Eco—i Manual

Metals Supplement

UN environment

DTU

European Commission

Disclaimer

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the United Nations Environment Programme concerning the legal status of any country, territory, city or area or of its authorities, or concerning delimitation of its frontiers or boundaries. Moreover, the views expressed do not necessarily represent the decision or the stated policy of the United Nations Environment Programme, nor does citing of trade names or commercial processes constitute endorsement.

ISBN: 978-92-807-3635-9

Eco—i Manual
Metals Supplement

UN ENVIRONMENT ECONOMY DIVISION

Sustainable Lifestyles, Cities and Industry Branch

1 rue Miollis
Building VII
75015 Paris
Tel: +33 1 44371450
Fax: +33 1 44371474
E-mail: economydivision@unep.org
Internet: www.unep.org

TECHNICAL UNIVERSITY OF DENMARK

Department of Mechanical Engineering
Engineering Design and Product Development

Nils Koppels Allé Building 404
DK- 2800 Kgs. Lyngby
Tel (+45) 45 25 19 60
Fax: (+45) 45 25 19 61
E-mail: info@mek.dtu.dk
http://www.mek.dtu.dk/

About the UN Environment Economy Division

The UN Environment Economy Division helps governments, local authorities and decision-makers in business and industry to develop and implement policies and practices focusing on sustainable development.

The Division works to promote:

- sustainable consumption and production,
- the efficient use of renewable energy,
- adequate management of chemicals,
- the integration of environmental costs in development policies.

The Office of the Director, located in Paris, coordinates activities through:

- The International Environmental Technology Centre - IETC (Osaka, Shiga), which implements integrated waste, water and disaster management programmes, focusing in particular on Asia.
- Production and Consumption (Paris), which promotes sustainable consumption and production patterns as a contribution to human development through global markets.
- Chemicals (Geneva), which catalyzes global actions to bring about the sound management of chemicals and the improvement of chemical safety worldwide.
- Energy (Paris), which fosters energy and transport policies for sustainable development and encourages investment in renewable energy and energy efficiency.
- OzonAction (Paris), which supports the phase-out of ozone depleting substances in developing countries and countries with economies in transition to ensure implementation of the Montreal Protocol.
- Economics and Trade (Geneva), which helps countries to integrate environmental considerations into economic and trade policies, and works with the finance sector to incorporate sustainable development policies.

UN Environment activities focus on raising awareness, improving the transfer of knowledge and information, fostering technological cooperation and partnerships, and implementing international conventions and agreements.

For more information see www.unep.org

Acknowledgements

The sector specific supplement for metals value chains, as an integral part of the Eco-innovation Manual, has been commissioned by the United Nations Environment Programme (UN Environment) and is the result of close collaboration with International Support for Sustainable Products and Production (issppro).

Lead authors: Sonja Bauer with contributions from Craig Hawthorne and Sanja Uršanić.

Supervision and coordination at UN Environment, Economy Division: Elisa Tonda, Andrea Floudiotis, Liazzat Rabbiosi, and Katie Tuck.

The working version of sector specific supplement for metals value chains was tested during the implementation of the 'Resource Efficiency and Eco-Innovation in Developing and Transition Economies' project by project teams of SIRIM Berhad in Malaysia, Egypt National Cleaner Production Centre in Egypt, Centro Nacional de Producción Más Limpia y Tecnologías Ambientales in Colombia, Council for Scientific and Industrial Research in South Africa and CER/Grupo GEA in Peru. UN Environment is grateful for their committed work in testing and applying the eco-innovation manual's methodology and sector specific supplement with Small and Medium Enterprises for metals value chains in their respective countries and for their invaluable feedback from this experience.

UN Environment acknowledges the following people that provided comments to the preparatory work for the conceptual and methodological formulation of the sector specific supplement of the metals value chains: Craig Jones, Markus Reuter, Tomas Marques, Jakob Johann Fleischmann, Daniel Ayes, Adriana Alzate, Tatiana Botelho, Jorge Perez, Sonia Valdivia, Puji Lestari, Girish Sethi, and Ahn Hak Hoon.

In addition, UN Environment acknowledges the valuable contribution made by the following people: Feng Wang, Faycal Boureima, Vera Barrantes, Kevin Ramirez, Reinhard Joas, Jamie O'Hare, Karina Boers and Helena Rey.

Special thanks also go to the participants of the Regional validation and training workshops in five global regions of Asia Pacific, Africa, Latin America and the Caribbean, Europe and West Asia. Too numerous to mention, their inputs and provision of comments have also significantly helped to tailor this supplement to the needs of the end user.

Design activities were led by Mercè Rua and Adrià Garcia i Mateu from Barcelona-based design collective HOLON.

UN Environment gratefully acknowledges the funding support of the European Commission to the 'Resource Efficiency and Eco-Innovation in Developing and Transition Economies' project and related activities.

Table of contents

Eco—i Metals

List of activities with supplementary content

Eco—i Metals

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

**Activities not covered in the supplement are faded*

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

List of activities with supplementary content

Eco—i Metals

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

SET BUSINESS MODEL

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 Metals

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

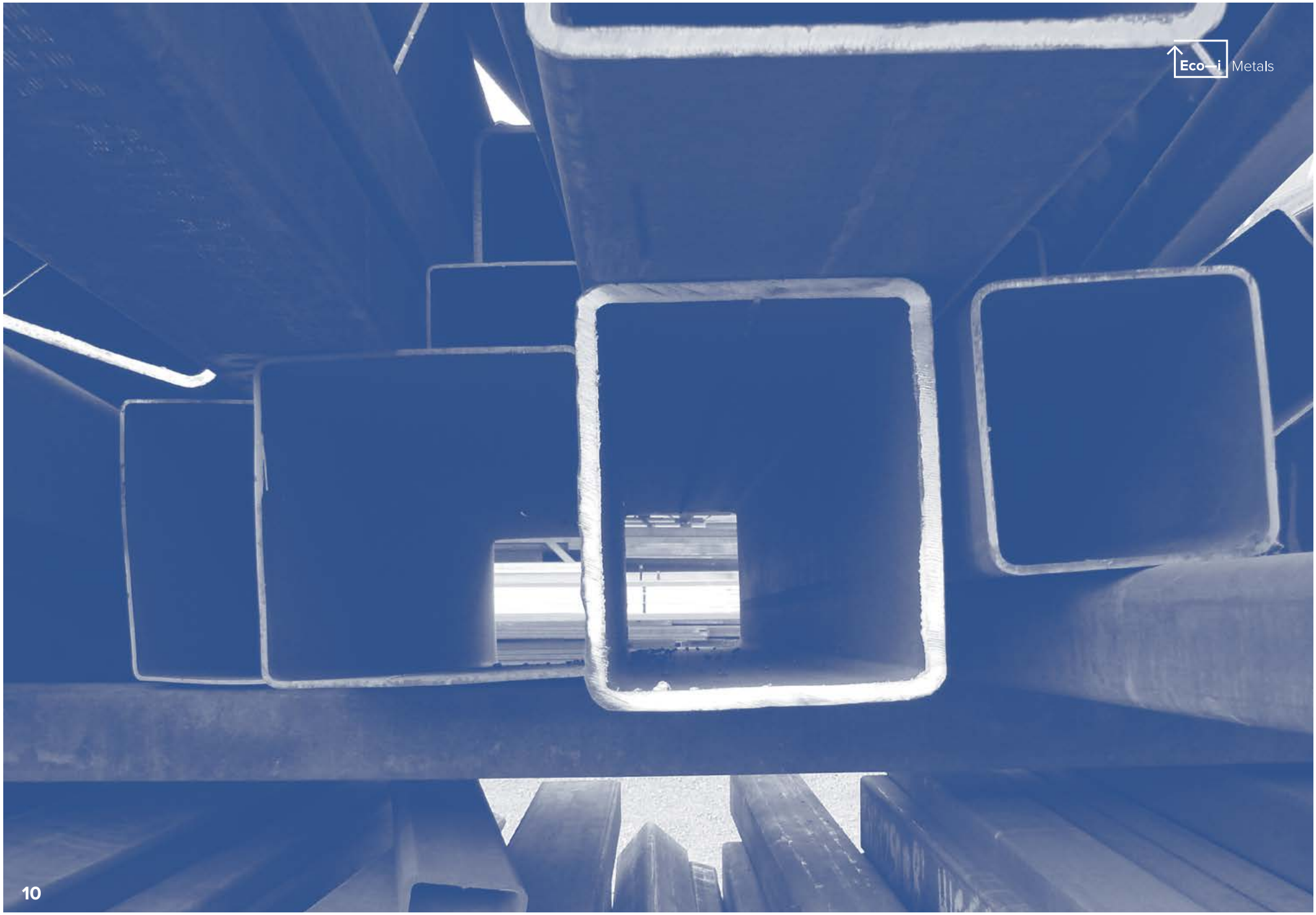
Do a project review workshop
RE.1

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


Eco—i Metals

Introduction

Metals are a key resource in the modern world and are constantly being modified to meet new demands in every area of engineering and technology. Various types of metals, e.g. ferrous and non-ferrous, are commonly used in different applications depending on specific metals properties to fulfil desired requirements.

This supplement will focus on highlighting eco-innovation opportunities along the metals value chain including fabrication, manufacturing, use and recycling (dashed lined in Figure 1). Though mining, refining, and metals processing will not be specifically addressed in this supplement, they are important in this context since they are linked to specific trends and related sustainability challenges relevant for the downstream metal value chain, e.g. raw material scarcity, energy intensity, working conditions in the extraction industry.

Building on these principles and the methodology presented in the Eco-innovation Manual, this supplement provides specific information to advance eco-innovation with companies in this metal products' value chain. It is complementary to the Eco-innovation Manual and not a stand-alone guide. Similar to the Eco-innovation Manual, this supplement makes use of a learning case study of a fictional company in a developing country, BikeBizz Co. to illustrate the implementation of the eco-innovation methodology and selected templates applicable to the metal value chain.

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 Metals


gram on the Life Cycle Thinking
t at raw materials)
holders matrix
oordinates (e.g. B2, D4) in top

PR.1
Evaluate potential markets

Eco—i Metals

PR.1 Evaluate potential markets

Eco—i Metals

TIPS & TRICKS

GUIDE COMPANY SELECTION USING TARGETED QUESTIONS

You may consider using the following questions to help identify the type of company you should be targeting in the selected markets:

- Which end markets are most attractive from a Value Proposition perspective?
- What type of companies in the metals value chain are providing goods or services to these end markets and where are they located in the value chain?
- Which value chain steps create the most value?

Based on this, you can pose some additional company specific questions:

- What key sustainability capabilities can metals sector companies in these value chains or markets offer to achieve a competitive advantage?
- What is the potential for the metals sector company to engage value chain partners and offer sustainable solutions to end markets?

USE ENVIRONMENTAL IMPACT DATA TO SELECT RELEVANT SUB-SECTORS TO TARGET

Table 1 provides information on the environmental impacts of specific subsectors in the metals sector, which can help with the market-level analysis described in the Eco-innovation Manual. For example, the manufacturing of electrical equipment tends to have high environmental impacts, with respect to energy and water consumption as well as waste water and CO_2 emissions, whereas the fabrication of metal products tends to have high environmental impacts with respect to material and water consumption.

Table 1: Comparison of resource efficiency and environmental impact of metals industry subsectors (Note: Rankings are based on data from Germany, 2010 [VDI, 2013])

Selected subsectors	Energy	Material	Water	Waste water	CO2-Emm.
C25-Fabrication of metal products	2	5	4	5	1
C26-Manufacture of computer, electronic & optical products	4	2	1	1	3
C27-Manufacture of electrical equipment	5	4	6	6	5
C28-Manufacture of machinery	3	3	5	4	4
C29-Manufacture of motor vehicles	1	1	3	3	2
C30-Manufacture of other transport equipment	6	6	2	2	6

Notes: The ranking is assigned vertically. The highest ranking means that subsector has the highest resource intensity and therefore the highest environmental impact for that category. (1=lowest impact, 6=highest impact).

PR.1 Evaluate potential markets

Eco—i Metals

TAP INTO CONSUMER DEMAND

End-market demand in the metals value chain is showing a growing need to address sustainability challenges arising from emerging trends such as urbanization and changing consumption patterns (e.g. consumer lifestyle). It is therefore possible to picture opportunities for companies in the metals value chain in supplying the expanding sustainable buildings end-market. This includes mainstreaming a range of regionally appropriate practices and technologies that promote on-site renewable energy, water, and resource efficiency. More specifically, this could mean an expansion of the market for renewable, recycled and resource efficient metal materials and the development of newer, more durable, and high-strength metal products, as well as an increasing demand for energy efficient cooling and heating technologies, etc. LEED (Leadership in Energy and Environmental Design), for example, is already certifying more than 139,000m^2 of building space every day in more than 130 countries and it is only one of several green building standards around the world [UN Environment, 2013]. For more information on these and related issues, you can refer to UN Environment's work on promoting related resource efficient and sustainable consumption and production (SCP) including activities on Sustainable Cities and Buildings.

CONSIDER MULTIPLE ECO-INNOVATION OPPORTUNITIES IN AN EXPANDED METALS VALUE CHAIN

The various metals value chain subsectors serve a wide spectrum of end markets linked to economic development, such as the automotive, construction, energy, electrical & electronic equipment (EEE) industries. An example of a viable market for eco-innovation implementation services could be companies servicing the automotive industry, since this sector is faced with many pressures (e.g. regulation, market demand, health and environmental issues, profitability) that drive the industry to deliver new sustainable mobility solutions. Companies that wish to cooperate with the automotive industry need to find alternative solutions (e.g. products and services) and create business models that can save resources, improve recycling strategies, and increase profitability. The metals sector has highly integrated and globalized value chains, thereby providing opportunities for developing and emerging economies to access local markets as well as regional and international export markets.

UNDERSTAND THE SUSTAINABILITY CRITERIA USED BY CUSTOMERS

When performing your market research, you may also identify how customers judge sustainability performance and whether they have established certain sustainability criteria. For example, the EU market offers potential for export manufacturers of metal parts and components that are able to supply advanced components customized according to the need of end-users, especially if they are able to do coating treatments in-house, following process certification according to ISO 14001 and being compliant with the RoHS Directive.

PR.1 Evaluate potential markets

Eco—i Metals

BACKGROUND INFORMATION

Most metals are used in alloy form, which is a material composed of two or more metals, or a metal and a non-metal.

The metal life cycle starts with mining of raw material (i.e. metal ores) and refining them for the process of primary metal manufacturing. The primary metals (e.g. iron, steel and ferro-alloys, and non-ferrous metals: aluminium, lead, zinc, tin, copper, etc.) go through processes of fabrication and/or manufacturing resulting in different metal end products ready for use that are provided to business customers as well as consumers. Once metal products have reached the end-of life, they can be recycled, used in cycles of another metal, such as copper wires mixed into steel scrap, or disposed at the landfill as waste. Figure 1 provides a simplified metal life cycle, including how discarded material enters the cycle of another metal since many end products (e.g. automobiles, EEE, etc.) usually consist of different materials including diverse metals. However, it is important to mention that the metals life cycle can take different paths depending on types of metals and end products.

