supported by consumer education.
- Enhanced customer experience – through repair, upgrade and recycling services.
- Technology enabled – smart features help track energy consumption, adjust settings, trigger proactive maintenance and repair.
- Reliable and local - technology already in place throughout LAC, made locally.

Strategic Goals

- A reliable and stable pool of good-quality suppliers that are managed effectively and satisfied working with Silicon Latina.
- Provide healthy conditions for anybody along the value chain in contact with our products or components through active management of production and dismantling facilities, and communication with customers.
- Life cycle material costs are known and reduced (per unit) annually.
- Non-recyclable materials are reduced by 30% in both packaging and products.
- Our total sales will increase by 10% per year and by year 3 at least 30% of our total sales will correspond to our most sustainable products.
- Customers are educated on the whole-of-life costs of their appliances and save money with Silicon Latina's refrigerators.
- Lower and middle-income households represent at least 50% of the sales of efficient models, indicating accessibility beyond higher income.
- Repair, upgrade and refurbishing services are accessed by 40% of users in the first 5 years of their purchase.
- Strive for a leadership role in the sector in the LAC region and be known as a company that complies 100% with international standards and is concerned about consumers' interests.

SET BUSINESS MODEL

Defining a new business model to deliver the business strategy

Eco—i Electronics

BM.4
Generate business model concepts at the big picture level



The aim of this activity is to generate a number of business model concepts at the ‘big picture’ level.

ORIENTATION

The guidance in the Eco-innovation Manual refers to both top-down and bottom-up approaches for creating and assembling business model alternatives. The top-down approach starts with the big picture of the business model and looks for cohesive patterns and themes stemming from the strategic direction and ideas pulled together in the Strategy phase.

To support this approach, the manual provides inspiration in the form of six business model patterns (UNEP, 2017), with case examples for each. In this supplement, we provide some useful background resources for electronics. In addition, this document provides work through the business model canvas for a diversification of Silicon Latina’s activities.

The most important to understand is what combination of strategic elements to select for increasing the success chances based on the big picture ideas.

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- At least three alternative business model concepts.
- This output is used in the activities:

Throughout the step: Generating ideas at the individual building block level – if taking a ‘Top-down’ approach.
Throughout the step: Evaluate the business model concepts and select one to pitch.

BM.4 Generate business model concepts at the big picture level

Eco—i Electronics

BACKGROUND INFORMATION

Any company wishes to reduce its dependence on increasingly scarce and costly resources being virgin or natural ones, while at the same time not only minimising the burden created by waste but creating additional value and, above all, keeping an economically sustainable path for the company. This is a challenge if linear thinking is maintained. Companies seeking innovative options are embracing circular thinking. Accenture (2014) suggests five business models following circular economy patterns based on which the two business models for Silicon Latina are developed: Business Model #1 – Circular plastics in electronics; Business Model #2 – Circular and user-centric electronics.

- **Pattern 1:** Circular supplies provide fully renewable, recyclable or biodegradable resource inputs that underpin circular production and consumption systems
- **Pattern 2:** Resource recovery enables a company to eliminate material leakage and maximize the economic value of product-return flows.
- **Pattern 3:** Product life extension allows companies to extend the lifecycle of products. Value that would otherwise be lost as waste is kept or even improved by repairing, upgrading, remanufacturing or remarketing products.
- **Pattern 4:** Sharing platforms promote collaboration among product users, either individuals or organisations.
- **Pattern 5:** Product as a service* provides an alternative to the traditional "buy and own" model. Products are used by one or many customers through a lease or pay-for-use arrangement.

* Can be applied to product flows in any part of the value chain

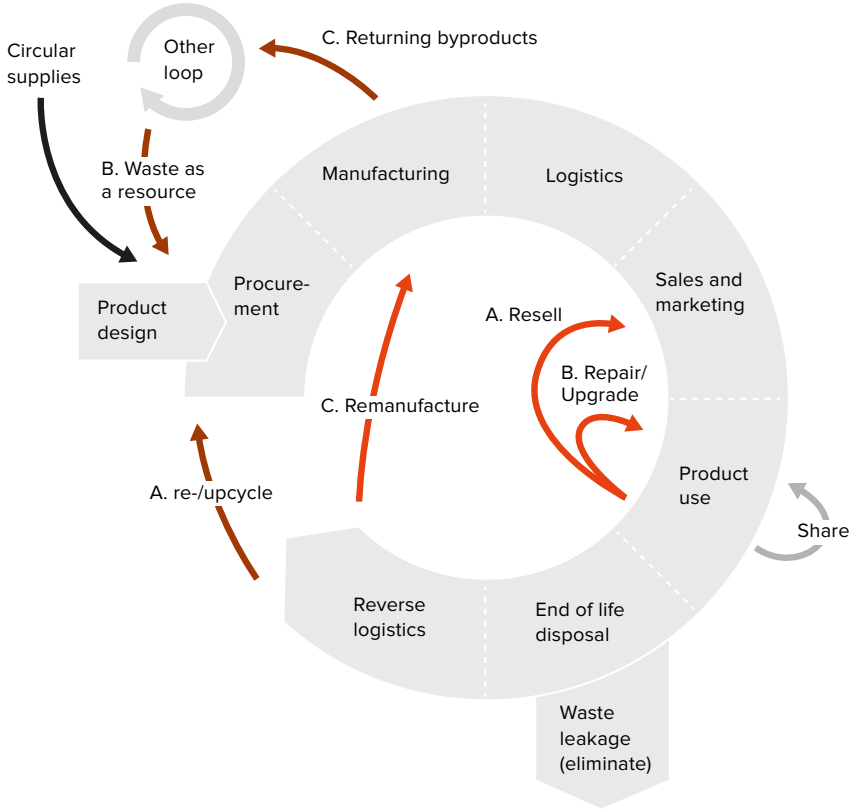


Figure BM.4-1: Examples of Business Models based on Circular Economy Patterns (Accenture, 2014)

BM.4 Generate business model concepts at the big picture level

Eco—i Electronics

LEARNING CASE STUDY OF BUSINESS MODEL CANVAS –USER-CENTRIC ECO-REFRIGERATORS & CIRCULAR PLASTIC COMPONENTS IN ELECTRONICS

Two business models are articulated along selected circular patterns of business models (Fig. BM.4-1) and further elaborated based on the strategic elements of Table ST.3-1 and on the findings of the set strategic phase (ST).

Business Model #1 – Circular plastic components in electronics

CIRCULAR PLASTICS IN TV, COMPUTER SCREENS AND FRIDGES

This business model covers technological improvements in the resource efficiency of the products, without interacting directly with the end-users. This includes improvements to components in cooperation with, for example, providers of recyclable and recycled plastics. Plastics sourced will follow the international requirements for chemicals of concern contained (type of CoC allowed and thresholds) which will ease the recovery pathway and the circularity. New plastic components will be marked by indicating the plastic types. Additional product improvements will not be visible to customers in a B2C or B2B relationship, hence, formal labels will help communicating the resource efficiency measures to them. The measures introduced are cost-efficient and should increase sales (provided a clear communication and marketing campaign is in place vis-à-vis the producers of electronics requiring these components), hence, the RoI could be under 18 months.

The value proposition focusses on 'affordable and circular products'. No additional market segments are foreseen to be attracted to these products which are perceived to an improved version of the current offering.

This business model illustrates the application of Pattern 1 – Circular Supplies and Pattern 2 - Resource Recovery.

Business Model #2 – User-centric eco-fridges

SMART, SUSTAINABLE FRIDGES WITH DEMONSTRATED ENERGY SAVINGS

Diversification of products and markets with eco-innovated and user-centric products that strengthen the customer relationship characterise business model #2. In addition to circularity improvements (see business model #1), in this model products are enhanced collaboratively by addressing customers interests and seeking new ways to create value throughout the lifetime of the products. Customers are B2C and B2B buyers.

The eco-refrigerators will be smart appliances that facilitate the use and optimise the performance of the refrigerators during operation. Smaller sizes will be available for smaller or particularly low-income households. Bigger sizes will be offered through leasing options.

The newly designed refrigerators will have two transparent doors for the cooling part to avoid unnecessary energy losses from frequent or fully opening the cooling chamber. A smart thermostat will automatically regulate the temperature based on the load or products inside the chamber and the temperature in the room. Customer assistance will facilitate optimal operation of the eco-refrigerator (to avoid energy losses). A real-time monitoring application will be included to inform the user on the savings compared to its previous consumption reference. Before 2030 when the HCFC will be banned in developing countries, these substances will be substituted as well as HFC used for isolating foam.

Material passports will be used on plastic components of the fridges and screens, enabling traceability regarding the content of recycled material and potential inhibitors of further recycling (this will promote the removal of flame retardants and additives containing chemicals of concern).

Maintenance and repairing services are offered through the retailers network and associated repairers verified by Silicon Latina. For EoL products, retailers are the designated focal points

BM.4 Generate business model concepts at the big picture level

Eco—i Electronics



for collection which will deliver the materials and products to the corresponding facilities as part of the take-back scheme setup in each country.

Patterns 1 (Circular Supplies), 2 (Resource Recovery), 3 (Product life extension) and 5 (Product as a service) are the basis for this business model.

Table BM.4-2 reflects the main aspects of the business model #2 in a canvas and was developed for Silicon Latina jointly for the two products: eco-refrigerators and eco-panels.

All these measures are possible through a close cooperation with key suppliers listed in the canvas. Especially, in the case of alternative plastic components for electronics, a change of supplier will be needed, preferably from the region (and not from South Korea where SELCo is based). A re-negotiation of the franchise with SELCo will take place.

In particular, the new eco-refrigerators in a B2C context will appeal to consumers which are more and more interested in buying from companies engaged in sustainability.

Two value propositions are shown in the business model canvas, one for each product: circular plastic components and smart fridges.

The pricing strategy will be value-based for both cases and slightly higher than the traditional products. Considering a growing market of 5% per year for both products as earlier assessed, the revenues are expected to increase 2.5 million USD per year per product.

BM.4 Generate business model concepts at the big picture level

Eco—i Electronics

As reflected in the template below, the new business model builds on core elements in the existing business model with new elements indicated by blue text. A selection of this initial set of business model elements are then considered and explored in more detail in the block-level activities BM.5 – BM.14 (note: new or refined elements are indicated in blue text).

<table>
<tr><th>Key Partners</th><th>Key Activities</th><th>Value Propositions</th><th>Customer Relationships</th><th>Customer Segments</th></tr>
<tr>
<td rowspan="2">- Retailers in Brazil and LAC countries
- Providers of HFCs and substitutes
- PakChi (packaging supplier)
- Designers of efficient cooling systems & of components fridges (sensors, IoT)
- Local refrigerator repair networks
- Alternative plastic components providers/ producers
- Partnering with SELCo for providing more sustainable components
- Partnership with TCO Certified or EPEAT
- Partnership with the Producer Responsibility Organisation (PRO) and recyclers in the value chain</td>
<td>The product development processes from design sketch, through sampling to order placement
- Customer relationship management (B2B, B2C and B2G)
- Production of refrigerators and assembly of flat panel displays incl. packaging
- Marketing communications (e.g., marketing campaign to launch the new product and features)
- Purchasing/buying, and production order monitoring incl. cooperation with providers/producers of sustainable plastic components
- Logistics
- Repairing services in cooperation with retailers
- Competencies and skills development (e.g., on repairing services and on chemicals of concern)
- Extended producer responsibility management</td>
<td rowspan="2">User-centric eco-refrigerator including app for real-time monitoring
Refrigerators with top energy efficiency thanks to an improved design and smart features to optimize operation monitoring savings in real time.

Circular plastics in electronics
Recycled and recyclable plastic components in the electronics offered to the market.

General characteristics
- Customised fridges also for leasing
- Affordable fridges with repairability features.
- Available repair and maintenance services in the LAC cities through regular training
- Attractive customer services that helps optimising energy consumption in operation, enables the maintenance and repair of the appliances, and their circularity at end-of-first-life. It also ensures responsible disposal at the end-of-life
- TCO label and energy labels show compliance with high levels of sustainability criteria and energy
- The plastic components used in the appliances include recyclable and recycled plastics
- Refrigerators are HCFC-free and using the current most environmentally friendly replacement (H-600a or R600a iso-butane with no ozone depletion potential and very low GWP (3 CO_2-eq))
- Insulation foam is CFC-free (replaced with pentanes)</td>
<td>- B2C and B2B relationships management systems.
- Customer services for the optimal use, maintenance and repair of refrigerators, leasing services
- Certain decentralisation through local retailers in main LAC cities
- B2G relationship mainly through sustainable public procurement initiatives</td>
<td rowspan="2">Direct customers
- Retailers
- Distributors

End customers
- Households in LAC (low, middle and high income)
- Educational institutions
- Health facilities
- Businesses
- Sustainable procurement initiatives</td>
</tr>
<tr>
<td>Key resources

- Franchise with SELCo for assembling electronics
- Good business relationship with suppliers of main components and of sustainable alternative components
- IT integrated system for orders, production and inventory control supporting responsible sourcing
- Motivated management staff with understanding of sustainability as a business imperative
- Quality Control system
- Production equipment
- Retailers network with technical and client services capacities
- Labels of TCO Certified or EPEAT for use in product passports</td>
<td>Channels

- Shops, supermarkets
- Online sales
- Local distributors (shops or chains)
- Commercial agents (self-employed intermediary)
- Sales force
- Newsletters to customers
- Trade centres
- Sustainability trade fairs</td>
</tr>
</table>

BM.4 Generate business model concepts at the big picture level

Eco—i Electronics

Cost structure	Revenue streams
- Technical facilities - Reduced franchise (for SELCo) due to the re-negotiation - Design & development - App development and operation for monitoring energy use savings in refrigerators - Supply chain / materials - Production costs - Labour and labour training time - Label costs - Fixed costs (wages, rents, utilities, insurances) - Logistics (transportation & distribution) - Marketing, communication & branding creation - Customer support - Repair costs for staff, equipment and infrastructure - Disposal costs	- Sales - Repair - Refurbishing **Forms of payment and financing** - Direct payment - Leasing model for fridges - A combination of the approaches above

Table BM.4-2: Canvas of business model #2 with diversification of markets with eco-innovated products and strong customer intimacy

Reference:

- Accenture (2014). Innovative Business Models and Technologies to Create Value in a World without Limits to Growth. https://www.accenture.com/t20150523t053139__w__/us-en/_acnmedia/accenture/conversion-assets/dotcom/documents/global/pdf/strategy_6/accenture-circular-advantage-innovative-business-models-technologies-value-growth.pdf

STEP

Generating ideas at the individual building block

ORIENTATION

Activities *BM.5* to *BM.14* of the Eco-I Manual unpack and explore specific blocks of the Business Model Canvas (BMC), with *BM.6* and *BM.7* both addressing different aspects of the Value Proposition block.