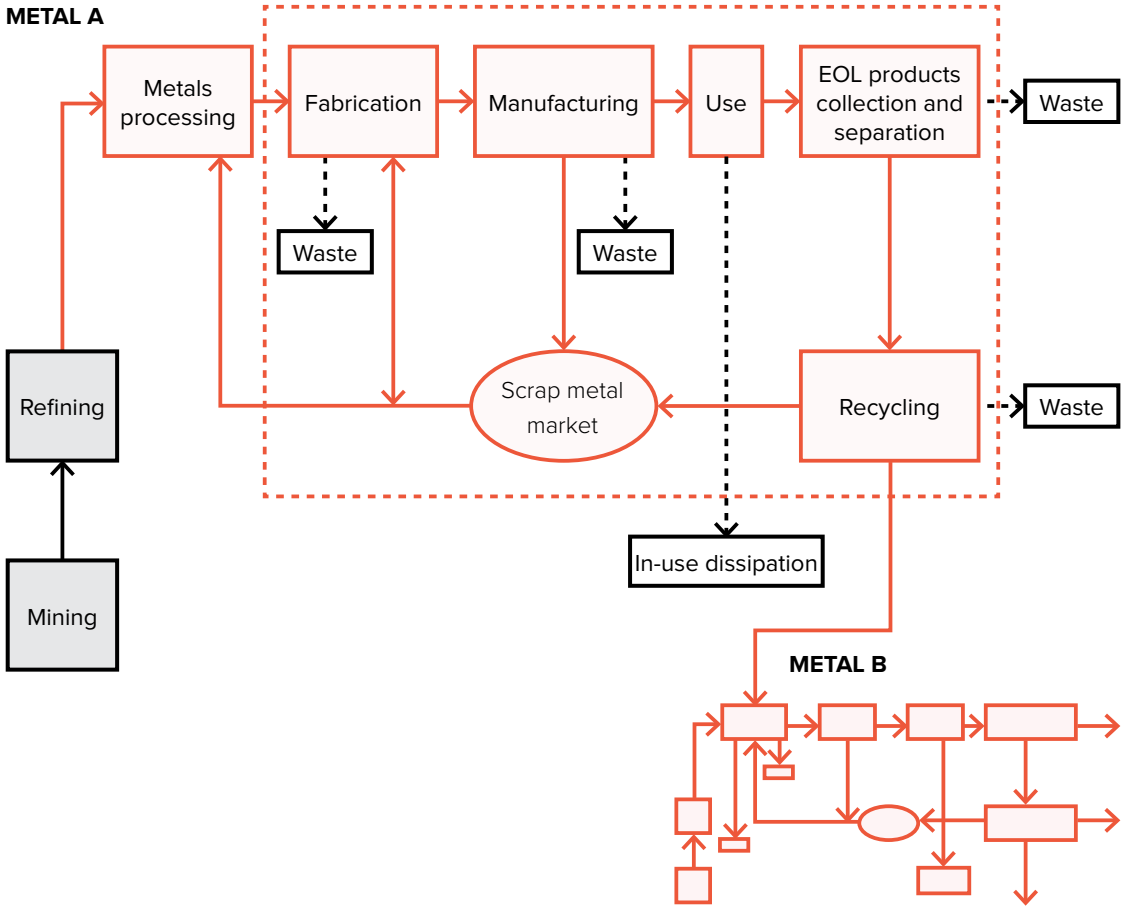


Figure 1. Simplified metal life cycle including interaction of different metals (adapted from [UN Environment Metals, 2011]). The dashed box demarcates the phases of the metal life cycle that are the focus of this supplement.

PR.1 Evaluate potential markets

Figure 2 illustrates specific processes within fabrication and manufacturing and provides a non-exhaustive list of some product, production and management opportunities for particular processes including management and design aspects of the production.

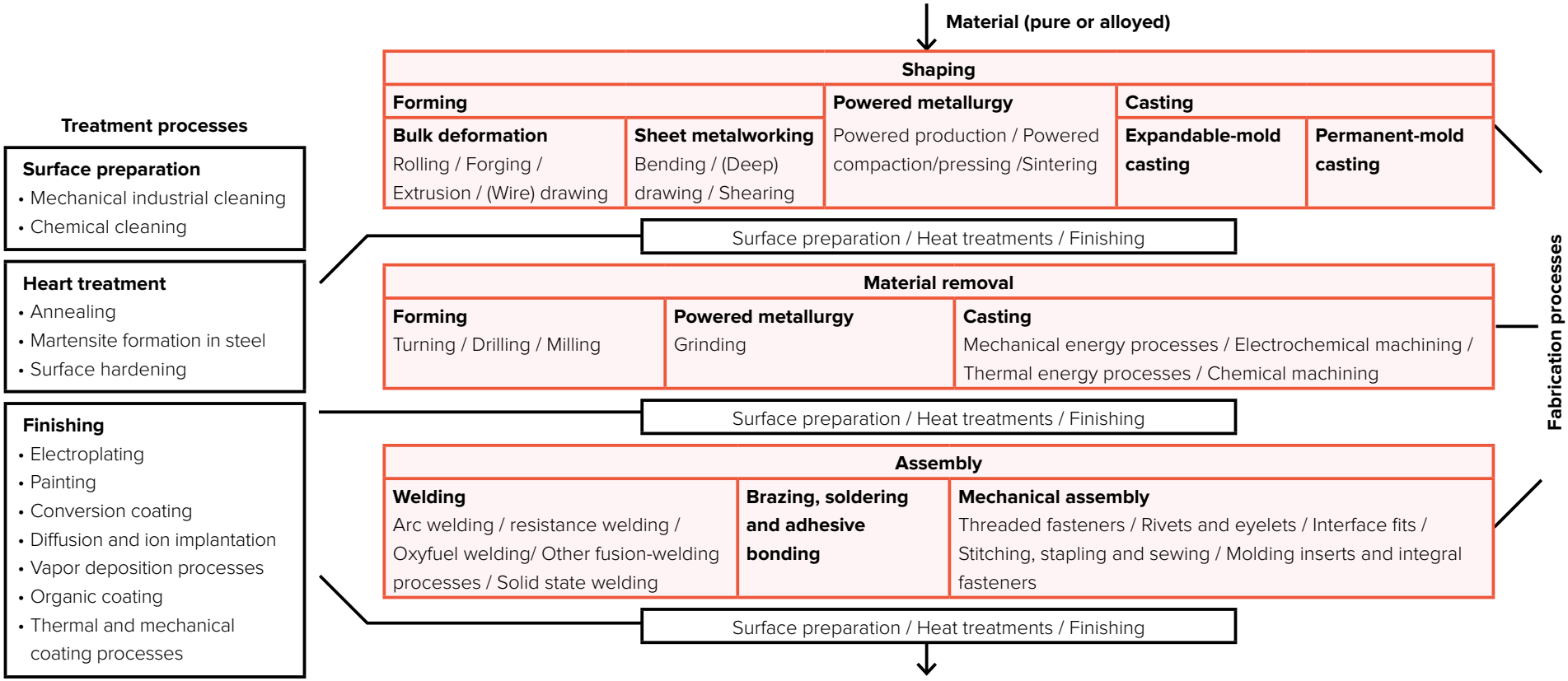


Figure 2: Overview of manufacturing categories and sub-processes in the metal processing sector (fabrication and manufacturing)

PR.1 Evaluate potential markets

Eco—i Metals

In the metals sector, the focus will be on the fabrication and manufacturing of metal-based products. The table below provides a non-exhaustive overview of different metal subsectors according to the UN International Standard Industrial Classification of All Economic Activities (ISIC), which will be focused on in this supplement.

Table 2. UN International Standard Industrial Classification of All Economic Activities (ISIC)

ISIC Code & General Description	**Example subsectors**
C24 – Manufacture of basic metals This division includes the activities of smelting and/or refining ferrous and non-ferrous metals from ore, pig or scrap, using electro-metallurgic and other process metallurgic techniques. This division also includes the production of metal alloys and super-alloys by introducing other chemical elements to pure metals. The output of smelting and refining, usually in ingot form, is used in rolling, drawing and extruding operations to make products such as plate, sheet, strip, bars, rods, wire, tubes, and pipes as well as hollow profiles. Further, the output can also be in molten form in order to make castings and other basic metal products.	• Production of granular iron and iron powder • Production of steel in ingots or other primary forms • Production of semi-finished products of steel • Manufacture of hot-rolled and cold-rolled flat-rolled products of steel • Manufacture of hot-rolled bars and rods of steel
C25 – Manufacture of fabricated metal products1 This division includes the manufacture of “pure” metal products, such as parts, containers and structures, usually with a static, fixed function, as opposed to the following divisions 26-30, which cover the manufacture of combinations or assemblies of such metal products, sometimes in combination with other materials, into more complex units that, unless purely electrical, electronic or optical, work with any moving parts.	Manufacture of structural metal products Manufacture of tanks, reservoirs and containers of metal Manufacture of steam generators, except central heating hot water boilers Forging, pressing, stamping and roll-forming of metal; machining Treatment and coating of metals

PR.1 Evaluate potential markets

Eco—i Metals

ISIC Code & General Description	Example subsectors
C26 – Manufacture of computer, electronic and optical products Manufacture of computers, computer peripherals, communications equipment, and similar electronic products, as well as the production of their components. The design and use of integrated circuits and the application of highly specialized miniaturization technologies are characterizing the production processes of this division. The division also contains the production of consumer electronics, measuring, testing, navigating and control equipment, irradiation, electro-medical and electrotherapeutic equipment, optical instruments and equipment, as well as the manufacture of magnetic and optical media.	• Manufacture of electronic components and boards • Manufacture of computers and peripheral equipment • Manufacture of communication equipment • Manufacture of consumer electronics • Manufacture of measuring, testing, navigating and control equipment • Manufacture of optical instruments and photographic equipment • Manufacture of magnetic and optical media
C27 - Manufacture of electrical equipment Manufacture of products that generate, distribute and use electrical power. Also included is the manufacture of electrical lighting, signalling equipment and electric household appliances.	• Manufacture of electric motors • Manufacture of batteries and accumulators • Manufacture of electric lighting equipment • Manufacture of domestic appliances
C28- Manufacture of machinery and equipment This division includes the manufacture of machinery and equipment that act independently on materials either mechanically or thermally or perform operations on materials, such as handling, spraying, weighing or packing, including their mechanical components that produce and apply force, and any specially manufactured primary parts. This includes the manufacture of fixed and mobile or hand-held devices, regardless of whether they are designed for industrial, building and civil engineering, agricultural or home use. The manufacture of special equipment for passenger or freight transport within demarcated premises also belongs within this division. C33 – Repair and installation of machinery and equipment This division includes the specialized repair of goods produced in the manufacturing sector with the aim to restore machinery, equipment and other products to working order.	• Manufacture of fluid power equipment • Manufacture of pumps, compressors, taps and valves • Manufacture of ovens, furnaces and furnace burners • Manufacture of office machinery • Manufacture of power-driven hand tools • Manufacture of machinery for food, beverage and tobacco processing • Manufacture of machinery for textile, apparel and leather production • Repair of fabricated metal products, machinery and equipment • Installation of industrial machinery and equipment

PR.1 Evaluate potential markets

Eco—i Metals

ISIC Code & General Description	Example subsectors
C29-Manufacture of motor vehicles, trailers and semi-trailers This division includes the manufacture of motor vehicles for transporting passengers or freight. The manufacture of various parts and accessories, as well as the manufacture of trailers and semi-trailers, is included here.	• Manufacture of motor vehicles • Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers • Manufacture of parts and accessories for motor vehicle
C30- Manufacture of other transport equipment This division includes the manufacture of transportation equipment such as ship building and boat manufacturing, the manufacture of railroad rolling stock and locomotives, air and spacecraft and the manufacture of parts thereof	• Building of ships and floating structures • Manufacture of railway locomotives and rolling stock • Manufacture of air and spacecraft and related machinery • Manufacture of motorcycles • Manufacture of bicycles
C31- Manufacture of furniture This division includes the manufacture of furniture and related products of any material except stone, concrete and ceramic. The processes used in the manufacture of furniture are standard methods of forming materials and assembling components, including cutting, molding and laminating. The design of the article, for both aesthetic and functional qualities, is an important aspect of the production process.	• Manufacture of chairs and seats • Manufacture of office furniture • Manufacture of kitchen furniture
C32- Other manufacturing This division includes the manufacture of a variety of goods not covered in other parts of the classification. Some groups contain primarily metal-based products.	• Manufacture of jewellery, bijouterie and related articles • Manufacture of musical instruments • Manufacture of medical and dental

PR.1 Evaluate potential markets

Eco—i Metals

Important sources of information about the metals sector can be found at:

Metals sector useful information

UN Environment International Resource Panel Global Metal Flows Working Group website includes data on up-to-date information on metal recycling and other relevant topics - http://www.unep.org/resourcepanel/Home/tabid/106603/Default.aspx

- Metal Recycling: Opportunities, Limits, Infrastructure
- Recycling Rates of Metals, 2011
- Environmental Risks and Challenges of Anthropogenic Metals Flows, 2013, publication includes data on greenhouse gasses emissions for the metals sector and energy intensity information
- Metal stocks in society: scientific synthesis, 2010

Global Automotive Stakeholders Group (GASG) website is a good source of information related to the use of certain substances in automotive products – http://www.gadsl.org/

Market data

World Steel Association website provides data on steel production and current market trends – http://www.worldsteel.org/media-centre/key-facts/1.html

European Commission website on metals and minerals can be also consulted for data and facts related to ferrous and non-ferrous metals market – http://ec.europa.eu/enterprise/sectors/metals-minerals

Meeting the world's energy, material, food and water needs, 2011, McKinsey, publication

International Cadmium Association website includes interesting information about latest development in the battery industry, http://www.cadmium.org/

EUROBAT (Association of European Automotive and Industrial Battery Manufacturers) website includes up-to-date information related to issues of common concern for the automotive and industrial battery manufacturers, http://www.eurobat.org/

Funding Options for Small and Medium Size Enterprises to Finance Cleaner Production Projects and Environmentally Sound Technology Investments, 2009, UNIDO

Various consultancies specialise in the metal manufacturing sectors and provide sector specific data on markets and relevant trends, including:

- KPMG Industrial Manufacturing - http://www.kpmg.com/global/en/industry/industrial-manufacturing/metals/pages/default.aspx
- They also annually issue a report on metals: the Global Metals Outlook 2014 (current version)
- Roland Berger Industrial know-how - http://www.rolandberger.com/expertise/industries/
- PwC Metal practice - http://www.pwc.com/gx/en/metals/

Trends in the metals industry

Business Case for Eco-Innovation, 2014, UN Environment, publication - http://www.unep.org/ecoinnovationproject/

Geo-5 for Business, 2013, UN Environment, publication - http://www.unep.org/geo/pdfs/geo5/geo5_for_business.pdf

PR.1 Evaluate potential markets

Eco—i Metals

UN Environment Resource Efficiency Programme, website - http://www.unep.org/resourceefficiency/Home/tabid/55480/Default.aspx

UN Environment activities on Cities and Buildings, http://www.unep.org/resourceefficiency/Portals/24147/scp/REC/Cities%20and%20Buildings%20–%20UNEP%20DTIE%20Initiatives%20and%20projects_hd.pdf

Megatrends and what's on horizon, 2013, Ernst&Young - http://www.ey.com/Publication/vwLUAssets/EY_-_Megatrends_and_what%E2%80%99s_on_the_horizon/$FILE/EY-com_gl_state_of_mining_and_metals.pdf

Trends in the mining and metals industry, 2012, ICMM, publication - http://www.icmm.com/trends-in-the-mining-and-metals-industry

Resource Revolution: Tracking global commodity market, 2013, McKinsey, trends survey - http://www.mckinsey.com/insights/energy_resources_materials/resource_revolution_tracking_global_commodity_markets

International Council of Mining and Metals (ICMM) website offers a wealth of information related to current trends in the metals sector – http://www.icmm.com

European Round Table of Industrialists (2013), Raw materials in the industrial value chain.

References

VDI, 2013: Analysis of resource efficiency potential in SMEs from manufacturing industry, 2013, VDI Centre for Resource Efficiency GmbH (VDI), Germany

UN Environment Metals, 2011: Recycling Rates of Metals, 2011

UN ISIC, 2008: United Nations (2008), International Standard Industrial Classification of All Economic Activities (ISIC), Rev.4. ISBN: 978-92-1-161518-0.

European Round Table, 2013: European Round Table of Industrialists (2013), Raw materials in the industrial value chain.