As described in the Eco-I Manual (p. 226), these block-level activities can be relevant for both top-down and bottom-up approaches defining new or enhanced business models.

To provide illustration of and some degree of insight for each of the nine blocks, this supplement explores the respective blocks in the initial draft of the new business model presented in BM.4 for the learning case study.

Template of Business Model Canvas

<table>
<tr>
<td rowspan="2">Key Partners

BM.13</td>
<td>Key Activities

BM.12</td>
<td rowspan="2">Value Propositions

BM.6
BM.7</td>
<td>Customer Relationships

BM.9</td>
<td rowspan="2">Key Partners

BM.5</td>
</tr>
<tr>
<td>Key Resources

BM.11</td>
<td>Channels

BM.8</td>
</tr>
<tr>
<td colspan="2">Cost Structure

BM.14</td>
<td colspan="3">Revenue Streams

BM.10</td>
</tr>
</table>

BM.5
Generate ideas for the customer segments block



This activity aims to generate ideas for how to address hotspots or strategic changes related to the customer segments block.

ORIENTATION

Electronic products consumers are segmented based on demographics (such as age, gender, spending power) and behavioural patterns including consumer choices (such as reasons for buying). In this activity, referring to the hotspots or strategic changes related to the customer segments block from the activities *ST.7 Do a SWOT analysis*, additional relevant aspects when assessing the electronics customer segments are further elaborated.

These aspects can support the refinement of the customer segments defined in *ST.3* for Silicon Latina.

Template of Business Model Canvas

<table>
<tr><td rowspan="2">Key Partners
BM.13</td><td>Key Activities
BM.12</td><td rowspan="2">Value Propositions
BM.6
BM.7</td><td>Customer Relationships
BM.9</td><td rowspan="2">Key Partners
BM.5</td></tr>
<tr><td>Key Resources
BM.11</td><td>Channels
BM.8</td></tr>
<tr><td colspan="2">Cost Structure
BM.14</td><td colspan="3">Revenue Streams
BM.10</td></tr>
</table>

EXPECTED OUTPUTS FROM THIS ACTIVITY:

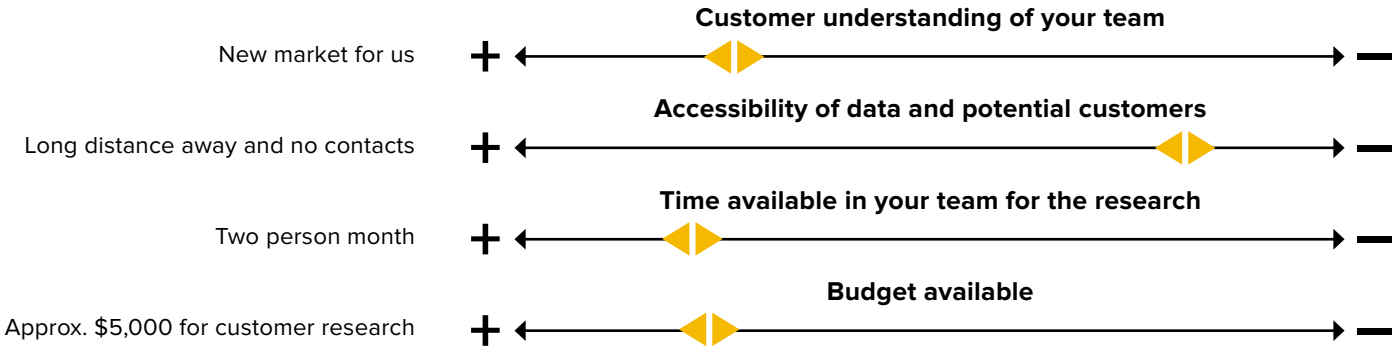
- Specific ideas for how to change the customer segments block to address the hotspots or strategic changes, used in the activities *BM.4 Generate business model concepts at the big picture level* – if taking a 'Bottom-up' approach, *BM.15 Evaluate the benefits*, *BM.16 Evaluate the costs* and *BM.17 Evaluate the risks*.

BM.5 Generate ideas for the customer segments block

Eco—i Electronics

LEARNING CASE STUDY OF CUSTOMER RESEARCH

CUSTOMER SEGMENT	SCOPE AND OBJECTIVES OF CUSTOMER RESEARCH	RESEARCH METHODS
 Middle-income LAC (MILAC) customers	• Aim of this research is to answer the following questions for the middle-income LAC (MILAC) market: - What considerations are important in their purchasing behaviour, notably sustainability and functionality aspects of the product? How does this behaviour change per age group, purchasing power and country? - Which sustainability issues are most important? • Are these customers willing to pay a price premium for products performing better in terms of most important sustainability issues? • What are the most important products' performance criteria? • What is a convenient size of a refrigerator for the needs of different household sizes? • How sensitive/active are they concerning recycling and climate change issues? • Which are the preferred refrigerators and TV/computer screen brands and retailers in the region? • Do these brands and retailers have sustainable procurement policies or certain sustainability certifications? • Do these brands and retailers have the capacity to engage in assistance, repairing and maintenance?	• Desk research – may be able to find general data on MILAC attitudes to sustainability and more detailed market data through internet research • Purchasing of data, if resources available. Market intelligence companies sell fit-for-purpose data which can save time when doing preliminary research • Industry associations data. Some associations serve their companies with targeted statistics (e,g, the Global e-Sustainability Initiative) • Telephone interviews with large retailers – as a prospective supplier they may be willing to share market information with the team • Web survey – will need to get email contacts for potential customers. Partner with large retailer to get valuable information • Test of a sample of retailers personal in order to know their technical capacities for assisting customers.



BM.5 Generate ideas for the customer segments block

Eco—i Electronics

TIPS & TRICKS

ELECTRONICS CUSTOMER FEATURES: FUNCTIONALITY-FOCUSED, DIGITAL DIVIDE, CUSTOMER INTIMACY AND ONLINE SHOPPER

Shoppers are typically segmented based on demographics (such as age, gender, spending power) and behavioural patterns including consumer choices (such as reasons for buying). Some particular aspects are worth considering when assessing the electronics customer segments.

Customers are functionality-focused. Most electronics customers worldwide are functionality-focused, meaning buyers make their choices based on technical specification and ease of use. Consumers in this segment are more than twice as likely to select 'technical specification' and 'ease of use' as important factors when buying an electrical item (Adobe, 2020, and Bacon, 2014). Pay particular attention to this segment when doing your research and making decisions on the segments to be targeted.

Increasing demand for customization. The quick pace of technological developments and emerging new players in the global market, is contributing to increasing customer expectations, demand for customisation and customer intimacy. Companies in the consumer electronics sector need to constantly identify ways to get closer to customers while maintaining profitability. This has pushed major players in the industry to develop a strong sense of brand awareness among their audience (businesswire, 2019).

Digital divide. Electronics sector segments tend to differ according to age. While seniors are increasingly making use of IT devices and electronics (according to the World Economic Forum (WEF, 2019), 70% of seniors were online in 2019), the digital divide exists, especially as increasingly sophisticated equipment can be daunting to less apt users. Pay attention to these kinds of perspectives as they may represent obstacles but also new eco-innovation opportunities with potential of great acceptability by customers.

Online shoppers. As one of the fastest growing and most competitive retail categories, the buying trends of consumer electronics (CE) are constantly evolving. Sales are increasingly shifting online which was a tendency seen since before COVID-19. Currently, buying trends like showrooming – visiting a shop to see a product before buying it online - often at a lower price – and webrooming – beating shipping times by picking up in person - are some examples that strengthen this evolution and will probably accentuate the digital divide (Smollan, 2022) (Decker, 2021).

References:

- Adobe (2020). Experience Index. 2020 Digital Trends. https://www.netscribes.com/online-consumer-electronics-buying-behavior-pre-post-pandemic/
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BM.6
Generate marketing ideas for the value proposition block



This activity aims to generate marketing ideas to address hotspots or strategic changes in the value proposition block.

ORIENTATION

This is the first of two sections exploring the value proposition block. Combining the hotspots or strategic changes related to the customer segments block from the activities ST.7 Value Proposition block, this activity applies the People, Planet, Profit (PPP) template to help extract considerations for expanding / enhancing the value proposition and how it is marketed. This is done by seeking a balance of positive sustainable impacts across stakeholders, outlined broadly as:

- People: the customer or society
- Planet: the natural environment
- Profit: the brand or manufacturer

Marketing ideas will be illustrated for the value proposition defined in ST.3 for Silicon Latina.

Template of Business Model Canvas

<table>
<tr><td rowspan="2">Key Partners
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<tr><td colspan="2">Cost Structure
BM.14</td><td colspan="3">Revenue Streams
BM.10</td></tr>
</table>

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Specific marketing ideas for how to change the Customer Segments block to address the hotspots or strategic changes, used in the activities *BM.4 Generate business model concepts at the big picture level* - if taking a 'Bottom-up' approach, *BM.15 Evaluate the benefits, and BM.16 Evaluate the costs and BM.17 Evaluate the risks.*

BM.6 Generate marketing ideas for the value proposition block

Eco—i Electronics

LEARNING CASE STUDY OF PEOPLE, PLANET, PROFIT

The learning case study follows the approach developed in the Eco-I Manual which focuses on highlighting the sustainability performance of the product and services of the company to which you are providing consultancy services. This is done by brainstorming on their benefits on society (including consumers, suppliers and workers), environment and the company in the 'People, Planet, Profit' template.

Figs. BM.6-1 and BM.6-2 illustrate this exercise for the **Business Models #1 and #2** proposed in BM.3 to Silicon Latina.

Key ideas are the ones in the centre area referred to here as 'tri-synergies. Consider these to generate new eco-innovation product and marketing after discussing 'which seem the most appealing ones', 'which are the most conflicting ones', and 'which ones are missing'? Select the Top 3 considering the value proposition. Draw upon the data and info obtained during the data gathering steps, such as in BM.1.

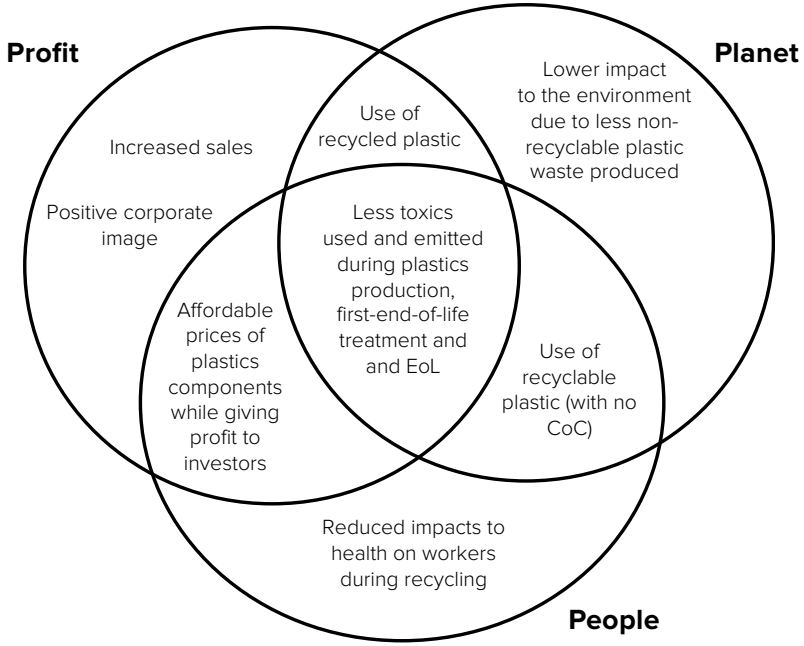


Figure BM.6-1:
PPP benefit ideas for circular component plastics of electronics **(Business Models #1)**

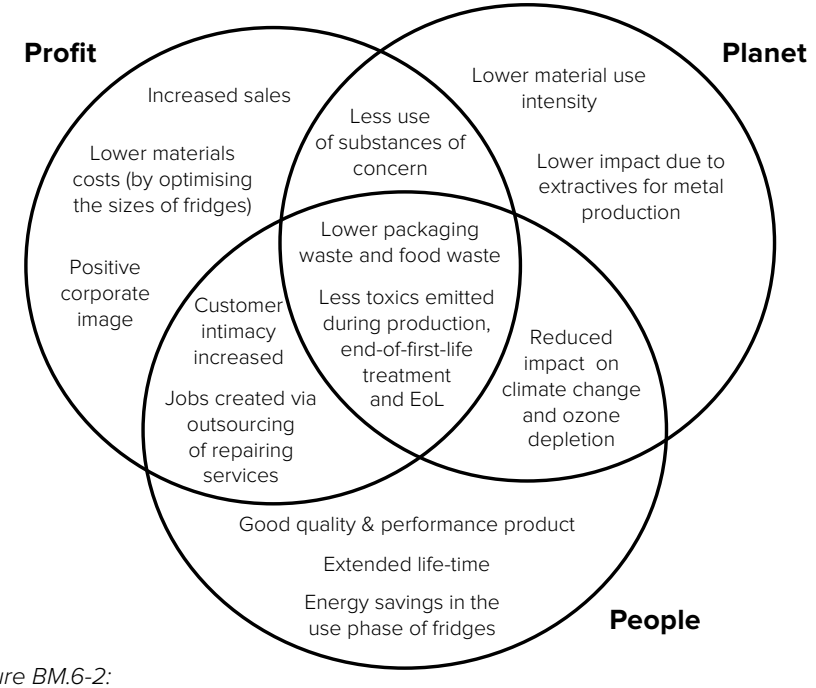


Figure BM.6-2:
PPP benefit ideas for user-centric eco-refrigerators **(Business Models #2)**

BM.6 Generate marketing ideas for the value proposition block

Eco—i Electronics

Examples of marketing ideas for the value propositions for the eco-refrigerators and eco-panels are:

Eco-refrigerators that save energy and food waste in real time

Circular plastics components in certified electronics

Reference:

- Yang, M., Vladimirova, D., & Evans, S. (2017). Creating and Capturing Value Through Sustainability. Research Technology Management, 60(3), 30–39. https://doi.org/10.1080/08956308.2017.1301001

BM.7
Generate technical ideas for the value proposition block



This activity aims to generate ideas to address hotspots or strategic changes in the value proposition block, making use of the 9 Windows on the World template.