OECD Toolkit, 2011: Sustainable Manufacturing Toolkit, 2011, OECD

UN Environment, 2013: Geo-5 for Business, 2013, UN Environment, publication - http://www.unep.org/geo/pdfs/geo5/geo5_for_business.pdf

PR.2
Building the right internal team

Eco—i Metals

PR.2 Building the right internal team

Eco—i Metals

TIPS & TRICKS

ENSURE TEAM HAS SKILLS FUNDAMENTAL FOR THE METALS SECTOR

In order to capture a company's performance and implement eco-innovation, it is important to have expertise in your team for the metal manufacturing markets you are targeting. This will enable your team to accurately identify the most important sustainability impacts as well as identify feasible business opportunities and innovations. The metalworking industry is complex and varied and you will most likely need different experts for different subsectors. Such experts can be identified using the *Life cycle Stakeholders* template explained in *PR.3 Building the right external partnerships* Involving material suppliers for instance can allow for the understanding of the manufacturing processes and error tracking of the final product. Additionally, having experts with specific know-how for the target markets will provide you with credibility when approaching companies to market your services. The team should include some skills important for the metals sector, such as proficiency in:

- Auditing companies manufacturing metal products
- Implementing common business models and business practices in the metals sector
- Plant safety risk assessments (Occupational Health & Safety)
- The Globally Harmonized System of Classification and Labelling of Chemicals (GHS) – in case of subsectors involved with chemicals, such as metal surface treatment

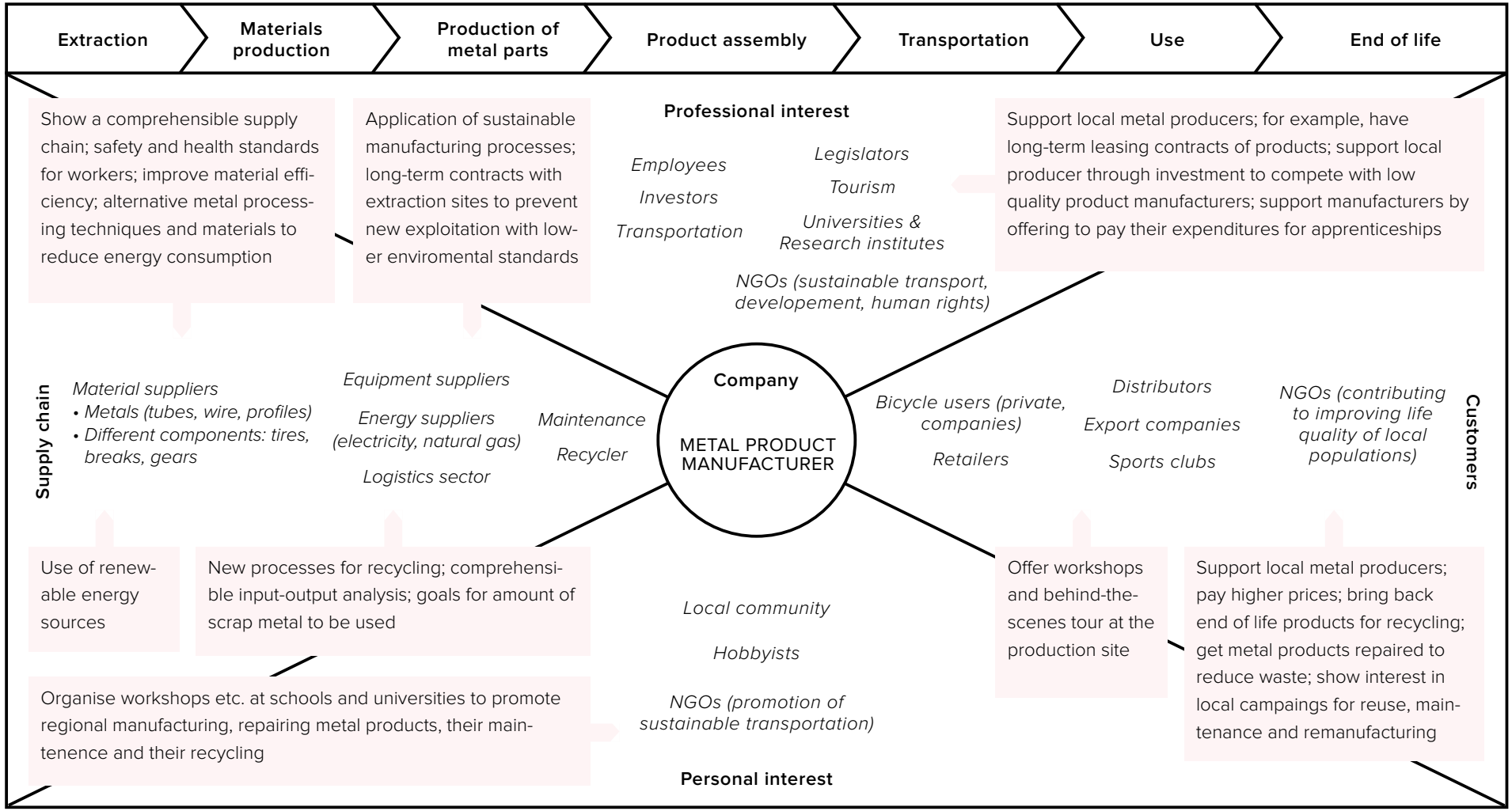
PR.3
Build the right external partnerships

Eco—i Metals

PR.3 Building the right external partnerships

Eco—i Metals

LEARNING CASE STUDY OF LIFE CYCLE STAKEHOLDERS



PR.3 Building the right external partnerships

Eco—i Metals

BACKGROUND INFORMATION

Examples of collaboration along the supply chain

An example of collaboration along the supply chain can be found in the US auto sector, where the Automotive Industry Action Group (AIAG)[1] encourages its members to report in accordance with the GRI Sustainability Reporting Framework and provides GRI trainings to its members. For increased sustainability in the supply chain "AIAG drives a common process among its member companies to incorporate environmental sustainability throughout the supply chain – whether through the development of common tools for reporting and data collection, or taking a more comprehensive approach to addressing sustainability at an organizational level".

The UltraLight Steel Auto Body (ULSAB)[2] sheet steel production industry initiative is another inter-industry example. It illustrates how companies in this sector joined and worked together to develop and promote stronger and lighter auto bodies providing answers to the challenges of the automotive industry around the world, regarding weight reduction of steel auto body structures while maintaining the performance and affordability and improving sustainability performance across the value chain.

The E-TASC Tool of the Global e-Sustainability Initiative[3] (Electronics – Tool for Accountable Supply Chains), launched in 2007 by the Global e-Sustainability Initiative (GeSI) and the Electronics Industry Citizenship Coalition (EICC) is a web-based tool for companies to "manage their own factories, communicate with their customers, and assess their suppliers on corporate responsibility risks". In the tool, companies fill in a questionnaire, which are then shared with multiple participating customers. It includes a risk assessment and examples of best practices to help companies improve performance.

The Steel and Metal Industry in Berlin-Brandenburg (Germany)[4] is a network comprising over 60 companies and institutions of the steel and metals industry, from actual metal production to final processing. Several universities and research organisations are affiliated to the cluster and provide information and support due to the highly qualified workers and trainers. Breaking down market access barriers, establishing supply and value chains, and developing successful strategies for the maintenance of qualified employees are topics in the focus of the networks' activities.

Additional examples of metals sector specific partnerships:

- Green Supply Programme

  A public-private partnership from Mexico implemented in the automotive supply chain throughout the country to reduce environmental impacts from the automotive manufacturing industry while enhancing competitiveness – For more info see the UN Environment Business case for Eco-innovation.

- COBALT

  The COBALT project offers a platform for a debate on sustainable raw materials used between different stakeholders in order to facilitate the sustainable management of raw materials Available at: www.cobalt-fp7.eu/

- Corporate Open Innovation Platform

  The platform helps clean-tech start-ups, universities and research labs to become more sustainable.

[1] AIAG website: www.aiag.org/scriptcontent/index.cfm

[2] ULSAB website: www.autosteel.org/Programs/ULSAB.aspx

[3] E-TASC: http://gesi.ecovadis.fr/

[4] Steel and Metal Industry Brandenburg: www.metall-brandenburg.de/en/The-Cluster/Networks

PR.3 Building the right external partnerships

Eco—i Metals

References

Steel Market Development Institute. The UltraLight Steel Auto Body (ULSAB). Available from: www.autosteel.org/Programs/ULSAB.aspx

American Chemistry Council, Inc. Global Automotive Declarable Substance List (GADSL). Available from: www.gadsl.org/

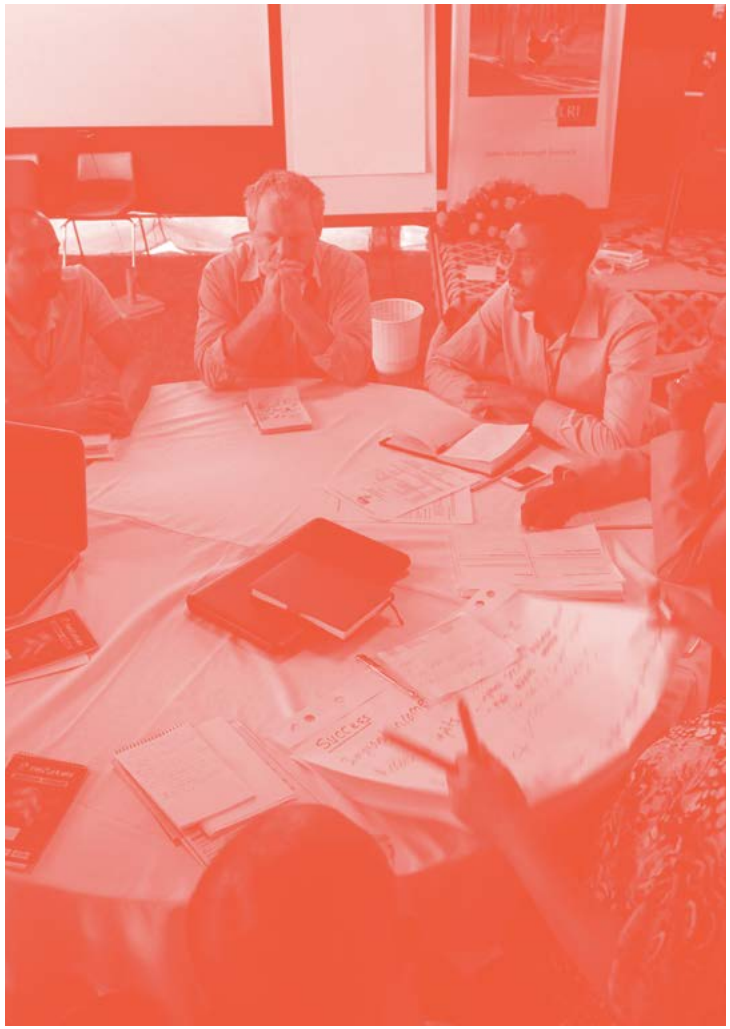
Global e-Sustainability Initiative (GeSI). E-TASC. Available from: http://gesi.ecovadis.fr/

Steel and Metal Industry Brandenburg. Available from: http://metall-brandenburg.de/en/TheCluster/Networks

GreenWin. Available from: www.greenwin.be/en

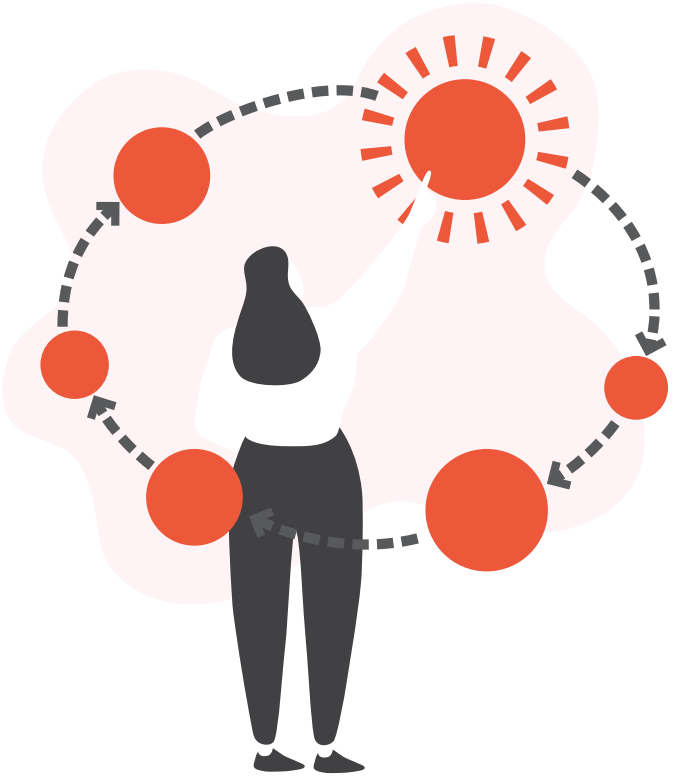
Corporate Open Innovation Platform that can be helpful for clean-tech startups, universities and research labs. Available from: http://cleantechnica.com/2014/06/11/corporate-open-innovation-platforms-can-helpful-cleantech-startups-universities-research-labs/

Innovative open platform for sustainability. Available from: www.innonatives.com/



PR.4

Identify sustainability hotspots across the value chain

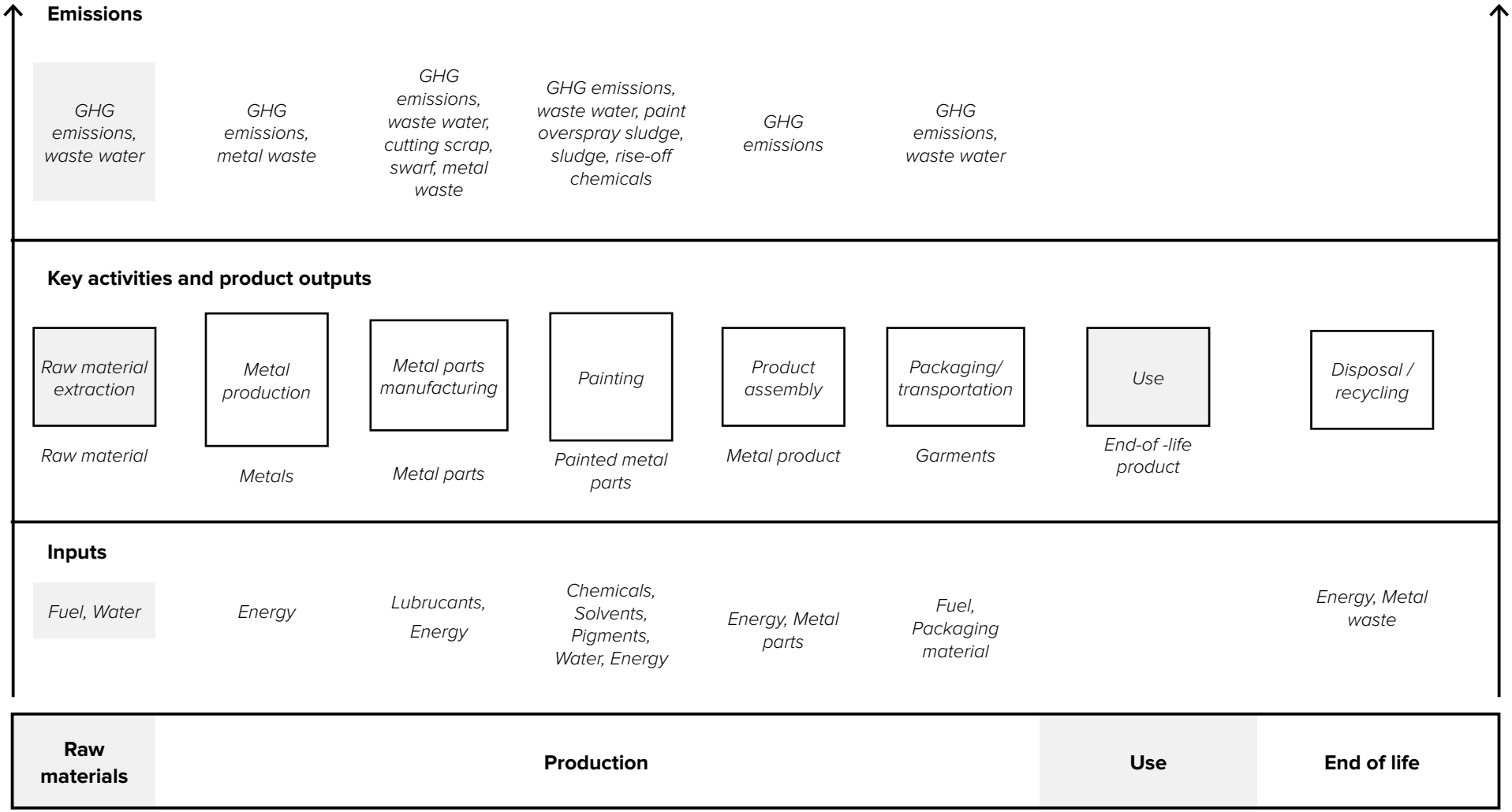


Eco—i Metals

PR.4 Identify sustainability hotspots across the value chain

Eco—i Metals

LEARNING CASE STUDY OF LIFE CYCLE INVENTORY



PR.4 Identify sustainability hotspots across the value chain

Eco—i Metals

LEARNING CASE STUDY OF LIFE CYCLE THINKING

As a summary of the filled templated showed below, some sustainability challenges and opportunities that a small metal producer might be facing are:

Sustainability hotspots (economic, environmental, social) for metal manufacturers are:

- Raw material scarcity and price volatility of metals (economic, environmental)
- Consumers are becoming increasingly aware of the mining conditions and want to ensure their products are sustainably sourced (environmental, social)
- Raw metals production consumes a lot of energy (economic, environmental)
- Inefficient use of metal feedstock and generation of metal waste along the metal value chain (economic, environmental)
- Health concerns related to hazardous substances used for the metal processing/treatment and paints (e.g. lead is used in bright colours) (environmental, social)
- Generation of hazardous waste related to electroplating and painting processes along the value chain (economic, environmental)
- Increasing concerns about health impacts for society and the environment due to the release of hazardous substances (e.g. lead containing compounds) from metal products after disposal (environmental, social)

					Environmental impacts		**Social Impacts**			**Economic impacts**
Phase	**Activity**	**Inputs**	**Product outputs**	**Emissions**	**Resource use**	**Ecosystem quality**	**On workers**	**On consumers**	**On stakeholders**	**Profitability**
Materials	*Extraction of raw materials*	• *Energy*	• *Raw materials*	• *Waste water* • *GHG emissions*	• *Unsustainable extraction of minerals, metal ores, hydrocarbons*	• *Impact on biodiversity* • *Claim of natural areas* • *Leaving exploited soils*	• *Bad working conditions for extraction* • *Health issues related to mining hazardous substances: mineral lubricants, solvents and lead points.*		• *Geopolitical conflict over natural resources*	• *Price volatility of raw materials* • *High prices of high tech materials (titanium/coal)*

					Environmental impacts		Social Impacts			Economic impacts
Phase	**Activity**	**Inputs**	**Product outputs**	**Emissions**	**Resource use**	**Ecosystem quality**	**On workers**	**On consumers**	**On stakeholders**	**Profitability**
Production	*Production of metals, rubber, plastics, various parts, chemicals (solvents, lead paints)*	• *Energy raw materials*	• *Metals* • *Rubber* • *Plastics* • *Various parts* • *Chemicals (solvents and lead paints)*	• *Hazardous waste (paints, solvents, chemicals for metal treatment)* • *Emissions (e.g. VOC)*	• *Unsustainable production*	• *Dumping of hazardous waste* • *Accumulation of substances in the soil and ground water*	• *Bad working conditions in production site* • *Gender issues* • *Safety issues: welding, paints, coating, solvents.*			
	Frame manufacturing	• *Energy* • *Materials*	• *Metal waste frame*				• *Bad working conditions in production site* • *Gender issues* • *Safety issues: welding, paints, coating, solvents.*			
	Painting	• *Materials for paint*	• *Painting waste*	• *Waste water*	• *Lead for paints*	• *Dumping of hazardous waste* • *Accumulation of substances in the soil and ground water*	• *Bad working conditions in production site* • *Gender issues* • *Safety issues: welding, paints, coating, solvents.*			
	Wheel manufacturing	• *Raw materials*	• *Metal waste wheels*				• *Bad working conditions in production site* • *Gender issues* • *Safety issues: welding, paints, coating, solvents.*			

					Environmental impacts		Social Impacts			Economic impacts
Phase	**Activity**	**Inputs**	**Product outputs**	**Emissions**	**Resource use**	**Ecosystem quality**	**On workers**	**On consumers**	**On stakeholders**	**Profitability**
	Bike assembly	• *Frame and wheels*	• *Bike*				• *Bad working conditions in production site* • *Gender issues* • *Safety issues: welding, paints, coating, solvents.*			• *Low-cost competitors are threatening the already low net profit margin as well as market share*
Transportation	*Transport to retailer*	• *Fuel*	• *Bike (at retailer)*	• *GHG emissions* • *Metal scrap from damaged bikes*	• *Resource depletion (fossil fuels)*	• *Climate change*			• *Noise*	• *Cost of transportation*
Use	*Use*							• *The population riding bikes is expected to rise from 10% to 15% in the next five years.* • *Consumers are keeping their bikes longer, investing instead in repairs, new parts and accessories instead of buying new ones.*	• *The LOHAS (Lifestyle of Health and Sustainability) market segment is growing rapidly, over 15% per year. The LOHAS segment is willing to pay a 20% premmium bikes.*	• *Low price due to competition* • *LOHAS segment has a potential market size of 0.6-1.3m$.*
End of life	*No recycling*		• *No recycling*	• *Waste e.g. tyres, plastic*		• *Waste dumping* • *Lead accumulation in soil and water leading to lead poisoning*			• *Generation of waste lead poisoning*	• *Valuable metals are disposed off* • *Emerging of second hand market competition*

PR.4 Identify sustainability hotspots across the value chain

Eco—i Metals

BACKGROUND INFORMATION

Over the course of a typical production process chain 25% of the amount of metal input is lost as scrap, as shown in Figure 3 below.

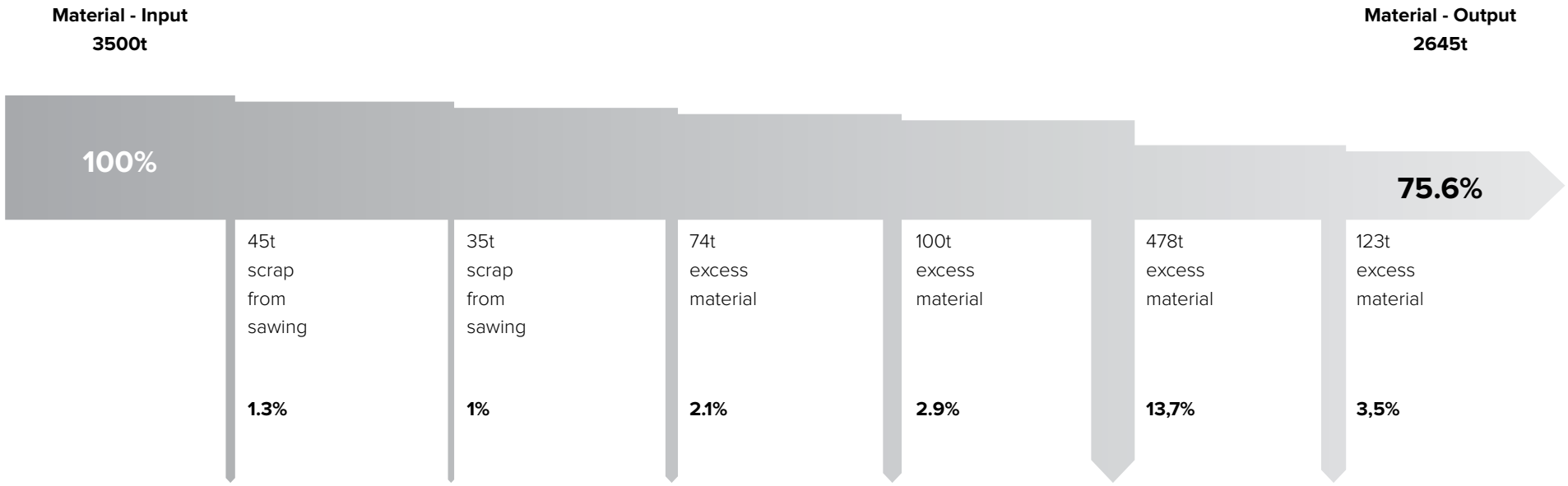


Figure 3: Material input and output of metal production

PR.4 Identify sustainability hotspots across the value chain

Eco—i Metals

The following table summarizes sustainability opportunities across the metal production processes.

Table 3: Production, product and management activities with sustainability opportunities across the metals sector

<table>
<tr><th>Production processes</th><th colspan="3">Sustainability opportunities</th></tr>
<tr><td rowspan="2">Shaping (forming, casting, powder metallurgy)</td><td>Energy efficiency:
• Reducing the preheating temperature of starting material for forging
• Using high temperature superconducting magnets for heating to forge increasing the efficiency by 15% compared to induction heating
• Use of SiC semiconductors instead of silicon based semiconductors as inverter for getting voltage required for specific manufacturing processes since they can be operated at higher temperatures with lower losses and imply higher heat recovery efficiency due to a higher transmission rate and a higher temperature difference</td><td>Heat recovery:
• Using waste heat of forging by bringing forged pieces to an isolated cupboard and recovering the energy using latent energy storages
• Heat transfer between consecutive process steps e.g. between forging and rolling mill which can reduce consumption by 50%
• Use of waste heat of drawing furnace for heating subsequent process baths (e.g. surface treatment)</td><td>Material efficiency:
• Reduction of excess material at forging or casting
• FEM simulation for optimizing shape of starting material for forging
• Counter punch moving towards the dye at extrusion for reducing force on the dye and therefore being able to produce parts with lower wall thickness
• Choosing amount of material used for forging based on type of material and complexity of process
• Reduction of reject
• Use high value feedstock in fabrication steps to minimize or even eliminate chemicals and materials used for cleaning, corrosion protection, and coating</td></tr>
<tr><td colspan="3">In general:
• Use of renewable energy
• Minimize scale through special coating to protect forging tools</td></tr>
</table>

PR.4 Identify sustainability hotspots across the value chain

Eco—i Metals

Production processes	Sustainability opportunities	
Material removal (conventional machining, abrasive processes, non-traditional machining)	**Energy efficiency:** • Speed-controlled ventilator instead of conventional compression cooler which reduces power consumption by 70%	**Material efficiency:** • Punching without generating sheet skeleton by re-positioning sheet on worktop • Use of alternative, material saving manufacturing processes (e.g. casting instead of machining part out of bulk material) • Reduction of reject
	In general: • Reduce process steps • Reduce lubricants, • Use water-based lubricants with biopolymers as they are more environmentally friendly, render machines easier and also provide cooling	
Assembly (Welding, brazing, soldering, adhesive bonding, mechanical assembly)	**Energy efficiency:** • Soldering instead of brazing where possible (lower energy input) • Use of different filler wire for welding which requires less energy to melt	**Material efficiency:** • Use welding process which does not require the adding of filler wire where possible • Alternative design for use of less filler wire or adhesive
	In general: • Substitute welding material/consumable with a lower fume-generating or a less toxic one • Local exhaust ventilation systems for alloys (e.g. prevent Cr(VI) exposure	
Surface preparation and cleaning	**Material efficiency (water, chemicals):** • Counter-rinse processes • Cleaning optimisation (e.g. temperature, contacting) • Reduce grease on surface in prior steps (e.g. optimise machining, cooperate with metal suppliers) • Use enclosed cleaning machines (e.g. VOC capture & reuse)	**Safer chemicals:** • Replace with mechanical cleaning • Substitution with safer chemicals
	In general: • Substitute welding material/consumable with a lower fume-generating or a less toxic one • Local exhaust ventilation systems for alloys (e.g. prevent Cr(VI) exposure	

PR.4 Identify sustainability hotspots across the value chain

Eco—i Metals

Production processes	Sustainability opportunities	
Finishing (electroplating, coating, paint application)	**Energy efficiency:** • Optimisation of plating temperature and general process conditions	**Material efficiency:** • Plating internal recycling/filtration and reuse of plating bath • Plating external recycling of plating bath and recovery of sludge metals • Switch paint application technique (e.g. dipping vs. spray), HVLP, electrostatic or powder coating • Reduce overspray for painting: e.g. switch to HVLP spray or electrostatic spray for higher efficiencies • Optimize existing equipment by implementing SOP's and training programme • Reduce waste: use heated hose for paint supply for two-component paints • Alternatives to solvent-based paint application: buy pre-painted parts, UV-paints, water-based paints, etc.
	Various: • Reduce cleaning and preparation steps	
Heat treatment	**Energy efficiency:** • Measurement of part temperature for optimizing treatment temperature and residence time • Heat recovery from water (for low-carbon steel), oil (for high-carbon steel) or air quenching • Direct hardening of steel heated by the forging process • Reducing losses during pre-treatment, i.e. cleaning and drying, by using a closed system for cleaning with an integrated vacuum system for drying whereby the cleaning fluid is warmed up by waste heat from the furnace, so no additional heat for drying needs to be provided • Bringing warm rolled metal sheets directly to the heat treatment furnace, which is possible through temperature measurement of the furnace and sheets for being able to regulate the furnace	

PR.4 Identify sustainability hotspots across the value chain

Eco—i Metals

Design	**Sustainability opportunities**
Life cycle design for sustainability[5]	• Material saving design through using for instance design parts which can be casts rather than parts that need to be machined out of bulk material • Favour the use of materials whose procurement does not harm the environment or people • Energy saving design through for instance involving less energy intensive production steps and a lower number of production steps • Design for reparability and recyclability
Management opportunities	**Sustainability opportunities**
Sustainable procurement	• Choose input material carefully • Main inputs are: ferrous, non-ferrous metals, chemicals (cleaning agents, paints, plating), packaging material, additives and working materials: heat-transfer medium, lubricants, transformer fluids • Increase use of renewable and recyclable materials • Substitute hazardous materials
Material management	• Reduce the use of materials • Reduce lost materials
Manufacturing process	• Reduce water use • Increase energy efficiency • Reduce emissions • Comply to regulations • Technical assistance
Logistics	• Lean manufacturing system • Integrated on-line logistics system • Environmental management systems, environmental strategies and monitoring
Waste management	• Prevention, reduction, collection, separation, recycling • Possibility to recycle hazardous waste or use it for energy production

[5] http://www.d4s-sbs.org/d4s_sbs_manual_site.pdf

PR.4 Identify sustainability hotspots across the value chain

Eco—i Metals

References

Examples of relevant labels, industry standards, voluntary initiatives:

Industry standards:

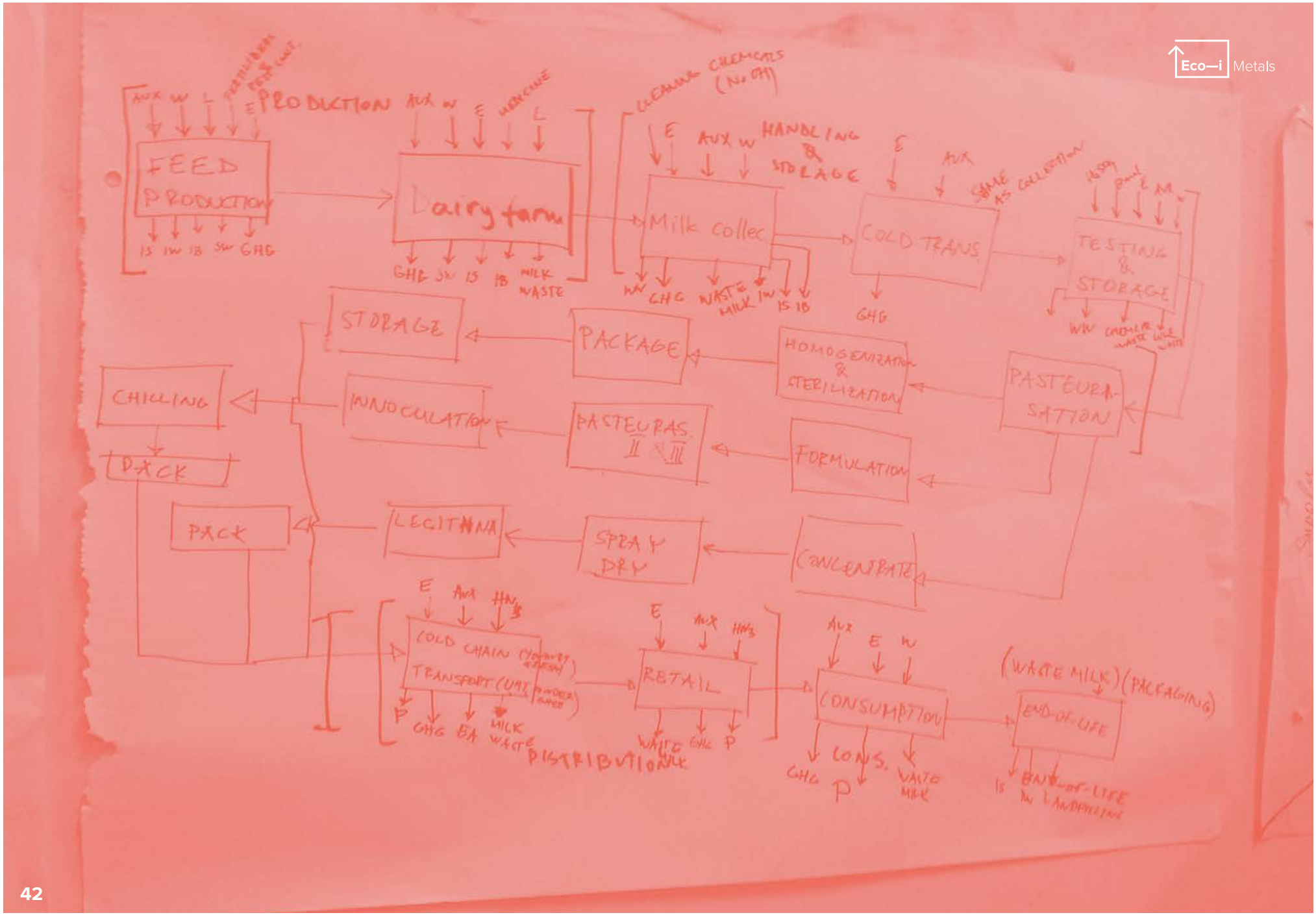
- ISO certificates. 9001 Quality management. 14000 Environmental management. 26000 Social responsibility. 50001 Energy management. Available from: www.iso.org

Labels:

- Green Label Singapore. Available from: http://www.sec.org.sg/sgls/ specifically for example a green label CATEGORY 043 for products made from at least 50% mixed recycled materials including iron, copper, nickel and zinc.
- SIRIM QAS Malaysia Green label. Available from: http://www.sirim-qas.com

Voluntary Initiatives:

- Global Reporting Initiative guidance for sustainability reporting. Available from: www.globalreporting.org
- GRI Mining & Metals Guidance. Available from: https://www.globalreporting.org/resourcelibrary/MMSS-Complete.pdf
- GRI Electric Utilities Sector. Available from: https://www.globalreporting.org/reporting/sector-guidance/sector-guidance/electric-utilities/Pages/default.aspx
- ICMM Material Stewardship is an approach helping companies to regard the entire life cycle of their products and take responsibility for the impacts of their production or goods. Available from: http://www.icmm.com/page/84173/materials-stewardship
- Aluminium Stewardship Initiative (ASI), Switzerland seeks to mobilise a broad base of stakeholders to foster greater sustainability and transparency throughout the aluminium industry. Available from: http://aluminium-stewardship.org/
- Ultra-Light Steel Auto Body (ULSAB) initiative . Available from: http://www.autosteel.org/Programs/ULSAB.aspx


FEED PRODUCTION
Dairy farm
Milk collec
COLD TRANS
TESTING & STORAGE
HANDLING & STORAGE
STORAGE
PACKAGE
HOMOGENIZATION & STERILIZATION
PASTEURA-SATION
CHILLING
INNOCULATION
PASTEURAS.
FORMULATION
PACK
PACK
LEGITIMA
SPRAY DRY
CONCENTRATE
COLD CHAIN
TRANSPORT
RETAIL
CONSUMPTION
END-OF-LIFE
DISTRIBUTION
(WASTE MILK)(PACKAGING)

PR.5

Identify the general opportunities and threats across the value chain

Eco—i Metals

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

Eco—i Metals

TIPS & TRICKS

CONSIDER KEY DRIVERS FOR ECO-INNOVATION IN METALS VALUE CHAIN

Some key drivers that provide challenges and opportunities across the product life cycle in the metals sector include:

- Metal sector market considerations:
  - Economic effects e.g. price fluctuation and material availability
  - Restricted substances either regional or for export
  - Consumer trends e.g. retail sector, sustainable sourced products
  - Geo-political e.g. conflict minerals
- Specific regulations supporting eco-innovation, e.g. pollution control (VOCs, waste water), waste management, recycling, hazardous substances, resource efficiency (material, energy), OHS (occupational health and safety), industry standards (e.g. automotive), sustainable procurement, etc.
- Supply chain pressures, e.g. eco-labels, sustainability reporting, industry initiatives such as the Aluminum Stewardship Initiative (ASI) from Switzerland, led by several key industry players (among others AUDI, BMW, Jaguar Land Rover, Nespresso, Tetra Pak); the ASI seeks to mobilise a broad base of stakeholders to foster greater sustainability and transparency throughout the aluminium industry
- Particular partnership patterns e.g. eco-industrial parks, business clusters, etc. (see *Background information* of activity *PR.3 Building the right external partnerships*)

The following example from the metals sector illustrates how a compan introduced an eco-innovation approach in order to access new markets.

Industry example 1: Access to new markets

Adelca, Ecuador is a manufacturer of primarily fabricated structural steel products such as cold-drawn rebar, section profiles, annealed and galvanized wire, etc. that are commonly used in construction or the fabrication of finished products. The company changed their strategy to producing steel products made from 100% recycled steel with an emphasis on excellence in service as well as exporting specific product lines that fulfil international quality standards to neighbouring markets.

Since Adelca's demand for scrap metal to produce recycled steel products was higher than the locally available supply, the company modified its business model to focus on increasing the amount of scrap steel recovered from end users and invested in building up its network of recyclers. This included supporting the establishment of collection centres, donating metal cutting equipment, offering loans, and paying the best price for the scrap metal provided. Adelca improved the safe and effective management of scrap steel by investing in the training of the network of scrap steel suppliers in efficient echnologies and environmentally sound practices.

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

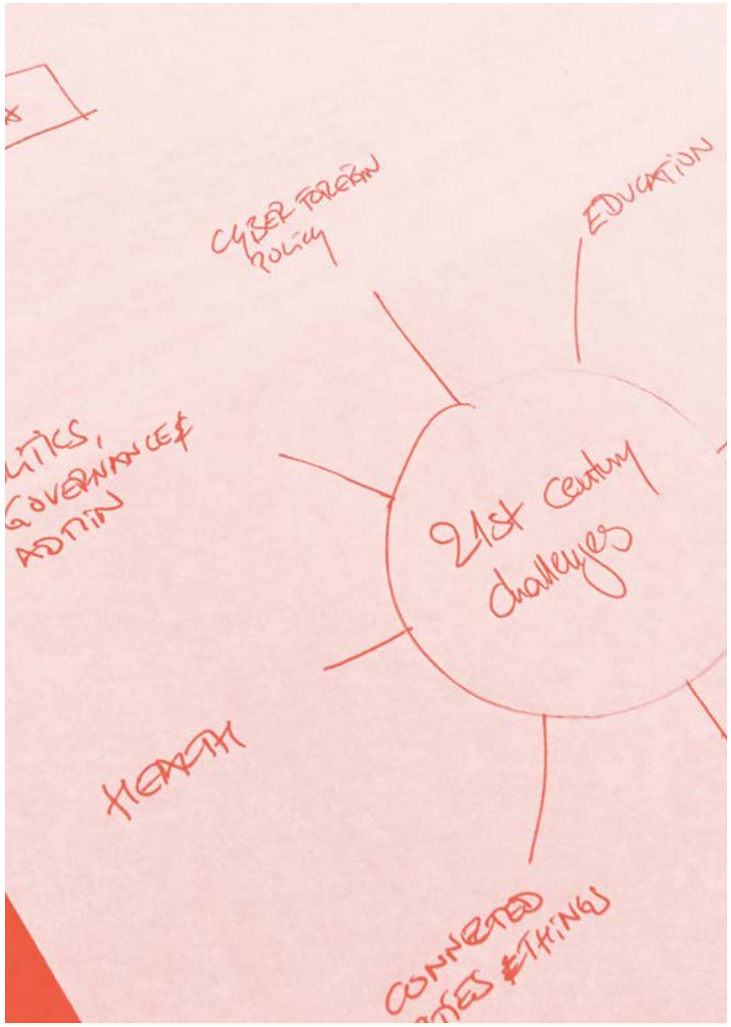
Another key component of Adelca's business model is the monitoring and integration of customers and suppliers needs through satisfaction surveys.

ECONOMIC BENEFITS

- Savings of US$ 12 million on the 20,000 tons of steel the company produces every month
- Recyclers network income exceeding US$ 1 million per month

ENVIRONMENTAL AND SOCIAL BENEFITS

- Savings result from each ton of recycled steel compared to virgin steel:
  - 1.5t iron ore and 0.5t coal saved
  - 40% less water, 75% less energy
  - 86% less air pollution
  - 76% less water pollution
- Integrated management systems: OHSAS 18001, ISO: 9001 and 14001 promoting continuous improvement in safety and environmental standards
- Company's recyclers network generates around 4,000 jobs (direct and indirect)



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

Eco—i Metals

LEARNING CASE STUDY OF PESTEL

To convince your potential clients to engage in eco-innovation you should be well informed about the particular market and should be able to address the sustainability hotspots and more general sources of threats and opportunities faced in the market and the company. The *PESTEL* template can be used to analyse external environmental threads and opportunities for the company. The 'significant' threats and opportunities are those that score 9 or above and are highlighted in yellow.

→ Refer to *'Background Information'* for a list of selected legislations supporting eco- innovation in the metals sector.

Heading	Description of issue/trend	Source or example	Time scale (0-6/7-24/24+ months)	Impact (1= Very low, 5= Very high)	Likelihood (1= very unlikely, 5= certain)	Significance (Impact x Likelihood)
Political	*Geopolitical concerns related to mining operations.*	*British Geological Survey: The Future of the Global Minerals and Metals Sector: Issues and Challenges out to 2050*	*24+*	*Low 2*	*3*	*6*
Economic	*Price volatility of raw materials and basic materials.*	*McKinsey: Tracking global commodity market, 2013*	*0-6 months*	*High 4*	*4*	*16*
	Demand for more sustainable products.	*Sustainable Brands: Available at: http://www.sustainablebrands.com/news_and_views/behavior_change/50-global-consumers-willing-pay-more-socially-responsible-products*	*0-6 months*	*High 5*	*4*	*16*
Social	*Reports of unfair and difficult working conditions in the extraction industry.*	*ILO Newsletter. Available at: http://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_187783/lang--en/index.htm*	*7-24 months*	*Medium 3*	*5*	*15*
	Health concerns related to chemicals used for the metal processing and paints.	*ILO. Available at: http://www.ilo.org/oshenc/part-xiii/metal-processing-and-metal-working-industry/metal-processing-and-metal-working/item/698-environmental-issues-in-metal-finishing-and-industrial-coatings*	*0-6 months*	*High 4*	*3*	*12*

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

Eco—i Metals

Heading	Description of issue/trend	Source or example	Time scale (0-6/7-24/24+ months)	Impact (1= Very low, 5= Very high)	Likelihood (1= very unlikely, 5= certain)	Significance (Impact x Likelihood)
Technological	*Increasing demand for high tech materials.*	*Available at: http://www.isi.fraunhofer.de/isi-en/service/presseinfos/2009/pri09-02.php*	*24+ months*	*Low 2*	*4*	*8*
Environmental	*Problems with high waste production and disposal of waste.*	*Waste Management World. Available at: http://www.waste-management-world.com/articles/print/volume-11/issue-2/features/waste-management-2030.html*	*0-6 months*	*High 5*	*4*	*20*
Legal	Some countries introduced the reduction scheme for emissions of VOC.	European Commission VOC directive. Available at: http://europa.eu/legislation_summaries/environment/air_pollution/l28029b_en.htm	7-24 months	Medium 3	5	15

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

Eco—i Metals

BACKGROUND INFORMATION

Table 5: Trends relevant for the metals sector [UN Environment, 2013; OECD Economic Outlook, 2014; pwc, 2014]

Market trends	**Sustainability challenges/opportunities to engage in eco-innovation**	**Emerging opportunities for eco-innovation**
Natural resources scarcity and climate change	• Raw material scarcity • Climate change impacts	• Resource efficiency • Recycling • Urban mining • New materials
Demographic change and urbanization	• Increasing demand for metals • Metal stocks in society	• Recycling • Urban mining • Energy efficiency
Globalisation	• Increasing need to improve value chain exchange • Geopolitical risks	• New business models • Urban mining
Patterns of mobility	• Increased movement of people and freight in terms of mode, distance, frequency, and time in transit • Increased movement of people and goods within and between urban regions, including work and pleasure travel	• Advanced technical solutions (i.e. information and communication technology) • Urban mining
Health and social risks from operations	• Metal toxicity (e.g. lead, tributyltin oxide (TBTO), mercury) • Bad working conditions • Use of chlorinated solvents in metal treatment process steps	• Toxic free metal products (e.g. lead free paint) • Alternative toxic free metal techniques • Substitution with safer chemicals or mechanical methods • Recycling • New business models • Urban mining

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

Eco—i Metals

Market trends	Sustainability challenges/opportunities to engage in eco-innovation	Emerging opportunities for eco-innovation
Regulation and public scrutiny	• Significant rise in regulation and standards for industry • Call for transparency on corporate sustainability performance	• New business models -incorporating life cycle thinking approach • Enhanced access to export markets
Consumption patterns	• Demand for sustainable products and services • Growing demand for technically advanced solutions • Increased pressure to meet strict sustainability criteria	• Sustainability being included into decision making processes • New funding opportunities • New markets for innovative solutions
Technology and innovation	• Optimization of recycling rate • More emphasis on R&D • Reducing the use of chemicals (e.g. metal treatment/ forming) • Equipment/product manufacturing	• Re-manufacturing • Reverse logistics • Green engineering • Materials with superior sustainability performance • Substituting the use of hazardous chemicals • Optimizing the use of chemicals • Product centric recycling

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

Eco—i Metals

Table 4 presents opportunities for businesses, including SMEs, to take advantage of different economic areas along the value chain (from extraction to manufacturing to end-of-life recovery). The areas are further categorized according to regional relevance (Asia, Latin America, Africa and Africa) and some indicative examples are provided. For all three regions, eco-innovation opportunities reside in new materials and new applications of materials, as well as manufacturing resource efficiency technologies and providing energy efficient solutions (often regionally tailored). For example, 'sustainable product design' is of high relevance in Asia, medium relevance in Latin America, and of low relevance in Africa.

Table 4: Overview of general opportunities for eco-innovation in the metals industry value chain for the Asian, African and Latin American regions [EIO, 2013] (colour coding below)

High relevance	
Medium relevance	
Low relevance	

Value chain	Area	Regional relevance			Business opportunity for SMEs
		Asia	Latin America	Africa	
	Cleaner extraction technologies				Exporting and/or adapting technology to the needs of emerging markets
	Restoration of mining sites				Consulting and re-designing mining and post-industrial sites (especially in re-adapting for urban use)
	Sustainable product design				Consulting services and specific assignments on designing products (also with a view to meet requirements of the current and future EU legislation)
	New materials and new applications of materials				Consulting on existing and developing new materials with better environmental performance
	Cleaner production systems				Consulting on, selling existing and/or adapting/ developing cleaner production systems
	Resource efficiency technologies (materials, water, biomass, land)				Consulting, providing services (e.g. ESCOs), developing and adapting technologies to the needs of local markets
	Energy efficiency technologies and solutions				
	Value chain integration				Consulting services from engineering companies
	Training workforce				Providing specific training and consulting services on the use of environmental technologies as well as on energy and material efficiency

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

Eco—i Metals

Value chain	Area	Regional relevance			Business opportunity for SMEs
		Asia	Latin America	Africa	
	Transport logistics (freight)				Developing, selling and running transport logistics systems (both road, air and water)
	Alternative transport solutions				Promoting new solutions reducing energy intensity and emissions from transport (e.g. use of sails etc.)
	Product sharing schemes				Supporting emerging markets in developing business models supporting alternative product use schemes. The product sharing and leasing approaches are already spreading in many countries (e.g. cars, tools etc.). In emerging economies they could be solution allowing the user to benefit from the product without having to purchase it.
	Product leasing scheme				
	LCA / MIPS / GLUA / other environmental performance assessment methods				Developing measurement methods or perform product performance assessments. This could be linked with eco-labels and other labels and certifications.
	Waste treatment				Exporting and/or adapting technologies and organizational methods to the needs of emerging markets. It can also involve a genuine innovation collaboration taking into account specific needs of emerging regions.
	Recycling technologies				
	Electronic waste				
	Urban mining				
	Energy recovery				
	Designing green cities and green buildings				Promoting green city concept and specific building designs. The concepts can draw on European models and be co-developed with local architects and designers.
	Industrial ecology				Designing, implementing and consulting on industrial symbiosis.
	Sustainable mobility, including electric mobility				Designing, implementing and consulting on new mobility solutions
	Sustainable agriculture				Designing new farming concepts based e.g. on agro-ecology

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

Eco—i Metals

Examples of selected legislations supporting eco-innovation in the metals industry

Relevant international conventions:

- A series of conventions exist, which address specific metal issues often indirectly creating favourable conditions for innovation, including the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989), the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides (1998), the Stockholm Convention on Persistent Organic Pollutants (2001) and the Montreal Protocol on Substances that Deplete the Ozone Layer (1989).
- Another example is the Minamata Convention, which aims at curtailing the emissions of mercury on a global level. From 2020 onwards, particular mercury-containing products will be prohibited and health and safety measures have to be implemented. Industries in the contracting states are obliged to reduce their mercury emissions significantly.

Relevant regional regulations: European Union:

- Concerning waste electrical and electronic equipment (WEEE), the WEEE Directive and the RoHS Directive (restriction of the use of certain hazardous substances in electrical and electronic equipment) aim at establishing environmentally friendly disposal and recovery of electric and electronic disused devices. Producers of electric and electronic equipment are obliged to collect the products at their life cycle end and reuse, recycle or dispose them in an ecological manner. The RoHS Directive prohibits the use of certain heavy metals in the equipment in order to enhance the recyclability of WEEE.
- The regulation on the Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH) calls for the substitution of the most dangerous chemicals when suitable alternatives have been identified. This is specifically relevant for the metal treatment companies, which use chemicals in their processes. Therefore, REACH requests the industries to develop stronger relationships and better understanding on how chemicals are used.
- Greenhouse gas emissions are controlled by, amongst others, the EU Industrial Emissions Directive (IED) as well as the EU Emissions Trading System (EU ETS).
- The F-Gas Regulation on certain fluorinated GHGs implements the Kyoto Protocol. Every producer, importer and exporter of these gases is required to report to the commission and the national authority to enable them to control the implementation of the guidelines.
- Eco-design Directive, aimed to encourage energy efficiency, is also enforcing other environmental considerations including: materials use, waste issues and recyclability. These are specifically relevant for the cooling equipment also refrigerants (chemicals) therefore companies with innovative products that meet these standards will enhance access to EU export market, but also others with strict regulations. And in addition this is linked to the F-gas regulation and the Montreal Protocol.