ORIENTATION

This is the second of two activities in the eco-innovation methodology addressing the value proposition block. Whereas *BM.6* considered positive sustainability impacts and marketing ideas, *BM.7* gives technical consideration to products' negative sustainability impacts and their root causes.

As an example, the use of the Internet of Things (IoT) to prevent food waste and reduce energy consumption is identified as a technical idea by using the suggested Nine Windows technique, leading to new insights into how the value proposition could be enriched.

Technical ideas will be illustrated for the value proposition defined in *ST.3* for Silicon Latina.

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</table>

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Specific ideas for how to change the customer segments block to address the hotspots or strategic changes, used in the activities *BM.4 Generate business model concepts at the big picture level* - if taking a 'Bottom-up' approach, *BM.15 Evaluate the benefits*, and *BM.16 Evaluate the costs* and *BM.17 Evaluate the risks*.

BM.7 Generate technical ideas for the value proposition block

Eco—i Electronics

LEARNING CASE STUDY OF TECHNICAL IDEAS

For examining technical innovation opportunities to address the benefits explored in Figures BM.6-1 and BM.6-2, the Nine Windows technique is applied. Taking as example the expectation of 'less food waste' (see Figure BM.6-1), the present issue to be solved (increasing food waste) is placed at the center of the Nine Windows (in red).

- At the **super system level (e.g., at the Top Management level of the company)**, in the upper box on the left, a higher level aspect that occurred in the **past** is identified that reinforces the **current** conditions for the issue to take place. In the top box on the right side, a possible **future** positioning of the company is expressed that enables the ideal solution.
- At the **system level (e.g., at the production-design level)**, in the immediate box on the left, a key event that happened in the **past** is indicated that results in the **present** issue to be addressed. In the box on the right side, it is explained what the **future** will look like once the issue is solved.
- At the **sub-system level (e.g., in the design phase)**, in the lowest box on the left, a more specific situation in the **past** is indicated that led to a direct reason of the existing problem (at **present**). In the lowest box on the right side, the ideal **future** is expressed that allowed the innovations needed to address the issue.

The assessment at the three different levels, allows your team the identification of where the focus of your intervention could be (at a system, super system or sub-system level) and in which temporal dimension (past or present) for reaching the ideal future. In this example (see Table BM.7-1), let's assume that the assessment indicates that priority attention should be paid to the limitations imposed to designers in the past who have been recommending breaking-through sensor to convert the fridges into smarter ones (see text in blue).

	Past	Present	Future
Super system	The Top Management at Silicon Latina does not consider the continuous improvement of the sustainability of electronic appliances as a priority.	The message at Silicon Latina that zero waste in the company and its value chain is a priority has not gotten through.	The Top Management at Silicon Latina considers the savings by consumers is a key selling point and, hence, a priority.
System	Designers commissioned by Silicon Latina do not consider technological improvements for minimising food waste during the use of the fridges.	Food waste by users of Silicon Latina fridges is increasing over the years.	Economic savings from less food waste and energy savings are visible for the consumers.
Sub-system	Designer have been always criticized when recommending the use of new devices such as sensors (IoT).	Designers are still uncertain about the level of resources, freedom and creativity they are allowed to when engaging in new designs.	The Top Management at Silicon Latina clearly shows openness to new design ideas and communicate this to the designers.

Table BM.7-1: Assessment of the levels of intervention for generating technical ideas based on the Nine Windows technique

BM.7 Generate technical ideas for the value proposition block

Eco—i Electronics

Based on the assessment results at Silicon Latina to generate technical ideas (see Table BM.7-1) for reducing food waste, the designers are asked to elaborate further on the innovations of the fridges with the following results.

REDUCED FOOD WASTE THROUGH IOT AND ENERGY CONSUMPTION IN REFRIGERATORS.

A smart and discrete camera (IoT device) fitted with artificial intelligence (AI) placed inside the refrigerator transforms it into a smart ally against food waste. Every time you close the fridge door, the camera sends an update of the inside of the fridge to the Smarter app which manages an inventory of what you have in stock. This supports your shopping by preventing over-buying or forgetting what you need based on your habits. External screens on the doors can give you this information and additional hints for better using your fridge while preventing you opening and closing it so frequently.

One of the factors increasing a refrigerator's energy consumption, is a lack of air circulation. Circulating a fresh air stream at the rear of the refrigerator can reduce consumption by 15-25% (del Valle, 2017).

The internet-of-things (IoT) is a major technological trend for refrigerators and cooling systems. IoT devices have the following in common (Bradicich, 2015):

BIG ANALOG DATA.

Analog data represents the natural and physical world and is part of everything. Data considered related to levels of light, sound, temperature, voltage, radio signals, moisture, vibration, velocity, wind, motion, video, acceleration, particulates, magnetism, current, pressure, time, and location.

PERPETUAL CONNECTIVITY.

The IoT is always connected to products and allow users to monitor data, maintain the device (upgrade) and connect and nudge consumers.

REAL TIME.

Results with key data are provided on real time.

Through a similar process, ideas are generated for addressing the expectation of reducing the use of chemicals of concern in plastic components and their emissions during the production, end-of-first-life and end-of life treatment.

INCREASED RECOVERABILITY OF PLASTICS IN ELECTRONIC COMPONENTS.

Plastics components are marked with an indication of the plastic types. Contents of flame retardants and other chemicals of concern (plasticizers, colours related such as cadmium) are expressed in product sheets and provided by the suppliers. Product circularity data sheets (PCDSs) of plastics will support tracking the pathways for re-entering these components in circular flows and allow their re-use, remanufacturing for other products as well as recycling. According to a certification body (TCO Certified), in 2022, approved flame retardants and plasticizers for plastic components of electronics include the ones in Table BM.7-2.

BM.7 Generate technical ideas for the value proposition block

Eco—i Electronics

Substance name /Trade name	CAS number	Type: Plasticizer (PL) Flame retardant (FR)
Coconut Oil Polyester/GLOBINEX®T-70	854537-29-4	PL
Di(2-ethylhexyl) Terephthalate (DEHT)	6422-86-2	PL
Di(monoepoxyoleate, Monoacetate) Glyceryl Adipate	2101439-53-4	PL
Diisooctyl adipate	1330-86-5	PL
Epoxidized soya bean oil (ESBO)	2232918	PL
Oxydipropyl Dibenzoate	27138-31-4	PL
White mineral oil	8042-47-5	PL
Polyester Resin / Globinex T-80	2620689-07-6	PL
Bisphenol A diphosphate	181028-79-5; 5945-33-5	FR, PL
Triphenyl Phosphate	115-86-6	FR
Resorcinol Bis-Diphenylphosphate	125997-21-9	FR
Aluminum oxide	1344-28-1	FR
Melamine Polyphosphate/Melapur® 200	15541-60-3; 218768-84-4	FR
Aluminum Hydroxide	21645-51-2	FR
9,10-Dihydro-9-oxa-10-phospha phenanthrene-10-oxide (DOPO)	35948-25-5	FR

Substance name /Trade name	CAS number	Type: Plasticizer (PL) Flame retardant (FR)
Resorcinol Bis-Diphenylphosphate/Fyrolflex RDP	57583-54-7	FR
Substituted Amine Phosphate mixture	66034-17-1	FR
Siloxanes and silicones, di-Me, di-Ph,polymers with Ph silsesquioxanes	68648-59-9	FR
Red Phosphorus	7723-14-0	FR
Magnesium Hydroxide	1309-42-8	FR
Tetrakis (2,6-dimethylphenyl)-m-phenylene biphosphate	139189-30-3	FR
Aluminum diethylphosphinate	225789-38-8	FR
Cross-linked Phenoxyphosphazene	260408-02-4, 1184-10-7, 992-79-0	FR
Octaphenylcyclotetrasiloxane	546-56-5	FR
Phosphonic acid aluminium salt	56287-23-1	FR
Ammonium Polyphosphate	68333-79-9	FR
Phenoxyphosphazene	890525-36-7, 2791-22-2, 2791-23-3	FR
Polyphosphonate /Nofia® Phosphonate	68664-06-2	FR
Aryl bisphosphate	51732-57-1	FR
Poly[phosphonate-co-carbonate]/Nofia® Copolymer	77226-90-5	FR

Table BM.7-2: TCO Certified approved flame retardants and plasticizers for plastic components of electronics

Only waste plastics that do not contain chemicals of concern can be safely converted into plastic granulates for use in other high value products. Otherwise, they will be either incinerated or used in downgraded applications such as building components with no direct contact with populations.

References:

- Bradicich T. (2015). The 7 Principles of the Internet of Things. Published in 'Industry IoT Consortium'. https://blog.iiconsortium.org/2015/07/the-7-principles-of-the-internet-of-things-iot.html
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- SUBSPORT (2022). SUBSPORT Substitution Support Portal. https://oshwiki.eu/wiki/SUBSPORT_-_Substitution_Support_Portal
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BM.8
Generate ideas for the channels block



This activity aims to generate ideas for how to address hotspots or strategic changes related to the channels block.

ORIENTATION

To explore the channels block, the eco-innovation methodology suggests that you consider three aspects where there may be scope for sustainability gains: marketing, sales and delivery.

To support the communication of the value proposition, this section provides an orientation to the UNEP and ITC 2017 'Guidelines for Providing Product Sustainability Information'.

In the marketing process of electronics, sellers and retailers can help nudge shoppers in the direction of sustainable electronics. This will support measures targeting the consumption side and complement policies targeting the producer (and retailers) responsibility side.

These aspects can support the refinement of the channels block defined in ST.3 for Silicon Latina.

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</table>

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Specific ideas for how to change the channels block to address the hotspots or strategic changes, used in the activities *BM.4 Generate business model concepts at the big picture level* – if taking a 'Bottom-up' approach, *BM.15 Evaluate the benefits*, and *BM.16 Evaluate the costs* and *BM.17 Evaluate the risks*.

BM.8 Generate ideas for the channels block

Eco—i Electronics

TIPS & TRICKS

DEVELOP A MARKETING STRATEGY BASED ON CREDIBLE COMMUNICATION

When developing the business model ensure that the corresponding marketing strategy takes stock of the findings and ideas previously gathered and additional aspects for defining channels options.

- Consider the costs and value of different channels when developing a business model. Channels will be re-defined from one customer segment to another and from one product to another based on pricing-strategies (e.g., low cost for large audience, higher value for a small share of customers) for each case. Assess the potential cost-benefits of marketing campaigns for each segment.
- Apply the principles of the UNEP and ITC (2017) Guidelines for Providing Product Sustainability Information when developing sustainability-related claims/marketing information.

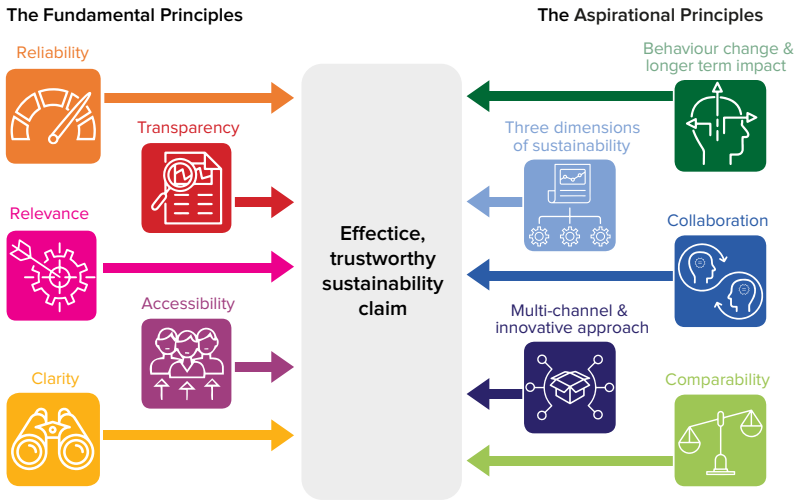


Figure BM.8-1: Fundamental and aspirational principles for sustainable claims of the UN Environment Programme, and the International Trade Centre (UNEP & ITC, 2017)

Third party certification can increase the reliability of information, in lines with the fundamental principles outlined in Figure BM.8-1. Well-known labels for electronics include for instance the TCO Certified and the EPEAT label:

- TCO Certified provides a Type 1 ecolabel for electronics, in accordance with ISO 14024. Criteria includes user health and safety, socially responsible manufacturing, environment and ergonomic design, have a life cycle perspective, covering manufacturing, use, and end-of-life or recovery phases. Certification applies to displays, desktops, notebooks, tablets, smartphones, all-in-one PCs, projectors, headsets, network equipment, data storage and servers.
- The Electronic Product Environmental Assessment Tool (EPEAT) is an ecolabel for the IT sector. EPEAT-registered products meet strict environmental criteria that address the full product lifecycle, from energy conservation and toxic materials to product longevity and end-of-life management. Certification applies to computers & displays, imaging equipment, mobiles, photovoltaic modules and inverters, televisions and servers.

ENGAGE SELLERS AND RETAILERS

A measure to start addressing the trend of increased consumption of electronics is producer responsibility, which means the seller of any electronic good has the responsibility for the product sold. An extended interpretation of 'seller' includes not only the producer but also the retailers. There is a growing awareness, however, policies targeting the producer (and retailers) responsibility side need to be increasingly complemented by measures targeting the consumption side. In electronics, sellers and retailers can help nudge shoppers in the direction of sustainable electronics by:

(a) informing about alternatives to purchasing new electronics, such as reused, repaired or refurbished products;
(b) walking-the-talk by allowing take-back options of used electronics in the store and explaining what will happen to them;
(c) clearly communicating benefits of more sustainable electronics such as energy savings linked to CO_2 emissions, economic benefits, recyclable plastics to produce new products afterwards, certification against eco-labels, reductions in packaging used and other relevant initiatives;
(d) channelling unanswered questions of customers back to brands and tracking of proper customer service.

BM.8 Generate ideas for the channels block

Eco—i Electronics

TIPS & TRICKS

Engage your retailers and sellers early in the process and align the communication and selling proposition e.g. via workshops and incentives.

A behavioural economic study (Norden, 2016) provides insightful results from applying nudging for increasing sustainable consumption of mobile phones in the age group 19 to 28 years. For this purpose, the following "green" alternatives were presented as nudging mechanism, at the time of purchase:

- buying used mobile phones.
- using products one owns longer by repairing them.