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

Example of national legislation relevant for the metals sector: USA:

- Important to mention is the Dodd-Frank Wall Street Reform and Consumer Protection Act. Companies are obliged to disclose to the public the use of so-called conflict minerals, such as tin, wolframite, gold, and tantalum from the Democratic Republic of the Congo or its neighbouring countries. Similar regulations are being drafted in the European Union.
- Therefore, companies exporting to the US and EU have to be aware of these regulations, as a proof of the origin of these minerals is requested in case conflict materials are part of the products.

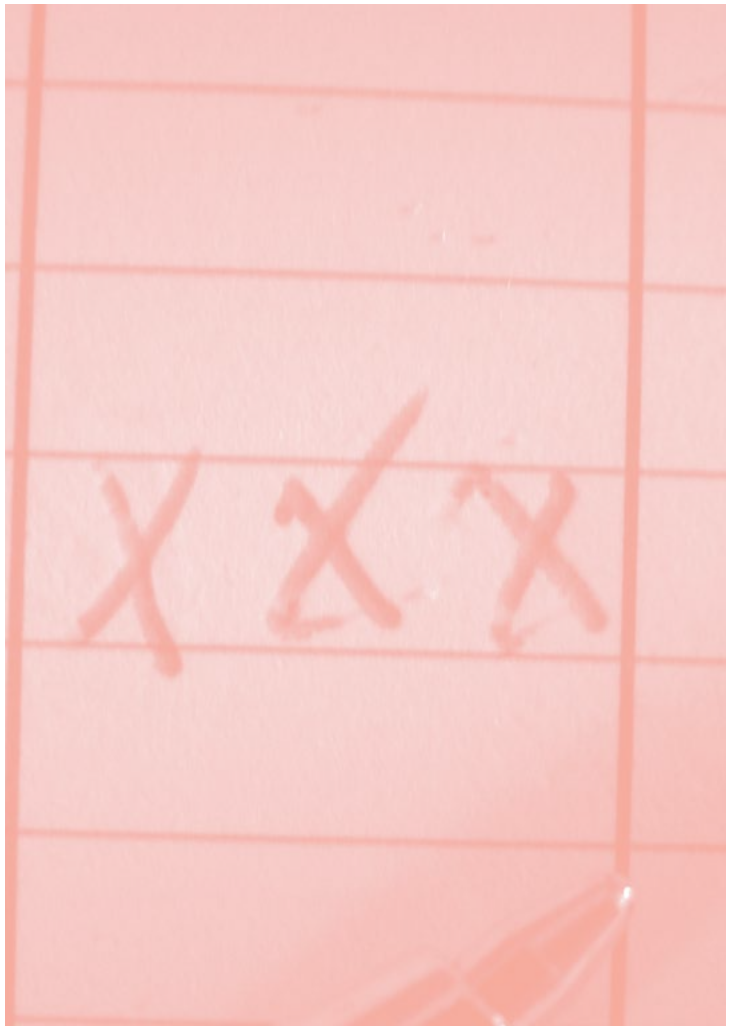
Example of national chemicals related legislation relevant for the metals sector: China

- In June of 2010, the Ministry of Environmental Protection in China adopted the Provisions on Environmental Regulations of New Chemical Substances, replacing a previous regulation from 2003. The 2010 regulations are similar to the EU's REACH and are known as "China REACH".

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

References

- UN Environment, 2013: Geo-5 for Business, 2013, UN Environment, publication available at: http://www.unep.org/geo/pdfs/geo5/geo5_for_business.pdf
- OECD Economic Outlook, 2014: Economic Outlook for Southeast Asia, China and India, 2014, OECD
- EIO, 2013: Paving the way to a green economy through eco-innovation, 2013, EIO Europe in transition, Eco-innovation Observatory
- Pwc, 2014: Making innovation go further in metals. How companies could gain by widening their innovation focus, 2014, pwc



PR.6
Develop a value chain vision

Eco—i Metals

PR.6 Developing a value chain vision

Eco—i Metals

LEARNING CASE STUDY OF VALUE CHAIN VISION

Threats and opportunities

Vision

The metal manufacturing industry is successful, profitable and growing strong in both domestic and international markets.

There are overarching pressures having strong influence on the metal manufacturing value chain such as a stricter regulatory environment, market demand for sustainable products, health and environmental issues related to metal manufacturing industry and often above all the need to ensure profitability. Volatile prices of raw materials caused by their scarcity and other global geopolitical issues encourage metal manufacturing value chain companies to start thinking about new ways to overcome these emerging challenges.

Enhanced and innovative cooperation between different metal value chain stakeholders is recognized as a solution with high potential to address the aforementioned challenges and lead to a significant decrease in raw materials consumption and emissions generation. Furthermore, innovative business models often include solutions addressing issues from all three aspects of sustainability to incorporate environmental impact reduction and health and social risks from operations, whilst increasing profitability for all involved stakeholders. .

Partnerships

Clients

PR.9

Pitching the benefits of eco-innovation to the CEO

Eco—i Metals

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

Eco—i Metals

BACKGROUND INFORMATION

At this point of the eco-innovation process, you have gathered all the necessary information on the target value chain and are ready to engage a company to offer your services as an eco-innovation service provider. From this point onwards in the supplement, we will use the hypothetical company BikeBizz Co. as a learning case study to provide practical examples of implementation of the eco-innovation methodology and selected templates at a company within the metals value chain.

Description of the BikeBizz Co.

The results of your desktop research and the completion of the eco-innovation *Target Identification* template identified the sector fabrication of metal products as a key sector that would benefit from eco-innovation services. The bicycle market in particular is currently showing signs of growth, in particular consumers are putting more value on high quality and sustainably produced bicycles[8].

After attending a local trade fair of manufacturers and wholesalers of bicycles and related parts, you identified the BikeBizz Co. as an ideal candidate for the implementation of eco-innovation due to its strategic position in the value chain, good position in the local market and as well its forward-thinking management team.

BikeBizz Co. is a small company specialized in the production of standard bicycles offering customization on customers demand.

The company was established by a cycling fan to produce bikes for the local market. The company employs 25 people and produces around 1500 bicycles per year.

BikeBizz Co. builds the frames including fork and handlebar out of purchased steel tubes and applies a corrosion protective coating and a final coating of paint. The company also produces the spokes out of steel wire, which are assembled with the other purchased wheel components. The finished wheel is balanced. Finally, the frame and wheels are assembled with the other bike components, also acquired from suppliers. The bicycles can be adjusted to customers' specific requests including for example frame design customisation to fit different applications (e.g. freight transportation).

The bikes are predominately sold to the local market through their small retail shop. A small percentage of their bikes are exported to a neighbouring country.

The majority of the employees are involved in the production processes (e.g. frame building, assembling, finishing). The management staff, altogether three, includes the director, the sales and customers' manager and the finance officer. They also have a salesperson running their retail shop.

Now that you have identified some key sustainability challenges and opportunities faced by the Company, you can use the output from the *Life cycle Stakeholders* template to help you identify the key partners with whom you could engage to offer eco-innovation solutions (see PR.3).

The following list describes how some stakeholders could potentially contribute to eco-innovation activities in the value chain:

Based on the completed *Life cycle Stakeholders* template for the BikeBizz Co., the key partners include:

- Suppliers of metal raw materials (e.g. tubes) and parts – ensure metals are sustainably sourced and optimize mechanical properties for production and use over the product's lifetime

[8] http://www.cbi.eu/market-information/metal-parts-components/metal-parts-bicycles

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

- Equipment suppliers – optimize resource efficiency of existing equipment; potential application of 3D printing and additive manufacturing to significantly improve material efficiency
- Chemical suppliers – improve corrosion protection and extend the durability of the bike; eliminate heavy metal containing pigments (e.g. lead-containing pigments)
- Customers – involve customers in workshops to assist in identifying key bike features and functions, as well as determining desirable payment schemes.

Your brief analysis of the subsectors of the metals sector produced the following representative life cycle diagram related to the life cycle of bicycles.

Market opportunities for bicycle manufacturers

- Using sustainable materials: recycled metals, solvent-free and lead-free paints, natural rubber tyres or made from recycled material
- Application of alternative metal processing techniques and materials to reduce energy consumption and improve material efficiency
- Design for reparability and recyclability
- Cooperating with a local NGO contributing to improving life quality of local populations or involved in the sustainable transportation initiatives offering sustainably produced metal products/bikes (e.g. partnering in awareness raising and creating better visibility, possible revenue stream)
- Diversifying into the production of bikes used for other uses (e.g. multi-purpose bikes), offering maintenance services (directly or through repair shops)

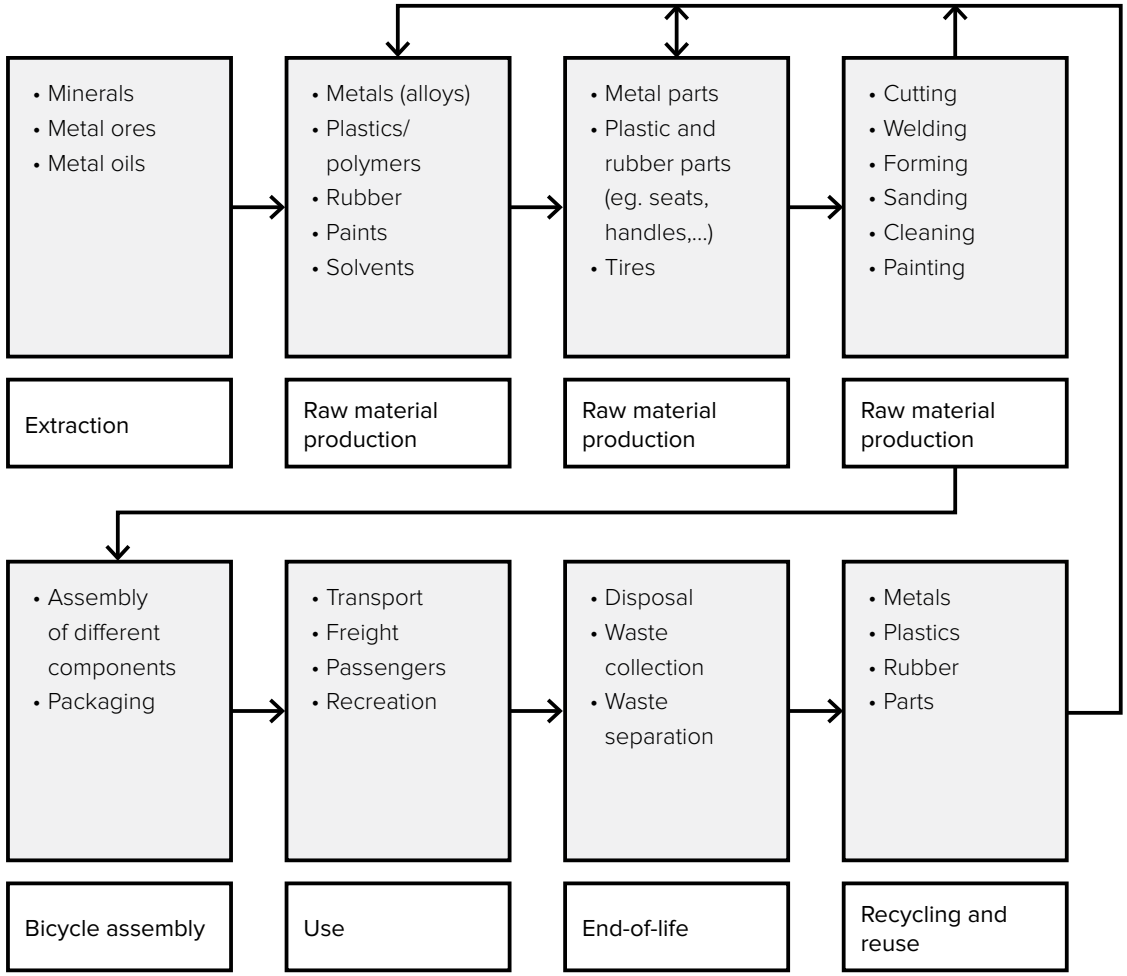
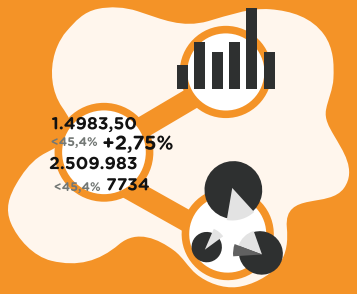
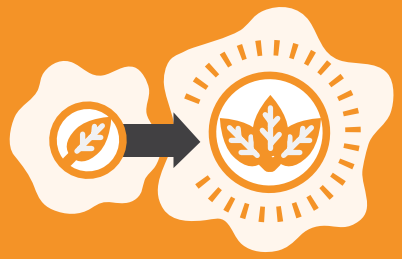


Figure 6 Representative life cycle diagram for the bike market


1.4983,50
<45,4% +2,75%
2.509.983
<45,4% 7734

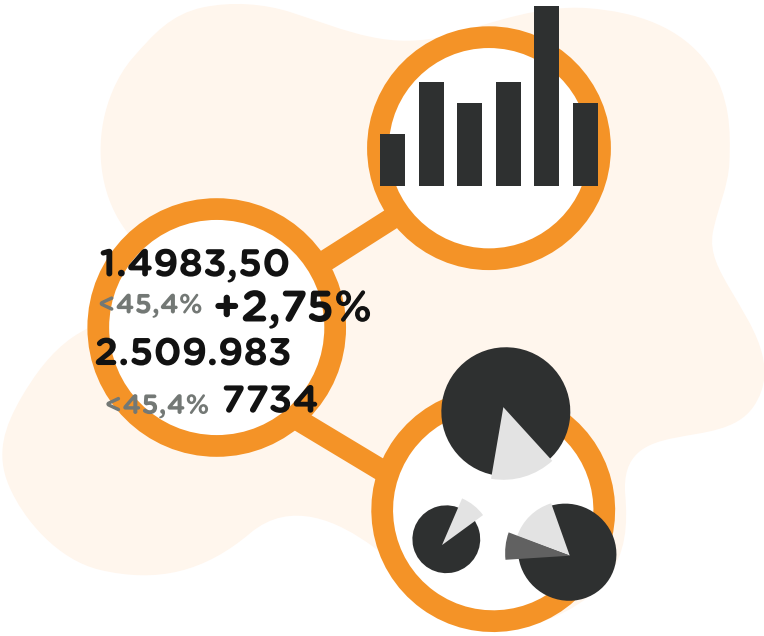


SET STRATEGY

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 Metals

ST.1
Plan my data gathering strategy



Eco—i Metals

ST.1 Plan my data gathering strategy

Eco—i Metals

BACKGROUND INFORMATION

Table 5 provides an overview of strategies commonly encountered in the machinery and equipment manufacturing subsector according to product type and customer market segment.

Table5: Typical strategies for the different market segments in the machinery and equipment manufacturing sub-sector.

Niche Market	**Mass Market**
High-end products	
• Automation features for complex tasks • Long lifetime, high precision/safety • Tailor-made machines/lines • Inclusion of pre/after-sales service • Strengthen export business by increasing geographic footprint • Produce upper mid-end product to defend high-end market position	• Development of solutions for entire application process • Drive innovation in core business including after-sales service
Mid-range products	
• Basic features for standard tasks • Long lifetime, high output, good precision/safety • Standard or slightly customized machines/lines • Develop niche globally • Defend again new entrants • Basic services • Explore options (e.g. differentiation) to expand into high-end segment	• Include cost focus into existing technology-driven strategy • Switch from technology to cost focus including product simplification

ST.1 Plan my data gathering strategy

Eco—i Metals

Niche Market	**Mass Market**
Low-end products	
• Minimal features for simple tasks • Limited lifetime, precision & safety • Limited to no automation, minimal flexibility • Standard single machines • Expand into other niche markets as well as mid-end entry options • Upgrade technology and management systems for expanded product portfolio	• Develop existing niche position in local and global markets • Focus on domestic market growth

ST.3
Capture the current business model

Eco—i Metals

ST.3 Capture the current business model

Eco—i Metals

LEARNING CASE STUDY OF BUSINESS MODEL CANVAS

The BikeBizz Co.'s current business model is based on the Value Proposition of locally produced, good quality bicycles adapted to specific customer requirements at an affordable price. The key activities of the company are manufacturing the bicycle frame out of acquired steel tubes, providing surface treatment, corrosion protection and painting for the frame, producing the spokes out of steel wire and assembling them with the other purchased wheel components as well as balancing the finished wheel, and finally assembling the frame and wheels with the other bike components, also acquired from suppliers. The bicycles can be adjusted to customers' specific requests.