The experiments showed that a "seller" that only presents new mobile phones induces a purchase of a new phone in 29% of the cases (1st column). A seller that presents new mobile phones and a green alternative (repairs or fixing the old mobile phone) induces the purchase of a new phone in a reduced proportion (only in about 11% of the cases). See Figure BM.8-2. The difference is statistically significant. From 100 potential buyers, through nudging, only 11 bought a new mobile instead of 29 (62% less). It is assumed that the difference (at least about 18%) opted for buying a used mobile or to repair it.

These results seem promising which suggests that the nudging experiments could be successfully implemented under certain conditions: the sellers (or retailers) need to contribute to the nudging process for which they would need incentives. Clearer advantages would be job creation and increased income which could occur in smaller economies.

Compared to more industrialised countries, in the smaller economies well-spread and large numbers of repairers and refurbishers already exist which at the same time offer potential clients new devices. These are favourable nudging conditions for increasing the sustainable consumption of electronics.

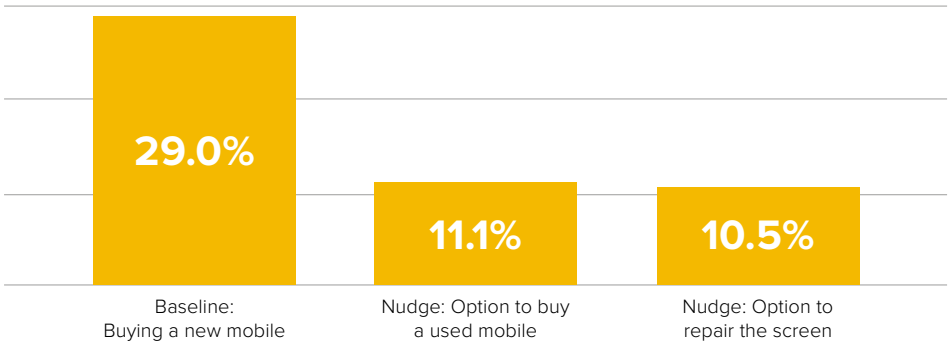


Figure BM.8-2: Changes in purchasing decision of a new mobile if other options are introduced (buy a used one or repair it)

References:

- EPEAT. About EPEAT. https://epeat.net/
- Norden (2016). Nudging for sustainable consumption of electronics. https://www.diva-portal.org/smash/get/diva2:943627/FULLTEXT01.pdf
- TCO Certified. About TCO Certified. https://tcocertified.com/
- UNEP & ITC (2017). Guidelines for Providing Product Sustainability Information. https://www.oneplanetnetwork.org/knowledge-centre/resources/guidelines-providing-product-sustainability-information

BM.9
Generate ideas for the customer relationships block



This activity aims to generate ideas to address strategic changes related to the customer relationships block.

ORIENTATION

This activity explores opportunities to enhance relations with customers based on new types and/or more frequent contact in line with changes in the value proposition. This activity involves bringing together the data related to the customer relationships block from the activities *ST.7 Do a SWOT analysis*, the business model and the operational performance.

Ideas for the customer relationships block will be illustrated for the value proposition defined in ST.3 for Silicon Latina.

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</table>

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Specific ideas for changes of customer relationships to address the hotspots or strategic changes, used in the activities *BM.4 Generate business model concepts at the big picture level* - if taking a 'Bottom-up' approach, *BM.15 Evaluate the benefits*, and *BM.16 Evaluate the costs* and *BM.17 Evaluate the risks*.

BM.9 Generate ideas for the customer relationships block

Eco—i Electronics

LEARNING CASE STUDY OF CUSTOMER RELATIONSHIPS IDEAS

Through the analysis done and data gathered in previous activities, many opportunities to enhance the relationship between the company and the customer may have emerged or can be built by linking them to the value propositions in BM.6 and BM.7. As identified in Table ST.3-1, examples to be considered in the business model linked to improving customer intimacy are illustrated below by using the Eco-I Manual template for Customer Relationship Ideas. Examples cover: the offering of electronics as a service (such as leasing or pay-as-you go models), transparency and credibility of the products and services via verified claims (such as type 1 labels), bundling of products and services (including, for example, professional maintenance and repairing as part of the guarantee), delivery services, etc.

VALUE PROPOSITION

SWOT

Customer relationships for Silicon Latina (B2B and B2C)

- Create social media presence and community platforms with a focus on sustainability where consumers can find out about the sustainability aspects of Silicon Latina's products (with regular posts, e.g., with tips for consumers)
- Offer IoT enabled refrigerators via product-as-a-service (not owning but paying for access to the appliance) in particular for B2B relationships
- Highlight third-party verified claims on products demonstrating sustainability aspects
- Communicate about the advantages of after-sale services (such as maintenance and repairs)
- Optimize purchasing and delivery services and make them user-friendly by meeting the needs and concerns of the customers

Customer relationships for Silicon Latina with retailers

- Develop incentives for retailers to promote the more sustainable products such as (i) sharing of tools and providing analytical support to showcase CO_2 emissions reduction and improved circularity to customers; (ii) offering the co-development of an online omnichannel experience with in-store technology that is consumer-friendly for finding products, obtaining information, making purchases and accessing services; (iii) providing access to the market information describing the particular features of customers preferring more sustainable products.

Additional data on the business model – linked to customer relationships

- Feedback from leasing organisations on financial aspects
- Sustainability criteria to be met for certifying the desired claim
- Feedback from the retailer network on capacities, costs and operational aspects

Additional data on operational performance – linked to customer relationships

- Feedback via the Sales department and retailer network from current customers that could be related to the new developments at Silicon Latina

CUSTOMER SEGMENT

Table BM.9-1: Ideas of customer relationships for Silicon Latina focusing on the eco-refrigerators

BM.9 Generate ideas for the customer relationships block

Eco—i Electronics

TIPS & TRICKS

ADAPT CUSTOMER EXPERIENCE IN POST-COVID-19 TIME.

McKinsey & Company (2020) encourages companies to (i) focus on care and concern, (ii) meet their customers where they are, (iii) reimagine the post-COVID-19 world (to forecast customer needs) and (iv) build agile capacities for fluid times to help address immediate customer needs and prepare for future. For example, companies should create options for meeting their customers locally e.g. via home delivery and suitable payment options, and show that the companies care through the product and service they offer.

As for your research within the partners and (potential) consumers of the company to which you are providing consultancy services, search for queries in the internet which can include ratings of the products in online selling platforms, comments in consumers' blogs and also in the internal records of the company about consumer complaints and satisfaction levels.

Back Market provides an example of customer relationships by connecting individuals interested in electronic products with experts in refurbishing selling repaired devises.

References:

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- TechSee (2019). TechSee j Shows: Consumers Return Billions of Dollars of Non-defective Electronics Annually From Sheer Frustration, Poor Customer Service. https://www.prnewswire.com/il/news-releases/techsee-survey-shows-consumers-return-billions-of-dollars-of-non-defective-electronics-annually-from-sheer-frustration-poor-customer-service-300845427.html

BM.10
Generate ideas for the revenue streams block



This activity aims to generate ideas, hotspots or strategic changes related to the revenue streams block.

ORIENTATION

While in the short-term revenue streams originating from new business models may not display potential to reach levels comparable to existing streams, they can offer an opportunity to contribute to the overall income portfolio. Noteworthy is the diversification of revenues that comes with new business models, decreasing risks of relying only on one revenue stream. There are a number of common areas to consider: maintenance, training, licensing, advertising and other relevant content.

This section provides inspiration through the Silicon Latina learning case.

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BM.8</td></tr>
<tr><td colspan="2">Cost Structure

BM.14</td><td colspan="3">Revenue Streams

BM.10</td></tr>
</table>

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Specific ideas for changes of revenue streams block to address the hotspots or strategic changes, used in the activities *BM.4 Generate business model concepts at the big picture level* - if taking a 'Bottom-up' approach, *BM.15 Evaluate the benefits,* and *BM.16 Evaluate the costs* and *BM.17 Evaluate the risks*.

BM.10 Generate ideas for the revenue streams block

Eco—i Electronics

LEARNING CASE STUDY OF REVENUE STREAMS IDEAS

In the template of Revenue Streams Ideas, examples of potential revenue streams are illustrated in for Silicon Latina.

REVENUE STREAMS

VALUE PROPOSITION

Maintenance contracts and upgrading services fees

- Offer upgrade services for the devices for a fee, for example, for installing IoT in the fridge (internal camera and a dashboard).
- Offer maintenance and repair services under the guarantee. Beyond the agreed period, these costs will be covered by the customer.

Training and licensing of maintenance and repair technicians

- Offer free training for personnel in the retailer network to provide repair and maintenance services. However, charge participants for additional specialized training (e.g., linked to new IoT technologies for refrigerators).
- Offer a brand licensing to individuals wishing to work outside the retailers' scheme of the company who will be charged licensing fees.

Take-back schemes

- Negotiate with recyclers revenues from used or broken equipment with high content of valuable materials (quality A) which was collected through the existing take-back system.

Note: Quality B would correspond to collected equipment with low valuable materials content.

Leasing of refrigerators for cold (supply) chain

- Rent refrigerators for limited periods of time which is a business model that is profitable for the company and cost-efficient especially for lower income customers to avoid upfront investment. This model offers unlimited repair and proactive maintenance.

Advertising partnerships

- Negotiate with food companies (e.g., fresh food companies) the sales of joint publicity slots. So, for example, when promoting the use of eco-refrigerators, proper cooling of fresh food can be used as an example to avoid food waste.
- Negotiate with delivery services of perishable food adverts in the refrigerator truck or chiller lorry used.

BM.11
Generate ideas for the key resources block



This activity aims generate ideas for how to address hotspots or strategic changes related to the key resources block.

ORIENTATION

The In-depth Assessment should have identified the key resources for the company, including physical, intellectual, human and financial resources. The following is a list of key resources typical for the electronics sector to help you think about how to generate new eco-innovative business models:

- Staff: Marketing and Sales, R&D, EHS, procurement
- Intellectual: The processing know-how, patents, franchises (if any), brands
- Human: Personnel with key competences such as product developers, production staff, marketing and sales staff, procurement (e.g. for recycled components)
- Financial: Capital in the company or access to capital
- Raw materials: price, volatility, availability
- Customer Relationships: marketing, sales, channel offerings (IT based, in person, others)
- Suppliers: capacities and locations (including local ones) in case of supply disruption.

A learning case study example is provided for Silicon Latina to illustrate how to unlock additional ideas for the key resources block.

Template of Business Model Canvas

<table>
<tr><td>Key Partners
BM.13</td><td>Key Activities
BM.12
Key Resources
BM.11</td><td>Value Propositions
BM.6
BM.7</td><td>Customer Relationships
BM.9
Channels
BM.8</td><td>Key Partners
BM.5</td></tr>
<tr><td colspan="2">Cost Structure
BM.14</td><td colspan="3">Revenue Streams
BM.10</td></tr>
</table>

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Specific ideas for how to change the key resources block to address the hotspots or strategic changes, used in the activities *BM.4 Generate business model concepts at the big picture level* - if taking a 'Bottom-up' approach, *BM.15 Evaluate the benefits*, and *BM.16 Evaluate the costs* and *BM.17 Evaluate the risks*.

BM.11 Generate ideas for the key resources block

Eco—i Electronics

LEARNING CASE STUDY OF KEY RESOURCES

Key resources for Silicon Latina (competitive advantage, gender equality, effectiveness of the company activities and future risks) are illustrated in the template of Key Resources Ideas.

SWOT (ST.7)

Additional data on business model
- The business aspects of leasing and take-back systems
- Customer intimacy aspects per gender
- Supply chain risks management
- Trends of prices increase of critical raw materials

Additional data on operational performance
- Mapping and analysis of capabilities of retailers for nudging experiments
- Mapping of workers retention incentives

KEY RESOURCES

In what ways could the resources of the company - including physical, intellectual, human and financial resources – be used to address hotspots or strategic challenges?

Competitive advantage
- Experienced management staff has the competences to develop the leasing business model.
- Efficient processing staff with longstanding experience can prevent increasing production costs due to changes in the lines.
- Existing take-back system can be strengthened to optimise the recovery of critical raw materials with possible additional incomes.

Gender equality
- Increase of female workers in business-to-business relationships and management positions will enhance the gender equality and, thus, the customer intimacy.

Effectiveness
- Partner with, train and reward local retailers who will be instrumental and increase the effectiveness in communicating about the sustainability attributes of the products, after-sale services and, thus, increasing the sales.
- Invest in a robust supply chain architecture to avoid any major supply disruption. The logistics network can be strengthened and the supply costs increase avoided through investments in the company's supply chain.

Future risks
- Staff could be poached by a rival processor – offer better working conditions and wages.
- Possible local or international supply disruptions.
- Increasing prices of critical raw materials used in electronics.

BM.11 Generate ideas for the key resources block

Eco—i Electronics

TIPS & TRICKS

ASSESS THE RISKS OF INCREASING PRICES OF CRITICAL RAW MATERIALS AND REDUCTION OPTIONS.

20 raw materials out of 54 used in electronics have been identified as critical raw materials according to an assessment conducted by the European Commission (EU, 2020) with magnesium, cobalt and tungsten being listed among the most critical. This assessment was based on the vulnerability of supply and relative economic importance of materials. The increasing prices in the long term (see Fig. BM.11-1) according to FocusEconomics (2022) indicate that any reduction in their use is likely to result in economic savings for the company. Target those materials or resources required for the electronics produced with highest market prices and identify reduction options through eco-innovation.

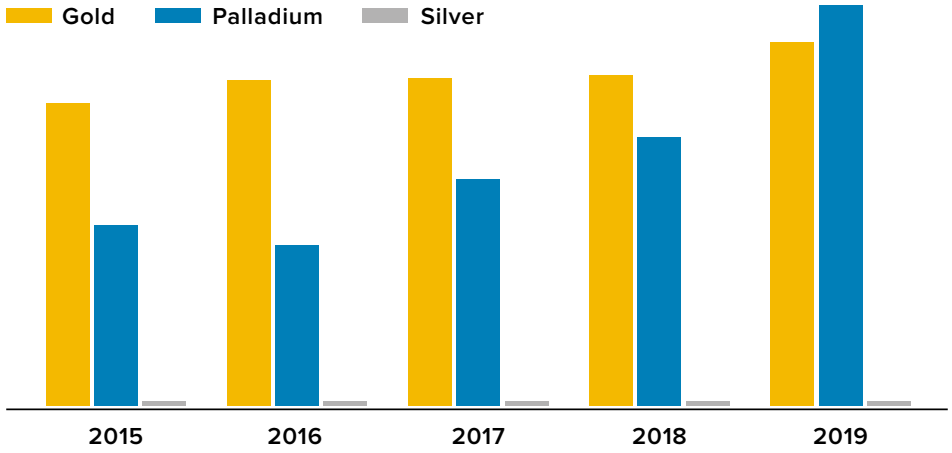


Figure BM.11-1: Trends of prices of precious metals contained in electronics (US$ per troy ounce-toz) (FocusEconomics, 2022)

References:

- EU (2020). Study on the EU's list of Critical Raw Materials (2020). https://op.europa.eu/en/publication-detail/-/publication/c0d5292a-ee54-11ea-991b-01aa75ed71a1/language-en
- FocusEconomics (2022). Precious Metals Price Outlook. https://www.focus-economics.com/commodities/precious-metals
- GoodElectronics (2019). Critical raw materials in electronics are wasted. https://goodelectronics.org/electronics-contain-valuable-raw-materials-often-go-landfill/

BM.12
Generate ideas for the key activities block



This activity aims to generate ideas for how to address hotspots or strategic changes related to the key activities block.

ORIENTATION

A good starting point for improving the sustainability performance of production processes is with conventional material flow and energy analyses. After identifying the most significant material, energy and monetary flows and any specific problems within the production system, you can use these data to focus your efforts in searching for ways to reduce the environmental, social and economic impacts of these flows. To help generate innovation ideas, systematic approaches such as the 9 Windows on the World template from the *BM.7 Generate technical ideas for the value proposition block* can be employed.

Examples of sub-activities for the key ones identified for Silicon Latina illustrate this process.

Template of Business Model Canvas

<table>
<tr>
<td rowspan="2">Key Partners

BM.13</td>
<td>Key Activities

BM.12</td>
<td rowspan="2">Value Propositions

BM.6
BM.7</td>
<td>Customer Relationships

BM.9</td>
<td rowspan="2">Key Partners

BM.5</td>
</tr>
<tr>
<td>Key Resources

BM.11</td>
<td>Channels

BM.8</td>
</tr>
<tr>
<td colspan="2">Cost Structure

BM.14</td>
<td colspan="3">Revenue Streams

BM.10</td>
</tr>
</table>

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Specific ideas for changes or improvements of the key activities to address the hotspots or strategic changes, used in the activities *BM.4 Generate business model concepts at the big picture level* - if taking a ‘Bottom-up’ approach, *BM.15 Evaluate the benefits*, and *BM.16 Evaluate the costs* and *BM.17 Evaluate the risks*.

BM.12 Generate ideas for the key activities block

Eco—i Electronics

LEARNING CASE STUDY OF IDEAS FOR KEY ACTIVITIES

For the key activities identified for Silicon Latina (see BM.4), a selection of sub-activities (in blue) are presented to clarifiy how to apply this process.

Key activities / sub-activities

- The product development processes from design sketch, through sampling to order placement
  - **R&D** particularly in designing for sustainability, for example, considering principles of lifetime extension and 3R (reduce, reuse recycling) e.g., of appliances, components then materials
- Customer relationship management (B2B, B2C and B2G)
- Marketing communications
  - **E-commerce** with new online marketing strategies and the community platform for enhanced customer experience
- Purchasing/buying, and production order monitoring incl. cooperation with providers/producers of sustainable plastic components
- Logistics
  - **Procurement of components** according to green procurement criteria or by preferring components with certified claims (such as TCO or EPEAT)
  - **Quality control** towards continuous improvement, for example by considering product stewardship and achieving requirements for certification and labelling schemes
  - **Supply chain management** to implement changes in material specifications for example
- Production of refrigerators and assembly of flat panel displays incl. packaging
  - **(Hazardous) Waste prevention and treatment** to prevent environmental and health risks, and facilitate a circular economy
  - Environmental, Health and Safety following a management system towards continuous improvement and supported with key performance sustainability metrics
- Repairing services in cooperation with retailers and other stakeholders that are part of the value chain network
- Competencies and skills development (e.g. on chemicals of concern)
- Extended producer responsibility management

BM.13
Generate ideas for the key partnership block



This activity aims to generate ideas on how to address hotspots or strategic changes related to the key activities block

ORIENTATION

For this activity, the manual provides a handful of suggested approaches particularly relevant for SMEs seeking to engage in constructive partnerships that address sustainability challenges and opportunities to strengthen the value proposition: They include:

- Work with trade associations, small business associations, free economic zones or eco-industrial parks to support engaging large groups of companies that are facing a common sustainability challenge
- Identify the partners that are already pro-actively addressing sustainability issues
- Seek out large companies that may have more influence over the supply chain
- Encourage the formation of networks or business clubs to tackle specific issues The stakeholder mapping in PR.3 should be referenced for potential partnerships.

These partnerships span the value chain and involve supply chain partners as well as market-oriented partners. Examples of partnerships identified for Silicon Latina are provided.

Template of Business Model Canvas

<table>
<tr><td rowspan="3">Key Partners
BM.13</td><td>Key Activities
BM.12</td><td rowspan="3">Value Propositions
BM.6
BM.7</td><td>Customer Relationships
BM.9</td><td rowspan="3">Key Partners
BM.5</td></tr>
<tr><td>Key Resources
BM.11</td><td>Channels
BM.8</td></tr>
<tr><td colspan="2">Cost Structure
BM.14</td><td colspan="2">Revenue Streams
BM.10</td></tr>
</table>

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Specific ideas for changing, prioritising or adding key partnerships on the basis of the existing onesto address the hotspots or strategic changes, used in the activities *BM.4 Generate business model concepts at the big picture level* - if taking a 'Bottom-up' approach, *BM.15 Evaluate the benefits*, and *BM.16 Evaluate the costs* and *BM.17 Evaluate the risks*.

BM.13 Generate ideas for the key partnership block

Eco—i Electronics

BACKGROUND INFORMATION

The following provides examples of two umbrella organisations and one company that promote partnerships along the electronics value chain. Worth noticing is the code of conduct, standard or call-to-action developed and shared by these organisations with the community; or, in the case of E-TASC, the provision and maintenance of an online tool for members-use only.

Electronics-Tool for Accountable Supply Chains (E-TASC)

E-TASC aspires to be both a community and a technology. It also functions as an ICT (Information and Communication Technology) industry standard solution for improving environmental and social practices within the electronics supply chain. The solution was created for ICT companies to effectively implement within the Global e-Sustainability Initiative (GeSI) Members and Suppliers a common approach for assessing and monitoring suppliers' Corporate Social Responsibility (CSR) practices as a means to identify supply chain risk and drive sustainability performance regarding labour, ethics, health & safety and the environment.

The reporting features within E-TASC enable companies to manage their supply chain and view assessment and audit data all in one place.

Ways of Working Together: Procedures and Standards (Fairphone, 2021)

Fairphone is a company that aims to work with partners who share the vision of creating a more fair economy..

The Fairphone 'Ways of Working Together' document summarizes its expectations regarding the policies and operational practices of its various partners and is used as a framework to assess and increase responsible business practices.

This document includes baseline standards and procedures that serve as minimum requirements; however, it does not preclude alternatives that exceed these minimums. This set of principles are applicable to the whole supply chain, including sub-suppliers and sub-contractors, vendors, service providers and other relevant third parties in the value chain.

PACE – The Electronics Program (PACE, 2022)

The Platform for Accelerating the Circular Economy (PACE) is a global collaboration platform for key public and private decision makers to share a vision, best practices, and scale the circular economy together in the electronics sector. The PACE Electronics program urges companies, governments, civil society organisations to adhere and implement the ten calls-to-action that can help accelerate the transition towards more circular electronics, and make it as impactful as possible. 1. Incentivize and Support Product Design for Circularity, 2. Enable Producers to Increase Sourcing of Recycled Content, 3. Transform Consumption Modes to Increase Market Demand for Circular Products and Services, 4. Guide and Support New Business Models for Environmental, Financial, and Social Triple-Win, 5. Encourage Bring-Back by Consumers, 6. Set Up Effective Collection Systems, 7. Enable Efficiency and Transparency in Compliant and Responsible Transboundary Movement, 8. Strategically Plan and Install Sorting, Pre-Processing, and Recycling Operations, 9. Increase Incentives for Investment in Recycling Technologies and Facilities, and 10. Integrate and Advance Decent Work in the Transition to a Circular Economy for Electronics.

References:

- E-TASC (2022). Electronics-Tool for Accountable Supply Chains. https://www.gesi.org/platforms/e-tasc-12
- Fairphone. (2021), Ways of Working Together: Procedures and Standards. https://www.fairphone.com/wp-content/uploads/2021/11/Ways-of-Working-Together-November-2021.pdf
- PACE (2022). The PACE Electronics Program. https://pacecircular.org/action-agenda/electronics
- The GoodElectronics network (2022). Members. https://goodelectronics.org/about-us/members/

BM.13 Generate ideas for the key partnership block

Eco—i Electronics

LEARNING CASE STUDY OF KEY PARTNERSHIPS

Based on a mapping of partner groups identified for the electronics value chains in PR.3 and of key partners identified in the preliminary business model canvas for Silicon Latina in BM.4, the focus in this activity is on identifying specific types of partnerships in support of eco-innovation activities, such as:

- Retailers, wholesalers and repair networks in Brazil and LAC countries for their active engagement in the new business models of the company and enhancing the customer intimacy.
- Providers of components such as plastics parts for electronics with less or no chemicals of concern. This includes plastic recyclers.
- Label organisations such as TCO or EPEAT.
- Experts on eco-innovation for the products concerned, for example, from cleaner production centres in Latin America and the Caribbean, universities and research organisations.
- National standardization bodies for closing gaps on technical aspects of electronics and eco-innovation such as the definition of targets concerning the use of recycled materials and chemicals of concern in electronics components with linkages to regulations.
- The Latin America and the Caribbean Circular Economy Coalition, chapter on electronics.
- National private or public take back systems to support the business model of increasing the circularity of the electronics after their use.

For each partner group previously mapped, the main benefits, challenges and strategies to overcome them are elaborated. See the example developed in the Table BM.13-1 for the partner group of retailers, wholesalers and repair networks in Brazil and LAC countries.

KEY PARTNERSHIPS

Partner	Main benefits of the partnership	Challenges to partnership
• Retailers, wholesalers and repair networks in Brazil and LAC countries for their active engagement in the new business models of the company and enhancing the customer intimacy.	• Longstanding relationship with commercial trust developed over-time. • National and regional outreach capacity to customers preferring more sustainable products.	• Lack of direct incentives for focusing on more sustainable products considering that these may represent many and diverse clients. • Lack of awareness concerning sustainability aspects of the product and lack of understanding about the particular features of potential clients of sustainable products.

Strategies to overcome them

Develop incentives for retailers to promote the more sustainable products such as (i) sharing of tools and providing analytical support to showcase CO_2 emissions reduction and improved circularity to customers; (ii) offering the co-development of an online omnichannel experience with in-store technology that is consumer-friendly for finding products, obtaining information, and making purchases and access services; (iii) providing access to the market information describing the particular features of customers preferring more sustainable products.

VALUE PROPOSITION

Refrigerators and eco-panels are:

Eco-refrigerators that save energy and food waste in real time

Circular plastics components in certified electronics

Table BM.13-1: Partnership benefits, challenges and strategies to overcome the challenges

BM.14
Generate ideas for the cost structure block



This sub-section aims to address hotspots or strategic changes related to the cost structure block.

ORIENTATION

The aim of this activity is to explore ways to optimise costs, either by driving spending and cost reduction while maximizing business value. In this activity, when generating the costs reduction ideas, we should not only look for 'economies of scale' or 'economies of scope' benefits, but also consider the potential negative social sustainability impacts behind the ideas.

This section also takes the opportunity to illustrate with examples potential costs optimizations when considering the cost structure block for alternative business models and value propositions.

Template of Business Model Canvas

Key Partners	Key Activities	Value Propositions	Customer Relationships	Key Partners
BM.13	**BM.12**	**BM.6** **BM.7**	**BM.9**	**BM.5**
	Key Resources **BM.11**		Channels **BM.8**	
Cost Structure **BM.14**		Revenue Streams **BM.10**		

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Specific ideas for how to change the cost structure block to address the hotspots or strategic changes,used in the activities *BM.4 Generate business model concepts at the big picture level* - if taking a 'Bottom-up' approach, *BM.15 Evaluate the benefits*, and *BM.16 Evaluate the costs* and *BM.17 Evaluate the risks*.

BM.14 Generate ideas for the cost structure block

Eco—i Electronics

TIPS & TRICKS

ASSESS THE RISKS OF INCREASING PRICES OF CRITICAL RAW MATERIALS AND REDUCTION OPTIONS

Measures to manage risks of volatile prices in the raw materials market include:

- Using a cost-plus pricing mechanism which passes on to the customer increasing costs linked to new business models with eco-innovation measures. By communicating this information to consumers (see the example of Fairphone 3 in Fig. BM.14-1), the price scheme becomes more understandable and consumers might be more likely to agree with the price.
- Having a balanced portfolio of suppliers, allowing flexibility and providing the option to shift volumes from one supplier to another.
- Reducing the use of critical raw materials to avoid availability risks and price fluctuations
- Prioritising the use of secondary raw materials (recycled materials).
- Joining waste compensation schemes through which waste management costs could be passed on to customers (see the example of Closing the Loop in Box. BM.14-2).

Closing the Loop (CTL) is a non-for-profit European social enterprise operating since 2014 with 5 employees in Europe and around 12 local African partners (one per country) responsible for their country activities. About 2000 people are engaged in CTL's supply chain who in some way or another financially benefit from its program in a way that is safe to them and their environment. CTL collects 'e-waste' (dead phones) in African countries and ensures that this waste is turned into metals. To cover the costs of its program, CTL's customers are charged a small fee per new phone, tablet, or laptop purchased which is used to responsibly collect end-of-life electronics in the concerned countries. Subsequently, the waste collected is recycled locally or shipped to authorized recycling facilities in the same region. In this way, Closing the Loop promotes waste-free electronics and, hence, circular electronics. CTL, also makes the purchase of electronics waste neutral or often described as the global version of Extended User Responsibility.