Further key activities are selling the bikes in their own small bike shop. Thus, the key partners of the company are the partnering store in the border region, the suppliers of semi-finished products and components. The key resources are the production machines, the acquired bicycle parts and the skilled staff. The biggest customer segment is constituted by the local customers, the customer relationships are mostly maintained by direct communication and the channels to the customers include media adverts, direct sale and export. The main costs for the company accrue from material procurement, electricity demand and staff expenditures, while the revenue is solely obtained from bike sales.

ST.3 Capture the current business model

Eco—i Metals

Key Partners

Suppliers of semi-finished products: steel tubes, steel wire, aluminium rims

Suppliers of bike parts: saddle, brakes, chain rings, derailleur etc

Suppliers of process agents: mineral oil based lubricant for cutting, alkaline chemicals for surface degreasing etc

Suppliers of paint pigments (bright colours containing lead), solvent for paint, primer

Electricity provider

Partnering store in the neighbouring border region

Key Activities

Manufacturing of bike frame from steel tubes obtained from suppliers (frame manufacturing, painting)

Manufacturing of spokes from steel wire and wheel assembly and balancing

Procurement of semi-finished products and bicycle parts

Assembly of bicycles

Adjusting bicycles to customers specific requests

Retail of produced bikes in own small bike shop

Key Resources

Materials: semi-finished products (tubes, wire), chemicals (paint, solvents, alkaline, lubricants), components (rim, brakes, gears, seat, handlebar grips, pedals, tires)

Electricity

Skilled production staff

Production equipment

Value Propositions

Locally produced bicycles occasionally customized to customers' specific request

Customer Relationships

Direct communication with a customer (telephone/ face-to-face)

Direct communication with a retailer shop in a bordering region (telephone/ face-to-face)

Channels

Direct sales to customers with the store

Export sales to the neighbouring border region

Local media advert

Customer Segments

Local customers: personal use, transport

Export (small amounts)

Cost Structure

Production equipment and its maintenance

Materials procurement

Labour, Electricity, Transport

Revenue Streams

Sales of bikes – locally and export

ST.4
Do a Walk-Through Audit

Eco—i Metals

ST.4 Do a Walk-Through Audit

Eco—i Metals

TIPS & TRICKS

PERFORM A SIMPLIFIED VALUE-STREAM MAPPING AS PART OF THE WALK-THROUGH AUDIT

It is possible for you to use a simplified value stream mapping method (see US EPA Lean and Environment Toolkit) to characterise the whole business process from customer order to product/service delivery.

CONSIDER KPIS AND BENCHMARKS

Try to gather data during the audit that could enable you to evaluate important metals sector manufacturing Key Performance Indicators (KPIs) for the company. Such KPIs cover topics including process efficiency (value-added time/total lead time), recyclability, and overall equipment efficiency – further examples of KPIs for the metals sector are provided in the *Background Information* section. Moreover benchmarking against best practice standards (e.g. world class process cycle efficiencies can exceed 25%) can be useful to identify priority areas for operational improvement.

TRY TO IDENTIFY CHEMICAL-RELATED RISKS AND HAZARDS

Information on hazards and risks related to chemicals used/handled, stored at the production site (e.g. cleaning agents, paints, lubricants, etc.) are explained on hazard/risk labels and in Safety Data Sheets (SDS) that should be 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 in order to improve the situation of the workers and also other value chain stakeholders (transporters, customers, communities).

CONSIDER CUSTOMERS SPECIFIC REQUESTS

When completing the activity *ST.4 Walk-through Audit*, you can also ask the company about specific requests from customers or other stakeholders regarding environmental performances and quality of products or operations, such as:

- Carbon/water/chemical footprint
- VOC-free formulations (e.g. coatings, inks)
- Heavy-metal free products (e.g. lead-free paints)
- Compliance with national laws on workplace health and safety policies (e.g. VOC fugitive emissions)
- Disposal or valorisation of hazardous waste (e.g. paint overspray sludge)

ST.4 Do a Walk-Through Audit

Eco—i Metals

LEARNING CASE STUDY WALK-THROUGH AUDIT RESULTS

Key observations

General aspects

- *The bicycle manufacturing process basically consists of frame manufacturing and painting, wheel manufacturing, bike assembly as well as packaging.*

Sales & Marketing

- *Relationship with customers and other stakeholders are well established*

Production — goods in

- *Frame is manufactured from steel tubes acquired from suppliers.*

Design & Engineering

- *Open to offer customised design solutions upon customer's request*

Production — main processes

- *Large amounts of hazardous wastes (lubricants/swarf sludge, over spray sludge)*
- Occupational health issues related to finishing processes (e.g. VOC emissions, lead paint)

Purchasing

Production — goods out

- *The finished bike is packed and can be delivered to the customer.*

Management

- *Lack a production manager and do not have time to map the different process steps.*

Operational Strengths

1. *operates with an effective and skilled team*

Operational Weaknesses

1. *The paint pigments applied by hand spraying, for which the material efficiency was estimated to be about 40%*

ST.4 Do a Walk-Through Audit

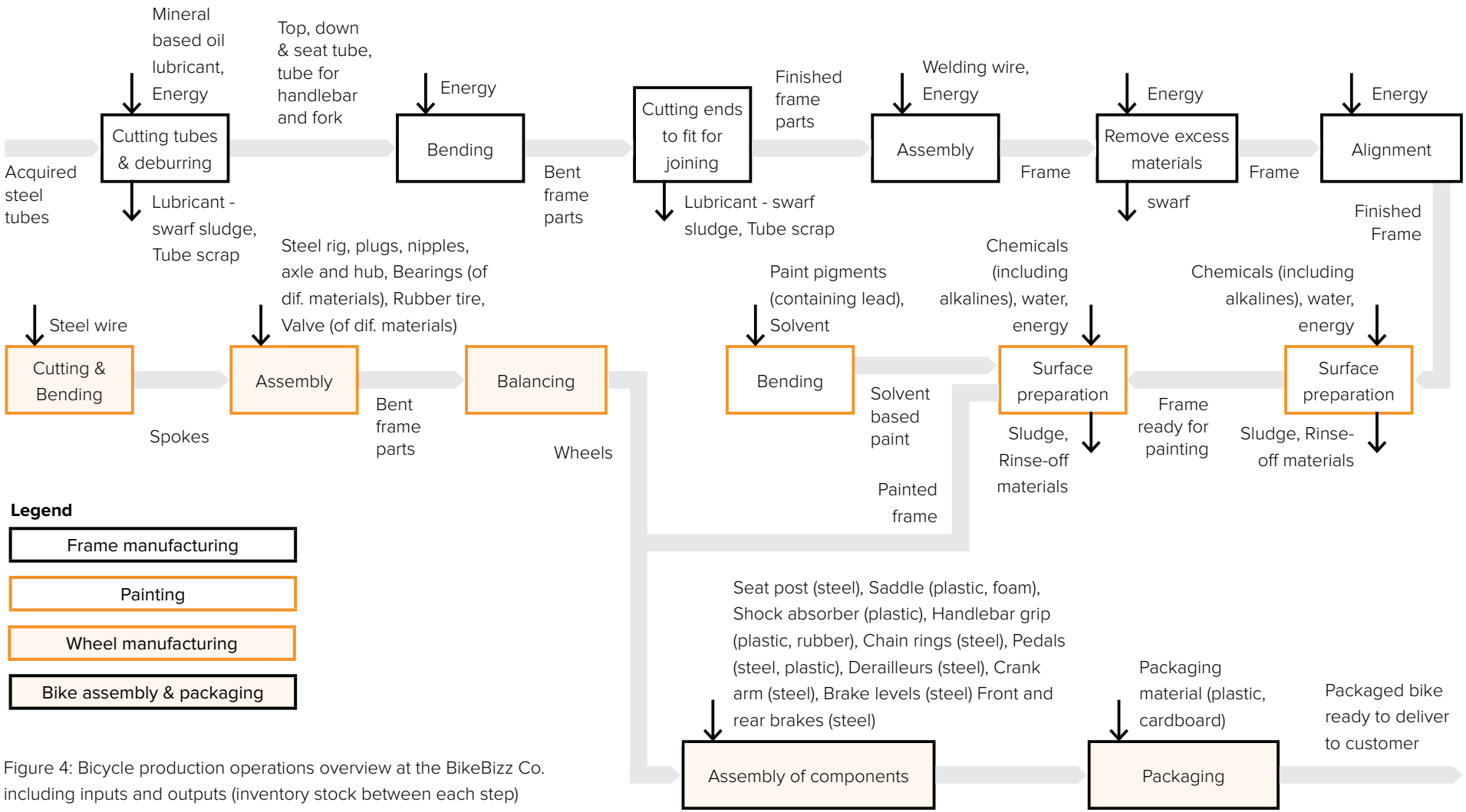


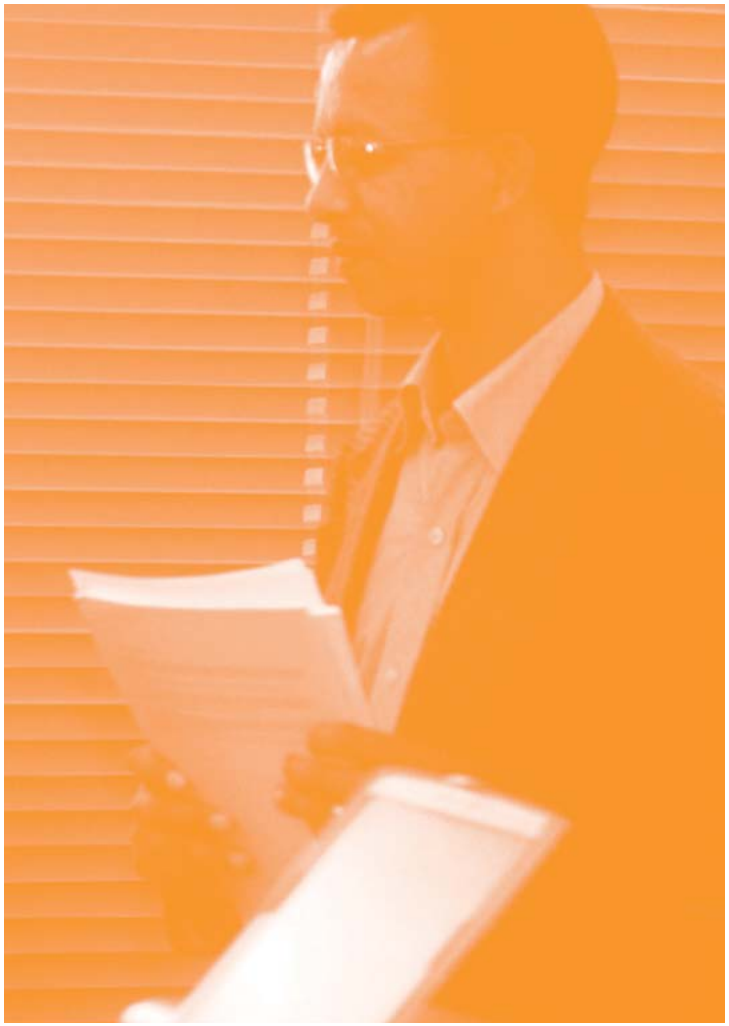
Figure 4: Bicycle production operations overview at the BikeBizz Co. including inputs and outputs (inventory stock between each step)

ST.4 Do a Walk-Through Audit

Eco—i Metals

From the *Life-cycle Thinking* template, the results of the *PESTEL* and the *Walk-Through Audit*, the main sustainability challenges and opportunities along the life cycle of the bicycle, the so-called sustainability hotspots, are identified:

- Growing demand for affordable, high quality forms of transportation (e.g. bikes) in local market
- Competition from low-cost international companies putting pressure on market share
- Increasing costs of energy and process agents in the metal fabrication production
- Growing demand for sustainable products and services in the bicycle production
- Increasing interest from long-term investors in companies involved in sustainable production
- Waste generation along the bicycle life cycle (raw materials extraction and production, end-of-life bicycles)
- Health and safety issues along the life cycle of the product
- Lack of recycling infrastructure for different waste streams (metals, hazardous waste)



ST.4 Do a Walk-Through Audit

Eco—i Metals

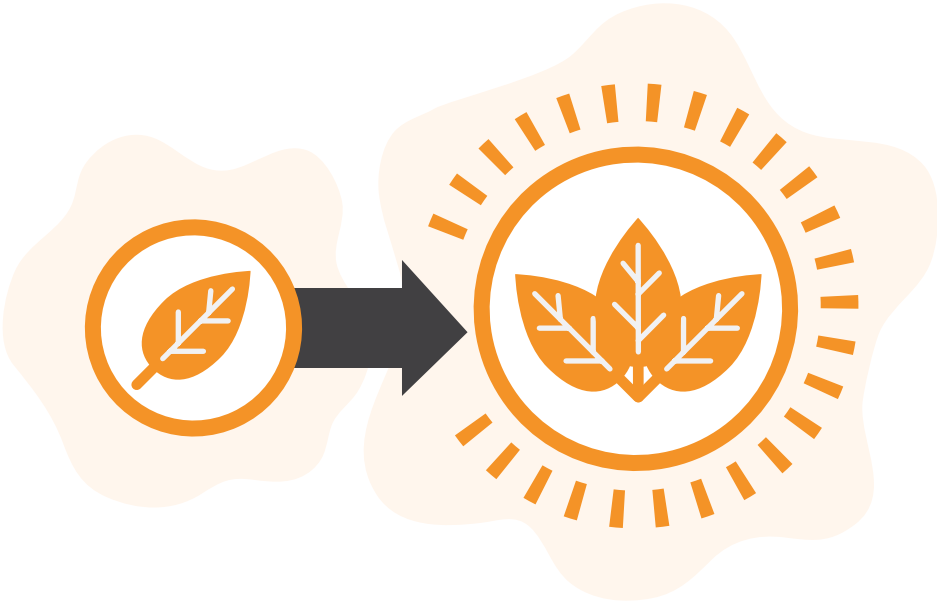
BACKGROUND INFORMATION

Table 6 presents examples of different indicators to measure sustainability in the metals sector. Elements in bold indicate important KPI's for the metals sector.

Table 6: Examples of different indicators to measure sustainability in the metals sector [OECD toolkit, 2011].