Box BM.14-2: Cost structure of the Closing the Loop initiative

Production cost: 41%

The majority of the phone's cost is spent on fair materials sourcing, components and production. Beyond the factory work at the final assembly partner Arime, this also covers the living wage bonus and funding of worker representation programs.

Operations, sales and campaigns: 21%

Fairphone invests in campaigns to raise awareness on the problems in electronics supply chains as well as the solutions. Additionally, this percentage covers all basic operating costs such as customer service, renting the offices and having a legal HR and management team.

Taxes, levies and charges: 21%

Almost a quarter of the phone's price goes towards paying taxes (like VAT), levies and other charges.

Product development, impact research: 16%

Fairphone invests in research and development of fairer material supply chains and working conditions, modular and long lasting smartphones as well as long term software support.

Profit: 1%

This is the money Fairphone generates as profit from selling each device – every phone purchased helps Fairphone to stay independent as a social enterprise and invest in social and environmental impact.

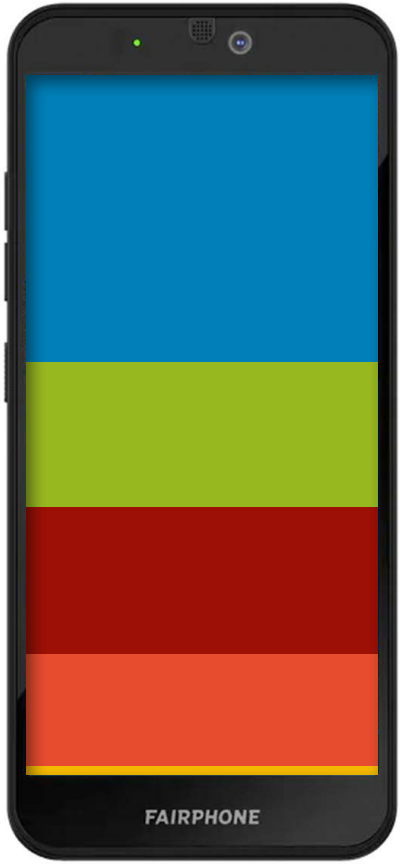


Figure BM.14-1: Cost breakdown of the Fairphone 3

References:

- Closing the Loop. Closing the Loop: Greener Procurement Safe, Solid and Engaging. https://www.closingtheloop.eu/
- Fairphone. Cost Breakdown of the Fairphone 3. https://web.archive.org/web/20210527124249/https://impact.fairphone.com/scaling-our-impact/

BM.15
Evaluate the benefits



The aim of this activity is to capture (and quantify) the benefits of each of the business model concepts in a systematic manner using the Life Cycle Thinking template.

ORIENTATION

In this activity, the potential benefits of each business model option should be captured using a simplified version of the Life Cycle Thinking template (completed in PR.4) where the benefits in terms of the six-sustainability metrics can be detailed for each phase of the life cycle.

The learning case study for Silicon Latina summarizes an array of potential benefits stemming from the business model to deliver the value proposition of user-centric and lifespan-extended fridges.

Template of Life Cycle Business Benefits

	Environmental impacts	Social Impacts	Economic impacts
Materials			
Production			
Transportation			
Use			
End of life			

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- An assessment of the business benefits of the business models concepts, used in the activity *BM.18 Integrate all the evaluations and make the final selection.*

BM.15 Evaluate the benefits

Eco—i Electronics

LEARNING CASE STUDY OF LIFE CYCLE BUSINESS BENEFITS

This example in BM.15-1 is based on the **business model #1 (Circular plastic components in electronics)** and the value propositions defined in BM.6 and BM.7.

Using the Life Cycle Business Benefits template, sustainability hotspots had been defined and strategic threats and opportunities for Silicon Latina. These results served as input for this activity (BM.15) and the final integrated evaluation (BM.18).

	Activity	Environmental impacts (positive)	Social impacts (positive)	Emissions or wastes (positive)
Materials	Sourcing of circular plastics components (recovered or recoverable) (80%) with less or no chemicals of concern	• Reduced virgin materials depletion (fossil fuels) for plastic productions • Less land use, freshwater toxicity and impacts on climate change	• Higher-skilled jobs created in the value chain inked to plastics processing technologies, auditing, plastics additives, etc. • Less impact on local communities (due to decreased plastics pollution)	• Less weight due to less unnecessary FR used; hence, lighter electronics and less transportation costs • Savings due to the sourcing of properly classified and labelled plastics components with less or no chemicals of concern while respecting health standards
Production	Assembly of plastics components	• Less risks of CoC impacts on the environment	• Reduced risks of CoC impacts on workers' health	• Negligible due to non-substantive change of technologies
Use	Safe use of plastic components in fridges and screens	• Less plastic wastes	• Reduced risks of CoC impacts on consumers' health	• Positive corporate image. • Increased exchangeability/recoverability of plastic components creates new incomes from repairing services • Access to new market niches demanding more sustainable products
End-of-life	Recovered plastics (80%) for other uses	• Increased circularity • Less plastic wastes	• Reduced risks of impacts on workers' health due to uncontrolled waste management.	• Increasing incomes for recyclers from improved recovery (in terms of quantity and quality) of plastics components and energy recovery

Table BM.15-1: Benefits of circular plastic components in electronics produced by Silicon Latina under the business model #1

BM.16
Evaluate the costs



This activity aims to capture (and quantify) the costs of implementing each of the business model concepts in a systematic manner using the Business Model Canvas template.

ORIENTATION

When considering the costs involved in implementing a business model it is worth considering two aspects. First, there are the monetary costs, which you should attempt to list and estimate. The second aspect to consider is the effort required to implement the new business model.

This activity aims to capture a high-level understanding of the additional or less effort required to implement a new business model. At this early stage, the suggested approach is to roughly gauge the gap between how the company performs today and what will be needed to perform successfully in the envisioned future business model. This can be done systematically using the respective blocks in Business Model Canvas (in BM.4).

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- An assessment of the implementation costs of the business model concepts, used in the activity *BM.18 Integrate all the evaluations and make the final selection.*

BM.16 Evaluate the costs

Eco—i Electronics

LEARNING CASE STUDY

When assessing the new costs or changes associated with new business models, the following two aspects are considered.

Effort required to implement the new business model
If two business model options are similar in terms of likely benefits, risks and economic costs, the deciding factor could simply be the effort to implement them. This requires an understanding of the gap between how the company performs today and how it needs to perform to successfully implement the business model, across all areas of the company.

The assessment of the efforts required to implement business model #2 at Silicon Latina was done by comparing the canvas blocks developed in BM.4 (see overleaf) for the new business model with the current canvas blocks (ST.3). Existing elements of the business model canvas (ST.3) are shown in black text and new or adapted ones (already introduced in BM.4) in blue text.

A scale of (**x**), (**xx**) or (**+**) is provided as follows: a green cross mark (**+**) indicates that current capabilities are likely sufficient without significant investment or implementation effort. A single red cross (**x**) indicates that some degree of development will be needed, whereas a double red cross (**xx**) identifies those areas where more significant development will be needed. No symbol against a point means that no change is required. In most cases where development is foreseen, piloting and phasing approaches are feasible.

Cost of implementing the new business model
As a next step, the monetary costs are estimated and listed in the canvas block on costs structure. The level of detail and precision may be quite 'rough' to start with – aim to assess the approximate costs the best possible and get feedback from the company. Examples of monetary costs will not be further developed for Silicon Latina.

BM.16 Evaluate the costs

Eco—i Electronics



Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
- Retailers in Brazil and LAC countries - Providers of HFCs and substitutes - PakChi (packaging supplier) - Designers of efficient cooling systems & of components (IoT sensors) **xx** - Local refrigerator repair networks **+** - Alternative plastic components providers/producers **x** - Partnering with SELCo for providing more sustainable components **x** - Partnership with EPEAT or TCO **x** - Partnership with the Producer Responsibility Organisation (PRO) and recyclers in the value chain **x**	The product development processes from design sketch, through sampling to order placement **xx** - Customer relationship management (B2B, B2C and B2G) - Production of refrigerators and assembly of flat panel displays incl. packaging - Marketing communications (e.g., marketing campaign to launch the new product and features) - Purchasing/buying, and production order monitoring incl. cooperation with providers/producers of sustainable plastic components **x** - Logistics **+** - Repairing services in cooperation with retailers **+** - Competencies and skills development (e.g., on repairing services and on chemicals of concern) **xx** - Extended producer responsibility management **+** **Key Resources** - Franchise with SELCo for assembling electronics - Good business relationship with suppliers of main components and of sustainable alternative components **x** - IT integrated system for orders, production and inventory control supporting responsible sourcing **+** - Motivated management staff with understanding of sustainability as a business imperative - Quality control system - Production equipment - Retailers network with technical and client services capacities **+** - Labels of TCO Certified or EPEAT for use in product passports. **xx**	**Eco-refrigerator including app for real-time monitoring** Refrigerators with top energy efficiency thanks to an improved design and smart features to optimize operation monitoring savings in real time. **Circular plastics in electronics** Recycled and recyclable plastic components in the electronics offered to the market. **General characteristics.** - Customized fridges also for leasing - Affordable fridges with repairability features - Available repair and maintenance services in the LAC cities through regular training - Attractive customer services that helps optimising energy consumption in operation, enables the maintenance and repair of the appliances, and their circularity at end-of-first-life. It also ensures responsible disposal at the end-of-life - TCO label and energy labels show compliance with high levels of sustainability criteria and energy - The plastic components used in the appliances include recyclable and recycled plastics - Refrigerators are HCFC-free and using the current most environmentally friendly replacement (H-600a or R600a iso-butane with no ozone depletion potential and very low GWP (3 CO_2-eq)) - Insulation foam is CFC-free (replaced with pentanes)	- B2C and B2B relationships management systems - Customer services for the optimal use, maintenance and repair of refrigerators, leasing services **+** - Certain decentralization through local retailers in main LAC cities - B2G relationship mainly through sustainable public procurement initiatives **+** **Channels** - Shops, supermarkets - Online sales - Local distributors (shops or chains) - Commercial agents (self-employed intermediary) - Sales force - Newsletters to customers - Trade centres	**Direct customers:** - Retailers - Distributors **End customers:** - Households in LAC (low, middle and high income) - Educational institutions - Health facilities - Businesses - Sustainable procurement initiatives **x**

BM.16 Evaluate the costs

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Cost structure	Revenue streams
- Technical facilities - Reduced franchise (for SELCo) due to the re-negotiation + - Design & development xx - App development and operation for monitoring energy use savings in refrigerators x - Supply chain/materials - Production costs - Labour and labour training time - Label costs x - Fixed costs (wages, rents, utilities, insurances) - Logistics (transportation & distribution) - Marketing, communication & branding creation - Customer support - Repair costs for staff, equipment and infrastructure - Disposal costs +	- Sales - Repair + - Refurbishing + **Forms of payment and financing:** - Direct payment - Leasing model for fridges + - A combination of the approaches above +

BM.17
Evaluate the risks



The aim of this activity is to capture the risks of implementing each of the business model concepts in a systematic manner based on life cycle thinking and suggest how the risks could be managed.

ORIENTATION

This activity begins with gathering an initial broad list of risks to complete the Risk Register template, followed by a rough assessment of the probability of the risk actually occurring, and the impact in the event it does occur. These two factors are then multiplied with one another to create a risk score. Risks can be identified through a combination of prior experience, the company's own scepticism, and by conducting a brainstorming session.

The learning case study for Silicon Latina offers selected examples of risks and considers key elements of the template.

Template of Risk Register

Risk Register for _____

Risk code and name	Impact description	Probability (1-3)	Impact (1-3)	Risk score	Mitigation	Contingency	Action date	Action by

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- An assessment of the implementation risks of the business model(s) concepts, used in the activity *BM.18 Integrate all the evaluations and make the final selections.*

BM.17 Evaluate the risks

Eco—i Electronics

LEARNING CASE STUDY

The risks examples concern the business model #2 proposed to Silicon Latina. The key risk identified in this example is the possible poor uptake by consumers. Mitigation and contingency measures are elaborated in the Table for facing this possible event.

Risk code and name	Impact description	Probability (1–3)	Impact (1–3)	Score	Mitigation	Contingency	Action date	Action by
Risk 01 Poor engagement of retailers	• Loss of reputation and trust amongst consumers • Loss of supply and revenue	1	3	3	• On site visits and training for retailers	Provide incentives, training and regular monitoring	Month 1 onwards	Sales manager & operations manager
Risk 02 Poor uptake by costumers	• Customers are not convinced about the energy savings • Customers are not interested in repairing and extending the lifetime	2	3	6	• Showrooms organized which will be designed based on survey results among customers on reasons about the poor uptake and for identifying possible motivations	Improve the customer intimacy and address the aspects identified as unsatisfactory by customers	Month 6	Sales manager
Risk 03 Label criteria (TCO or EPEAT) are not fulfilled	• The certification is not awarded to Silicon Latina's products	2	2	4	• Identify potential non-conformance that may impede certification ahead of time and take action	Resolve the gaps and resume the process to obtain the certification	Month 4	Sustainability department
Risk 04 Difficulties in finding suppliers of components with proven quality	• IoT developers with data protection issues unsolved • Plastics components with no proof of content (or unclear) such as the share of recycled materials and presence of chemicals of concern • Packaging materials with no proof of compostability or recyclability	2	3	6	• On site visit and demo sessions before approving new products • Expand the search for suppliers e.g. supported by the label organisations that certify high-quality products	In the short-term, focus on the most credible and reliable suppliers while expanding the suppliers pool	Month 4	Operations manager

BM.18

Integrate all the evaluations and make the final decision



This activity aims to help to select a new business model by providing a summary of key evaluation metrics for all the business model options being considered.

ORIENTATION

In this activity you and your team will summarize the evaluation you have performed using the Business Model Evaluation template. This template brings together the key metrics (the business benefits from the BM.15, the implementation costs from the BM.16, and the implementation risks from BM.11) for evaluating the business model options and will enable the selection of the best business model option.

Make sure that the senior management of the company you are providing consultancy services to is familiar with the detailed data that you have collated so that they can provide rigorous critical review and come to an informed decision.

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- A relative scoring of each of the business model options against a variety of indicators that show the benefits, costs and risks of implementing each of the new business model options.
- A recommendation as to which of the business model concepts you think the company should pursue used in the activity *BM.19 Pitch the new business model to the CEO.*

BM.18 Integrate all the evaluations and make the final decision

Eco—i Electronics

LEARNING CASE STUDY

Here results are shown for the two business models proposed for Silicon Latina. A full set of quantitative indicators (such as the return on investment -RoI- and investments needed) in a next step will support the final decision about the business model preferred by Silicon Latina.

	Metric	Current situation	Business model #1 Circular plastic components for electronics	Business model #2 Eco-refrigerator with circular components
Benefits	Resource use	2	3	5
	Ecosystem quality	2	3	4
	Human health and toxicity	2	3	3
	Other social issues: Customer intimacy	2	2	5
	Profitability	2	2	4
	Job creation and security	2	3	4
Risks	Long term risk (after mitigation actions and successful implementation)	2	4	4
	Implementation risk (High/Medium/Low)	(None)	Medium	Medium
Costs	Upfront capital investment (state cost estimate)	(None)	$ Minimum	$ Medium-High
	Implementation effort (High/Medium/Low)	(None)	Low	Medium-High

Scoring legend
0 – Option is more than 100% worse than the current situation
1 – Option worse is than the current situation
2 – Option is broadly the same as the current situation
3 – Option is better than the current situation
4 – Option is more than 50% better than the current situation
5 – Option is more than 75% better than the current situation

BUILD ROADMAP

Defining a new business model to deliver
the business strategy

Eco—i Electronics

BR.1
Prepare for the roadmapping workshop



This activity will help to create a Roadmap Development Matrix, which summarizes the benefits, costs and risks of the key innovation ideas and is required for the roadmapping workshop.

ORIENTATION

This activity will help to create a Roadmap Development Matrix, which summarises the benefits, costs and risks of the key innovation ideas which summarises the benefits, costs and risks of the key innovation ideas ideas that are required for the new business model. This comes from the relevant activities of the step Generating ideas at the individual building block level (from BM.5 to BM.14).

Template of Roadmap Development Matrix

Innovation idea title	Benefits	Capital investment	Implementation effort	Approx total cost	Implementation risk	Scheduling considerations

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Key details of the innovation ideas to be implemented captured within a Roadmap Development Matrix, used in the activity *BR.2: Do a roadmapping workshop with input from value chain partners.*

BR.1 Prepare for the roadmapping workshop

Eco—i Electronics

LEARNING CASE STUDY OF ROADMAP DEVELOPMENT MATRIX

Innovation ideas for the business model #2 of 'user-centric fridges (with demonstrated energy savings, circular components and reduced chemicals of concern contained)' are presented with highlights on benefits, resources needed, implementation risks and scheduling issues, if any. This was done by using the Roadmap Development Matrix template. The innovation ideas build on the results of the set business model phase (BM).

Innovation idea (II) title	Benefits	Capital investment	Implementation effort (and labour cost)	Approx. total cost and payback period	Implementation risk (high/medium/low)	Scheduling considerations
II-1. Use of circular plastic components with passports declaring the content (CoC, recycled content, origin)	• Increased exchangeability/ recoverability of plastic components creates new incomes from repairing services • Less weight of circular plastics due to less unnecessary flame retardants used; hence, lighter components and less transportation costs.	$15000 for researching, testing and replacing components and certifying substances contained	6 person-month ($1,500) for developing the sheets (for 3 months)	$19000. This is paid back with increased sales in the 2nd year	Low	None
II-2. Sustainable design of eco-refrigerators with two doors, including repairability features	• Attractive offer for the customer due to increased energy efficiency in the use phase and customer intimacy. • Sustainable use of materials. • Access to new customer segments with a unique positioning in market	$30,000 for research and testing and additional $30 per eco-refrigerator	4 person months ($24000) (during 9 months)	$30 per eco-refrigerator produced +$54000. This is paid back with increased sales in the 2nd year.	Medium	Need to identify tailored designers for this change
II-3. A smart IoT sensor in the eco-refrigerators for regulating the temperature	Increased energy efficiency in the use phase and customer intimacy	$3,000 for testing and additional $15 per eco-refrigerator	3 person months ($6000) (during 2 months)	$15 per eco-refrigerator produced +$9000. This is paid back with increased sales in the 2nd year.	Medium	Need to complete the two-doors innovation

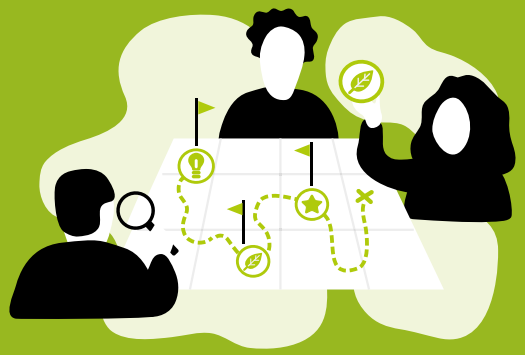
BR.1 Prepare for the roadmapping workshop

Eco—i Electronics

Innovation idea (II) title	Benefits	Capital investment	Implementation effort (and labour cost)	Approx. total cost and payback period	Implementation risk (high/medium/ low)	Scheduling considerations
II-4. A real-time monitoring application of energy savings in the eco-refrigerator	• Increased customer intimacy • Savings for the consumer	None	2.5 person months over 5 months ($5000)	$5000. This is paid back with increased sales in the 2nd year.	Low	None
II-5. Certification & claim (compliance with sustainability criteria), materials fact sheets & awareness raising	• Better informed consumers • Increased credibility of communications about the products	$10000 per product and $5 per claim – product	4 person months ($12000) (during 6 months)	$5 per product + $22000. This is paid back with increased sales in the 2nd year.	Low	Once products are ready and before marketing
II-6. Training repairers for facilitating the repair	• High-skilled jobs created • Less waste • Reduced costs for consumers for the extended lifespan of the products	$500 for the IT infra-structure	1 person month ($10000) (1 year) for developing the training videos	$10500. This is paid back with increased sales in the 2nd year.	Medium	Once products are available in the market
II-7. Marketing campaign to launch the eco-fridges	• Increased product sales (approx. $2.5 Mio per product this year)	$100,000	6 person months ($18000) (1 year)	$118000. This is paid back with increased sales in the 2nd year.	Medium	Innovation measures completed first

BR.2

Do a roadmapping workshop with input from value chain partners



Develop a roadmap that will enable the company to implement the new business model and achieve the strategic goals.

ORIENTATION

A key element described for the roadmapping process is deciding how to organise the innovation ideas into projects for eco-innovation. This could involve breaking up large innovation ideas and grouping them, with a recommended aim to end up with projects that are between 1 and 12 month(s) in duration.

The next step is to create a logical sequence in which to tackle the projects, giving consideration to any prerequisites, as well as risk levels and payback periods. Requirements regarding collaboration partners and/or key personnel should also be considered.

The learning case study below offers examples of these considerations for selected innovation ideas related to the targeted business model.

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Roadmap for eco-innovation implementation used in the activity *BR.3 Define and prioritize the requirements of the first project.*

BR.2 Do a roadmapping workshop with input from value chain partners

Eco—i Electronics

LEARNING CASE STUDY OF ROADMAP

This example illustrates in the Roadmap template for selected strategic goals (defined in ST.9), the time period of the innovation ideas (from II-1 to II-7) generated in BR.1 according to the business model #2 (user-centric fridges (smart, sustainable fridges with demonstrated energy savings). This is developed with input of key value chain partners. For example, chemical products suppliers support with the identification of circular plastics and/or with alternative flame retardants.

Strategic goals (SG) (from ST.9)	TIME
SG #3 Non-circular materials are reduced by 30% in both plastics components and products.	II-1.a Gradual substitution of the original plastic components with recoverable/recycled ones until 90% is achieved II-1.b Plastic components sheets (or passport) declaring the type, content of CoC, recycled material, origin and recyclability
SG #5 Customers understand the benefits for the environment and their budgets of Silicon Latina's refrigerators with extended lifespans.	II-2. Sustainable design of eco-refrigerators with two doors in small and big sizes II-3. Smart IoT sensors in eco-refrigerators II-4. A real-time monitoring application of energy savings in the eco-refrigerator
SG #4 Total sales will increase by 10% per year and by year 3 at least 30% of total sales will correspond to most sustainable products.	II-6. Awareness raising & training of retailers and repairers assisting customers in the optimal use and maintenance II-5. Certification of new products II-7. Marketing campaign for launching products incl. the leasing option for B2B markets Switch to user-centric business model
	Year 1: Quarter 1 | Year 1: Quarter 2 | Year 1: Quarter 3 | Year 1: Quarter 4 | Year 2: Quarters 1–4

Legend: II – Innovation Idea (from BR.1)

BR.3
Define and prioritise the requirements of the first project



This activity aims to define and prioritize the requirements for the first project for eco-innovation from the roadmap.

ORIENTATION

This activity will help organizing the requirements for the innovation idea selected with the Requirements Specification template to guide the development processThe innovation idea of the first project may come from the from the relevant activities of the step Generating ideas at the individual building block level, and the activity *BR.2 Do a roadmapping workshop with input from value chain partners.* Based on the findings from the risks, benefits and integrated assessment conducted, a priority mark (M, S, C or W) is indicated:

M - MUST have this

S - SHOULD have this if at all possible

C - COULD have this if it does not affect anything else

W - WON'T have this, this time, but would like in the future

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- Systematically captured set of requirements and their prioritization for the first project (Innovation Idea) for eco-innovation used in the activity *IM.1 Create a project plan*.

BR.3 Define and prioritise the requirements of the first project

Eco—i Electronics

LEARNING CASE STUDY OF REQUIREMENTS SPECIFICATION

This example is based on the Template of Requirements Specification and illustrates, for selected innovation ideas 1 (defined in BR.1), the specific requirements for their implementation and the priority level.

Requirements specification for: Silicon Latina S.A. – Innovation idea 1:
II-1.a Gradual substitution of the original plastic components with recoverable/recycled ones until 90% is achieved. **II-1.b** Plastic components sheets (or passport) declaring the type, content of CoC, recycled material, origin and recyclability.

Number or code	Requirement	Comments	Priority (MSCW)	Review date	Reviewed/Approved
Req01	Mapping of plastics components needed and their exposure to (high) temperatures (such as chargers) requiring higher doses of flame retardants. The mapping includes the estimation of values of the key performance indicators (KPI) at the beginning and after the implementation of the measures designed for monitoring of progress. Some KPIs are presented below: • Plastic weight (kg) and types of plastics used • Recycled plastic used (%) • Amount of flame retardants used (gr) per plastic components • Amount of substitutes to flame retardants used (gr) per plastic components according to the TCO certified list		M	15th of month 1, year 1	Operations manager
Req02	Components not exposed to high temperatures are candidates for their replacement with components with less flame retardants.	Probably this means changing the provider from SELCo to a new one.	M	30th of month 1, year 1	Operations manager
Req03	Partnering with SELCo for providing more sustainable components. In parallel, and in order to build a robust supply chain with alternative options, identify alternative suppliers preferably from local sources to reduce the risk of disruptions. Request suppliers (SELCo and alternative suppliers) for samples from testing including a certificate of content.		M	15th of month 3, year 1	Purchasing manager

BR.3 Define and prioritise the requirements of the first project

Eco—i Electronics



Number or code	Requirement	Comments	Priority (MSCW)	Review date	Reviewed/Approved
Req04	Test the new components in the production of fridges and screens.		M	01st of month 5, year 1	Operations manager
Req05	If successful testing, introduce the new plastic components with the materials sheets in the new products.		M	15th of month 7, year 1	CEO
Req06	Engage a certification body for assuring compliance with the given sustainability criteria of plastic components to be used in the eco-refrigerators and flat panel displays.		S	01st of month 9, year 1	Sustainability manager

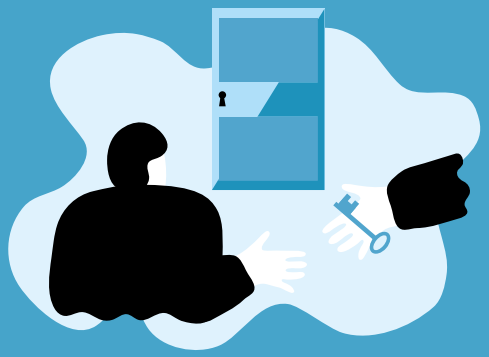
Legend:
M - MUST have this.
S - SHOULD have this if at all possible.
C - COULD have this if it does not affect anything else.
W - WON'T have this, this time, but would like in the future.

IMPLEMENT

Implementing the first project for eco-innovation that will help to realise the new business strategy and business model

Eco—i Electronics

IM.3
Provide guidance and solve problems



The aim of this activity is to provide appropriate guidance and problem-solving support for the company during the execution of the first project for eco-innovation.

ORIENTATION

By following the steps established in the Eco-I Manual, you are recommended to follow various iterations (see Fig. IM.3-1) from getting regular feedback through solving problems quickly and keeping the pig picture. Feedback from customers' representative(s) is essential and will feed the exercise of solving problems in a tailored and realistic manner while improving the customer intimacy. Creative thinking is a technique frequently used for collectively develop technical solutions.

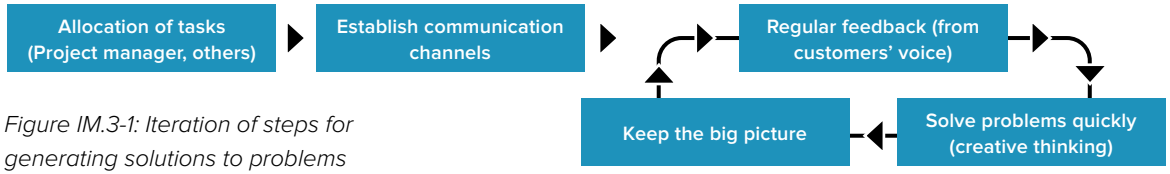


Figure IM.3-1: Iteration of steps for generating solutions to problems

The big picture to which the project is contributing to can be illustrated by using the Template of Project Implementation. This aims to keep in mind key aspects such as whether decisions being made are consistent with the business model and business strategy that have been set (in BM.4), or whether the project is having a positive impact on the company's social issues such as gender equality. Other aspects include confirming the operational areas of the company that will be impacted by this project, among other key aspects.

Template of Project Implementation

Big picture of the project	
Roles and responsibilities	Communication
Feedback from the customer	Emerging issues

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- First project for eco-innovation completed successfully, used for the Phase REVIEW, throughout the step Review the performance of the first project for eco-innovation.

IM.3 Provide guidance and solve problems

Eco—i Electronics

LEARNING CASE STUDY OF PROJECT IMPLEMENTATION

BIG PICTURE OF THE PROJECT

- What impact is energy efficiency in the use phase of eco-refrigerators having on the market? And on the branding of the company?
- How is the quality of the eco-fridges being impacted (or not) with the use of circular plastic components?
- How is the project viewed by staff? Is the culture of eco-innovation embedded in the organisation?
- How is the project perceived by the customers?

ROLES AND RESPONSIBILITIES

Project manager:
- Day-to-day project management
- Communication with project team
- Planning of tests

Production technicians:
- Implementation of tests
- Data gathering
- Support for idea generation

Service providers:
- Propose ideas to test
- Review of testing
- Communication with project team

COMMUNICATION

Weekly progress meetings:
- Managed by the project manager and attended by the project team and CEO

Via project noticeboard and smartphones:
- Managed by Project manager
- All internal audience

Progress reports:
- Managed by Project manager
- Senior management audience

FEEDBACK FROM THE CUSTOMER

- 'Customer' is represented by a retailers team
- Feedback from first progress report was positive with some adjustments to make, for example, to:
  - improve the user-friendliness of the web and smartphone application for monitoring savings of energy in eco-refrigerators and, thus, increasing its use;
  - make the very technical informative content sheets of plastics components and take-back system more accessible, by providing reader-friendly summaries for non-technical readers.

EMERGING ISSUES

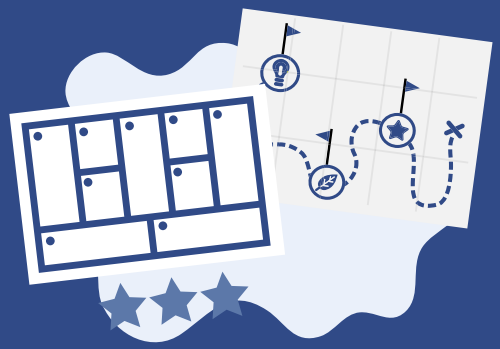
- New materials are emerging with improved qualities. Continuous research is needed on circular plastics alternatives.
- The increasing complexity of smart devices require the use of printed circuit boards which are reducing their sizes and weights over time. This technological innovation will need to be taken into account in a next eco-innovation cycle.
- Voice recognition is an emerging technology that is added to consumer products facilitating the operation of the electronic products and connection of sensors that feed with information e.g. for illustrating the efficiency levels in the use of the product (and energy savings). This should also be considered in a next eco-innovation cycle.
- The IoT is a new technology which requires reinforced training for the operational staff.
- Regular monitoring and search of (local) providers is needed for reducing the disruption risks.
- A life cycle assessment would be helpful for getting scientifically-sound results (such as on the reduction of CO_2 of the new business model) that can be communicated to the value chain holders (investors, the board, the customers). A dashboard tool is an option for presenting these results.

REVIEW

Review the performance of the first project for eco-innovation and update the future plans of the company

Eco—i Electronics

RE.3
Review the business model and roadmap



The aim of this activity is to review the business model and roadmap then make any necessary changes based on what you have learnt during the first project for eco-innovation.

ORIENTATION

According to the results of the first project for eco-innovation, this activity is to review the business model and roadmap (results from the phases of SET BUSINESS MODEL and BUILD ROADMAP) and do some adjustment with the Business Model and Roadmap Review template. Note that the focus is on the roadmap and business model because the overall strategy should not need updating regularly, although some small adjustments to the strategy and goals may be necessary at times.

The learning case study below offers examples of business model and roadmap review.

EXPECTED OUTPUTS FROM THIS ACTIVITY:

- A proposal for changes to the business model and roadmap or confirmation that no changes are required used in the activity RE.4 Present the review conclusions and agree next steps with the CEO.

RE.3 Review the business model and roadmap

Eco—i Electronics

LEARNING CASE STUDY OF BUSINESS MODEL AND ROADMAP REVIEW FOR SILICON LATINA

Results from project review

- A pool of verified providers of circular plastics components with proven quality should be setup and maintained.
- Key staff, retailers and repairers should complete training on emerging technologies such as on IoT and printed circuit boards.
- Product claims with CO_2 emissions reductions and sustainability criteria fulfilled should be certified by third-parties.

Validity of business model

- Customers expressed great interest in tracking their energy savings of using a new model of fridge that is more efficient and newly designed even if they are smaller eco-refrigerators.
- Competitors are providing similar energy efficient models at higher prices, however, with no user-friendly application (in apps downloadable in private smartphones) for monitoring 24/7.

Progress on sustainability hotspots

- Reduction of energy consumption during the use phase amounts to 30%.

Performance gaps

- No performance gaps identified.

Validity of roadmap

- One year seems adequate for developing, testing and introducing the changes in the new models; however, this depends on early success in identifying key designers and circular plastics components with the required quality.

New ideas to roadmap

- The company may consider investing in plastics laboratory equipment to ensure the quality required for the components. This will serve the certification process and feed into the requirements needed.

Roadmap order

- It is suggested to assess the technical and economic feasibility of the plastics laboratory infrastructure to ensure the quality needed.

Next project for the company

- Introduce the leasing system for electronics in order to promote the extended lifespan of products via regular maintenance and repairability, when needed.
- Introduce the pay as you go pricing mechanism for refrigerators supported with the app for monitoring savings.

Glossary of key terms

Eco—i Electronics

B2B / B2C
Business models that serve different types of customers: businesses or end-consumers. B2B stands for 'business-to-business while B2C for 'business-to-consumers'. A B2B company provides services or products to other businesses and a B2C company sells directly to end-consumers.

B2G
Business model that serves and sells directly to governments and the public sector in general. B2G stands for 'business-to-governments.'

Business model
Way a company does business. It is the translation of strategic issues, such as strategic positioning and strategic goals into a conceptual model that explicitly states how the business functions. The business model serves as a building plan that allows designing and realizing the business structure and systems that constitute the company's operational and physical form (Osterwalder et al, 2005).

Business strategy
Long term goals of a company and the markets in which the company will operate (i.e. vision and mission) (adapted from Andrews, 1997).

Compound annual growth rate (CAGR)
Rate of return that would be required for an investment to grow from its beginning balance to its ending balance, assuming the profits were reinvested at the end of each year of the investment's lifespan (Investopedia, 2022).

Chemical of concern or substance of concern
Hazardous substances that are particularly dangerous for human health or the environment, as they cause effects for life (from the 'Green Deal: Chemicals Strategy towards a toxic-free environment – Questions and Answers' (European Commission, 2020)).

Circular Economy
Economy that is restorative and regenerative by design, and which aims to keep products, components and materials at their highest utility and value at all times, distinguishing between technical and biological cycles (ISO 20400:2017, 3.1).

Consumer
Individual member of the general public purchasing or using property, products, materials or services for private purposes.

Cost plus pricing
Method in which the selling price is set by evaluating all variable costs a company incurs and adding a markup percentage to establish the price.

Customer
Organisation or individual member of the general public purchasing property, products or services for commercial, private or public purposes. A customer does not necessarily consume a purchased product or service. A customer can be part of a value chain, adding value to a given product or service.

Critical raw material
Materials (3.2.7) that, according to a defined classification methodology, are economically important and have a high-risk associated with their supply (ISO 14009:2020, 3.2.14).

Design for disassembly
Approach to the design of a product that facilitates disassembly at the end of its useful life, in such a way that enables components and parts to be reused, recycled, recovered for energy or, in some other way, diverted from the waste stream (ISO 14021:2016).

Due diligence
Comprehensive, proactive process to identify the actual and potential negative social, environmental and economic impacts of an organisation's decisions and activities over the entire life cycle of a project or organisational activity, with the aim of avoiding and mitigating negative impacts (ISO 26000:2010, 2.4).

Ethical behaviour
Behaviour that is in accordance with accepted principles of right or good conduct in the context of a particular situation and is consistent with international norms of behaviour (ISO 26000:2010, 2.4).

Gender
Roles, behaviours, activities, and attributes that a given society at a given time considers appropriate for men and women. These attributes, opportunities and relationships are socially constructed and are learned through socialization processes. They are context/time-specific and changeable. (UN Women).

Gender discrimination
Any distinction, exclusion or restriction made on the basis of sex which has the effect or purpose of impairing or nullifying there cognition, enjoyment or exercise by women, irrespective of their marital status, on the basis of equality of men and women, of human rights and fundamental freedoms in the political, economic, social, cultural, civil or any other field (Art.1 CEDAW, 1979).

Glossary of key terms

Gender equality
Equal rights, responsibilities and opportunities of women and men and girls and boys. Equality does not mean that women and men will become the same but that women's and men's rights, responsibilities and opportunities will not depend on whether they are born male or female. Gender equality implies that the interests, needs and priorities of both women and men are taken into consideration, recognizing the diversity of different groups of women and men. Gender equality is not a women's issue but should concern and fully engage men as well as women. (UN Women)

Gender-sensitivity
Ability to address existing gender inequalities when designing and implementing development projects, programs or policies.

Hotspot
Unit process or a phase of the life cycle of a product that has a significant potential social or environmental impact. Social hot spots can also be associated with a geographical location. Even if there is no quantitative criterion for determining a hot spot, a hot spot should contribute substantially to the total impacts of an impact category. (From the UNEP 2020 Guidelines for the Social Life Cycle Assessment of Products and Organisations).

Impact of an organisation
Positive or negative change to society, economy or the environment, wholly or partially resulting from an organisation's past and present decisions and activities (ISO 20121:2012, 3.44).

Initiative for social responsibility
Programme or activity expressly devoted to meeting a particular aim related to social responsibility.

Note: Initiatives for social responsibility can be developed, sponsored or administered by any type of organisation.

Life cycle
Consecutive and interlinked stages of a product (good or service) system, from the extraction of natural resources to the final disposal (adapted from ISO 14040:2006, 3.1).

Life cycle assessment
Systematic set of procedures for compiling and examining the inputs and outputs of materials and energy and the associated environmental impacts directly attributable to the functioning of a product throughout its life cycle (adapted from 14040:2006, 3.2).

Life cycle thinking
Mostly qualitative approach to understand how our choices influence what happens at each of the stages of the life cycle of an industrial activity: from raw material acquisition through manufacture distribution, product use and disposal. This approach is needed in order for us to balance trade-offs and positively impact the economy, the environment, and society (UN Environment Programme, 2004).

Marketing
Set of activities that are designed to help the company to understand the type of product it should offer to a market and communicate the benefits and value of the product to the targeted consumer. Marketing focuses on the product, promotion, price and distribution channels.

Market analysis
Activity of gathering information about the size, growth, profitability, target groups and existing products of a market, which is used to inform decision making at a strategic level. This specific activity would fall under the broader umbrella of marketing activities.

Modular
Composed of modules for easy construction or arrangement and adaptation or disassembly (ISO 20887:2020,3.22).

Obsolescence

Loss of ability of an item to perform satisfactorily due to changes in performance requirements (ISO 15686-1:2011, 3.14).

Organisation
Company, corporation, firm, enterprise, authority or institution, person or persons or part or combination thereof, whether incorporated or not, public or private, that has its own functions and administration (ISO 30000:2009, 3.10).

Organisational governance
System by which an organisation makes and implements decisions in pursuit of its objectives (ISO 26000:2010, 2.13).

Organisation structure
Arrangement of authority, responsibility and accountability in an organisation (ISO 30400:2016, 3.3).

Roadmap
Detailed plan to guide progress towards a goal (ISO/IEC/IEEE 26511:2018, 3.1.25).

Refurbishment
Modification and improvements to an existing product or component in order to bring it up to an acceptable condition (adapted from HSE, 2022).

Glossary of key terms

Social dialogue
Negotiation, consultation or simply exchange of information between or among representatives of governments, employers and workers, on matters of common interest relating to economic and social policy (ISO 23326:2022, 3.1).

Social responsibility
Responsibility of an organisation for the impacts of its decisions and activities on society and the environment, through transparent and ethical behaviour that
- contributes to sustainable development, including the health and welfare of society;
- takes into account the expectations of stakeholders;
- is in compliance with applicable law and consistent with international norms of behaviour;
- is integrated throughout the organisation and practised in its relationships

Note 1 to entry: Activities include products, services and processes.
Note 2 to entry: Relationships refer to an organisation's activities within its sphere of influence. (ISO 26000:2010, 2.18).

Stakeholder
Any group or individual who can affect, or is affected by, an organisation or its activities. Also, any individual or group that can help define value propositions for the organisation (Stakeholder Research Associates Canada Inc., United Nations Environment Programme, AccountAbility: Stakeholder Engagement, 2005).

Substance of very high concern
Chemical substance (or part of a group of chemical substances) which fulfil the following criteria according to the European article 57 of the REACH Regulation:
- it is carcinogenic;
- it is mutagenic;
- it is toxic for reproduction;
- it is persistent, bio-accumulative and toxic (PBT substances);
- it is very persistent and very bio-accumulative (vPvB substances);
- there is "scientific evidence of probable serious effects to human health or the environment which give rise to an equivalent level of concern"; such substances are identified on a case-by-case basis.

Stakeholder engagement
Activity undertaken to create opportunities for dialogue between an organisation and one or more of its stakeholders , with the aim of providing an informed basis for the organisation's decisions (ISO 26000:2010, 2.21).

Supply chain
System of organisations, technology, activities, information and resources involved in moving a product or service from supplier to customer (Michael Porter 1985).

Sustainable development
Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Transparency
Openness about decisions and activities that affect society, the economy and the environment, and willingness to communicate these in a clear, accurate, timely, honest and complete manner (ISO 26000:2010, 2.24).

Value chain
Entire sequence of activities or parties that provide or receive value in the form of products or services (ISO 26000:2010, 2.25).

Value chain partners
Parties in the value chain that provide or receive value including suppliers, outsourced workers, contractors, customers ,consumers, clients, members, and others.

Value proposition
Promise of measurable benefits resulting from the collaboration (ISO 44001:2017, 3.30).

Vulnerable group
Individuals who share one or several characteristics that are the basis of discrimination or adverse social, economic, cultural, political or health circumstances, and that cause them to lack the means to achieve their rights or otherwise enjoy equal opportunities.
(ISO 22300:2021, 3.1.292).

Worker
Person who performs work, whether an employee or someone who is self-employed (ISO 26000:2010, 2.27).

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