Group of indicators	**Examples of indicators**
Business performance	• To gauge operational performance, market and marketing efforts
Operational	• Overall Equipment Effectiveness • Lean metrics: batch cycle time, inventory days of supply (IDS), process velocity...
Environmental indicators	• To measure the interaction with or impacts on the environment
Inputs	• Restricted substances intensity • Recycled/reused content
Operations	• Water/Energy intensity • Renewable production of energy
Residuals intensity	• Air/water releases intensity
Products	• Recycled/reused content • Restricted substances content
Recyclability	• Energy consumption intensity • Water/Carbon/Chemical footprint

ST.6
Update the sustainability hotspots



Eco—i Metals

ST.6 Update the sustainability hotspots

Eco—i Metals

LEARNING CASE STUDY OF LIFE CYCLE THINKING

					Environmental impacts		Social Impacts			Economic impacts
Phase	**Activity**	**Inputs**	**Product outputs**	**Emissions**	**Resource use**	**Ecosystem quality**	**On workers**	**On consumers**	**On stakeholders**	**Profitability**
Materials	*Extraction of raw materials*	• *Energy*	• *Raw materials*	• *Waste water* • *GHG emissions*	• *Unsustainable extraction of minerals, metal ores, hydrocarbons*	• *Impact on biodiversity* • *Claim of natural areas* • *Leaving exploited soils*	• *Bad working conditions for extraction* • *Health issues related to mining hazardous substances: mineral lubricants, solvents and lead points.*		• *Geopolitical conflict over natural resources*	• *Price volatility of raw materials* • *High prices of high tech materials (titanium/coal)*
Production	*Production of metals, rubber, plastics, various parts, chemicals (solvents, lead paints)*	• *Energy raw materials*	• *Metals* • *Rubber* • *Plastics* • *Various parts* • *Chemicals (solvents and lead paints)*	• *Hazardous waste (paints, solvents, chemicals for metal treatment)* • *Emissions (e.g. VOC)*	• *Unsustainable production*	• *Dumping of hazardous waste* • *Accumulation of substances in the soil and ground water*	• *Bad working conditions in production site* • *Gender issues* • *Safety issues: welding, paints, coating, solvents.*			

					Environmental impacts		Social Impacts			Economic impacts
Phase	**Activity**	**Inputs**	**Product outputs**	**Emissions**	**Resource use**	**Ecosystem quality**	**On workers**	**On consumers**	**On stakeholders**	**Profitability**
Production	*Frame manufacturing*	• *Energy* • *Materials*	• *Metal waste frame*				• *Bad working conditions in production site* • *Gender issues* • *Safety issues: welding, paints, coating, solvents.*			
	Painting	• *Materials for paint*	• *Painting waste*	• *Waste water*	• *Lead for paints*	• *Dumping of hazardous waste* • *Accumulation of substances in the soil and ground water*	• *Bad working conditions in production site* • *Gender issues* • *Safety issues: welding, paints, coating, solvents.*			
	Wheel manufacturing	• *Raw materials*	• *Metal waste wheels*				• *Bad working conditions in production site* • *Gender issues* • *Safety issues: welding, paints, coating, solvents.*			
	Bike assembly	• *Frame and wheels*	• *Bike*				• *Bad working conditions in production site* • *Gender issues* • *Safety issues: welding, paints, coating, solvents.*			• *Low-cost competitors are threatening the already low net profit margin as well as market share*

					Environmental impacts		Social Impacts			Economic impacts
Phase	**Activity**	**Inputs**	**Product outputs**	**Emissions**	**Resource use**	**Ecosystem quality**	**On workers**	**On consumers**	**On stakeholders**	**Profitability**
Transportation	*Transport to retailer*	• *Fuel*	• *Bike (at retailer)*	• *GHG emissions* • *Metal scrap from damaged bikes*	• *Resource depletion (fossil fuels)*	• *Climate change*			• *Noise*	• *Cost of transportation*
Use	*Use*							• *The population riding bikes is expected to rise from 10% to 15% in the next five years.* • *Consumers are keeping their bikes longer, investing instead in repairs, new parts and accessories instead of buying new ones.*	• *The LOHAS (Lifestyle of Health and Sustainability) market segment is growing rapidly, over 15% per year. The LOHAS segment is willing to pay a 20% premmium bikes.*	• *Low price due to competition* • *LOHAS segment has a potential market size of 0.6-1.3m$.*
End of life	*No recycling*		• *No recycling*	• *Waste e.g. tires, plastic*		• *Waste dumping* • *Lead accumulation in soil and water leading to lead poisoning*			• *Generation of waste lead poisoning*	• *Valuable metals are disposed off* • *Emerging of second hand market competition*

ST.6 Update the sustainability hotspots

Eco—i Metals

As pointed out in the Eco-innovation Manual, an important part of understanding the operational performance of the company is to gather data about the life cycle sustainability impacts of the products the company offers and update the sustainability hotspots that you identified during the *PREPARE* phase. These data should be captured by updating the *Life-cycle-Thinking* template already completed in the *PREPARE* phase for the value chain, thus the updated *Life-cycle Thinking* template just presented.

With updated information about the sustainability impacts, you can now also update the sustainability hotspots. The following table illustrates the sustainability hotspots identified for the BikeBizz Co. along with some of the key stakeholders and ideas for how they could help to address these hotspots.

Table 7: Identified sustainability hotspots and how stakeholders could help

Sustainability hotspot	**Stakeholder and how they could help**
growing demand for affordable, high quality forms of transportation (e.g. bikes) in local market	• customer- willingness to pay a higher price
competition from low-cost international companies putting pressure on market share	• manufacturer- new production methods for higher metal utilization and less metal waste for higher utilization rates and better competition • manufacturer- diversification • manufacturer- using high quality and close production site as selling point • investors/local community- invest in local company to ensure good competition on the global market
increasing costs of energy and process agents in the metal fabrication processes	• manufacturer- more sustainable manufacturing processes
growing demand for sustainable products and services in the bicycle production	• customer- willingness to pay higher prices • manufacturer- use the demand for high quality products as selling point: advertise sustainability and local production
increased interest of the long-term investors in companies involved in sustainable production	• recycling company- recycling strategies to decrease the amount of metals dumped after use

ST.6 Update the sustainability hotspots

Eco—i Metals

Sustainability hotspot	**Stakeholder and how they could help**
waste generation along the bicycle life cycle (raw materials extraction and production, production, end-of-life bicycles)	• suppliers- more sustainable extraction methods; less use of natural area • manufacturers- more sustainable use of raw materials, paints, hazardous substances • recycling company/customer- take back actions for high metal return for recycling instead of dumping • recycling company – recycling strategies to decrease the amount of metals dumped after use
health and safety issues along the life cycle of the product	• extraction site managers- allow for better health insurances • manufacturer- higher standards of work place safety and health issues
lack of recycling infrastructure for different waste streams (metals, hazardous waste)	• manufacturer/recycling company: new recycling methods; new metal formulations for better separation and recycling; more sustainable use of hazardous substances; processes for internal reuse of hazardous substances

ST.7
Do a SWOT analysis

Eco—i Metals

ST.7 Do a SWOT analysis

Eco—i Metals

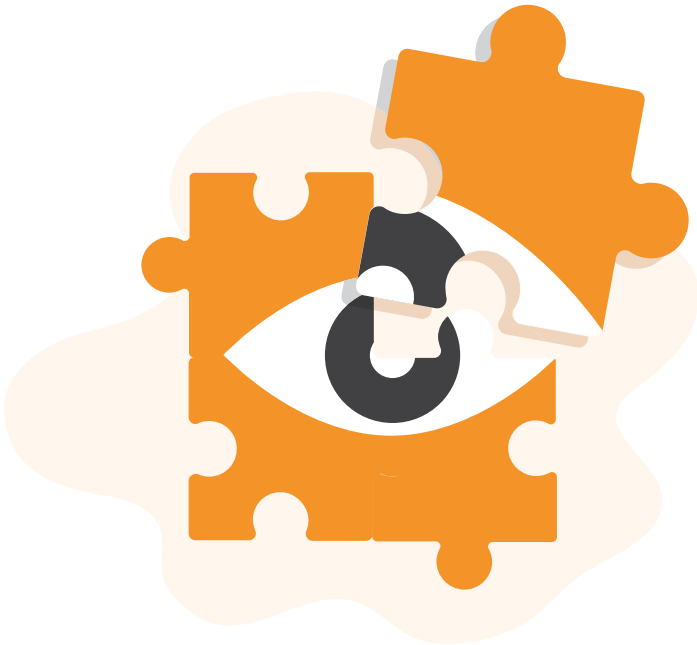
LEARNING CASE STUDY OF SWOT

	Helpful - to becoming more sustainable	**Harmful - to becoming more sustainable**

Internal origin (attributes of the company)	**STRENGTHS**
	• *Skilled, loyal workforce*
	• *Location close to neighbouring region*
	• *Retail shop linked to the production site*
	• *Production diversification possibilities: production of multi-purpose bikes*
		WEAKNESSES
		• *Significant amount of waste/emissions*
		  • *Scrap metal*
		  • *Over spray sludge (including lead in paint)*
		  • *Solvent emissions*
		• *Lack of production manager*
		• *Gender inequality*
		• *No systematic production line*
		• *High retail price*

External origin (attributes of the environment)	**OPPORTUNITIES** • *Customers demand high quality more affordable and sustainable* • *Good relationship with customers* • *Demand for improved customer services (repair, maintenance, warranty)* • *Low impact on environment* • *Multi-functionality of bikes*	**THREATS** • *Raw material price volatility* • *Waste generation along the bicycle life cycle* • *Competitive market (local and international)* • *Low retail prices* • *No waste management system (end-of-life bicycles)* • *High costs of high quality parts*

ST.8
Develop a vision for the company



Eco—i Metals

ST.8 Develop a vision for the company

Eco—i Metals

LEARNING CASE STUDY OF COMPANY VISION

SWOT

Value chain vision

Company vision

BikeBizz Co. is a leader in a new and growing market specialized in the production of standard bicycles offering customization on demand.

The aim is to specialise in manufacturing and selling sustainable bicycles with added-value services and accessories customized on demand. BikeBizz provides the customer with an enhanced cycling experience since the bike geometry (frame, seat, handle bars, forks) and accessories are personally customised for comfort and efficiency of use.

BikeBizz strives to treat their staff, suppliers and partners fairly and cooperate to build a profitable and sustainable value chain.

Feedback

ST.9
Define the strategic goals

Eco—i Metals

ST.9 Define the strategic goals

Eco—i Metals

LEARNING CASE STUDY OF TOWS

	STRENGTHS
	• *Skilled, loyal workforce*
	• *Location close to neighbouring region*
	• *Retail shop linked to the production site*
	• *Production diversification possibilities: production of multi-purpose bikes*
		WEAKNESSES
		• *Significant amount of waste/emissions*
		  • *Scrap metal*
		  • *Over spray sludge (including lead in paint)*
		  • *Solvent emissions*
		• *Lack of production manager*
		• *Gender inequality*
		• *No systematic production line*
		• *High retail price*

OPPORTUNITIES • *Customers demand high quality more affordable, and sustainable products* • *Good relationship with customers* • *Demand for improved customer services (repair, maintenance, warranty)* • *Low impact on environment* • *Multi-functionality of bikes*	**STRENGTHS-OPPORTUNITIES strategy ideas** • *Use the fact of the retail shop being linked to the production site to offer improved customer services (repair, maintenance, warranty)* • *Use the proximity of the shop to the production site for take back actions for end-of-life bikes to enhance recycling* • *Use the proximity for behind-the-scenes tours to show customers parts of the production*	**WEAKNESSES-OPPORTUNITIES strategy ideas** • *Use the high demand for repair, maintenance for enhancing the life of a bike to reduce waste* • *Find a production manager to build up a life cycle management plan to allow for analysis of the production line and possibilities to optimize production*
THREATS • *Raw material price volatility* • *Waste generation along the bicycle life cycle* • *Competitive market (local and international)* • *Low retail prices* • *No waste management system (end-of life bicycles)* • *High costs of high quality parts*	**STRENGTHS-THREATS strategy ideas** • *Being close to the neighbourhood can help building trust and understanding for higher prices* • *Use that as a selling point because people will appreciate their high quality products more and generate less waste* • *Diversify your production into multipurpose bikes as this will reduce the amount of metal used for other production lines* • *Build up a waste management system using the help of the neighbourhood: loyal workforce can educate children how to repair bikes and maintain them for as long as possible*	**WEAKNESSES-THREATS strategy ideas** • *Hire a production manager to build up a waste management system* • *Educate workers knowing the complete production process in order to describe a systematic production line to be able to face specific weaknesses*

ST.9 Define the strategic goals

Eco—i Metals

LEARNING CASE STUDY OF STRATEGIC GOALS

The *SWOT* analysis and *TOWS* template were used to generate a new business strategy that takes advantage of BikeBizz Co.'s current operational strengths (e.g. well established business operations and partnership relationships, skilled and loyal workforce and production diversification possibilities) and responds to identified market threats and opportunities. Particularly relevant threats identified include waste generation along the bicycle life cycle, competitive market (local and international), raw material price volatility and low retail prices. External opportunities such as customers demand for high quality products with low impact on environment and increased demand for improved customer services also create new possibilities, which BikeBizz Co. needs to consider when setting the strategic goals.

STRATEGIC GOAL #1	
What hotspot or other SWOT issue does the goal help to address?	*Waste generation along the bicycle life cycle*
What is the desired change?	*Reduction of metal waste along the bicycle life cycle by 75%*
How will you know if the goal has been achieved?	*Dumping rates will be reduced* *Output figures* *Input-output analysis*
When will the change be achieved?	*Within 5 years*
Final formulation of the goal:	*Reduction of metal waste along the bicycle life cycle by 75% within 5 years in cooperation with the value chain partners*

STRATEGIC GOAL #2	
What hotspot or other SWOT issue does the goal help to address?	*Customers demand high quality, affordable and sustainably produced bicycles*
What is the desired change?	*Track sales revenue for each financial year. Goal achieved when annual sales exceed are 25% higher than today.*
How will you know if the goal has been achieved?	*Certificates for lead free manufacture* *Suppliers proof by register of input substances* *Free of lead* *Testing of finished products for lead*
When will the change be achieved?	*Within three years*
Final formulation of the goal:	*Increase product sales revenue by 25% within 3 years*

ST.9 Define the strategic goals

Eco—i Metals

STRATEGIC GOAL #3	
What hotspot or other SWOT issue does the goal help to address?	*Health problems associated with lead in paint*
What is the desired change?	*Eliminate lead containing paints in cooperation with the value chain partners*
How will you know if the goal has been achieved?	*Certificates for lead free manufacture* *Suppliers proof by register of input substances* *Free of lead* *Testing of finished products for lead*
When will the change be achieved?	*Within 2 years*
Final formulation of the goal:	*The complete manufacturing chain will be lead-free within 2 years*

STRATEGIC GOAL #4	
What hotspot or other SWOT issue does the goal help to address?	*Significant amount of waste and emissions*
What is the desired change?	*Reduce hazardous waste by 25% in 2 years and 75% in 3 years*
How will you know if the goal has been achieved?	*Input-output analysis* *Inventory of hazardous substances used*
When will the change be achieved?	*Within 3 years*
Final formulation of the goal:	*Reduce hazardous waste generation throughout the value chain by 75% within 3 years*

ST.9 Define the strategic goals

Eco—i Metals

STRATEGIC GOAL #5	
What hotspot or other SWOT issue does the goal help to address?	*VOC emissions* *Significant amount of waste and emissions*
What is the desired change?	*Reduce VOC emissions by 50%*
How will you know if the goal has been achieved?	*Emissions analysis*
When will the change be achieved?	*Within 1 year*
Final formulation of the goal:	*Reduce VOC emissions from our manufacturing process by 50% within 1 year*

STRATEGIC GOAL #6	
What hotspot or other SWOT issue does the goal help to address?	*Metal waste resulting from production processes due to e.g. cutting, grinding (swarf)* *Lowers significant amount of metal scrap waste during sustainable production process increases efficiency.* *Lower levels of scrap waste during production decreases emissions due to production processes.*
What is the desired change?	*Reduce metal scrap waste to less than 1% of the input during production.*
How will you know if the goal has been achieved?	*Reduced waste lowering input amounts* *Input-output analysis*
When will the change be achieved?	*Within 2 years*
Final formulation of the goal:	*Reduction of metal scrap waste during production to less than 1% of the input within 2 years*

ST.9 Define the strategic goals

Eco—i Metals

STRATEGIC GOAL #7	
What hotspot or other SWOT issue does the goal help to address?	*Competition from low-cost international companies putting pressure on market share driving down profit margins*
What is the desired change?	*To become the local leader in sustainable production of personalized bicycles fitting local needs*
How will you know if the goal has been achieved?	*Good relations to customers and neighbour-hood* *Secure client base*
When will the change be achieved?	*Within 5 years*
Final formulation of the goal:	*To become the local leader in sustainable production of personalized bicycles fitting local needs within 5 years*

STRATEGIC GOAL #8	
What hotspot or other SWOT issue does the goal help to address?	*Low profit margins means little financial capital for investment*
What is the desired change?	*Increase profit margins by 10% on both domestic and export sales by lowering production costs through waste reduction and higher efficiency in the production process.*
How will you know if the goal has been achieved?	*Cash method of accounting* *Increased profit (profit and loss account)*
When will the change be achieved?	*Within 3 years*
Final formulation of the goal:	*Increase profit margins by 10% on both domestic and export sales within 3 years*

ST.9 Define the strategic goals

Eco—i Metals

Examples of sustainability strategies in the metals sector

There are many different types of strategies used by companies in the metals industry that can lead to eco-innovation in the metals value chain, here are some examples:

- Provide products and services to 'green' end markets
  For example, 'green buildings' is an end market that is currently growing and requires innovation across the value chain to improve the life cycle sustainability performance of buildings, especially in the building's use phase. Eco-innovation potential exists for metals sector firms that can improve sustainability performance by e.g. providing sustainable infrastructure products for the construction phase, or by reducing energy consumption over the building's lifetime by providing energy efficient machinery and equipment solutions (e.g. HVAC and automation systems).
- Improve sustainability performance of direct customers and their clients
  Resource efficiency is an important driver for many businesses in all sectors to reduce material and energy costs, reduce GHG emissions, and demonstrate their commitment to sustainability to customers and shareholders. The metals sector can provide many different solutions to improve resource efficiency in various industrial applications such as HVAC, materials handling, packaging, textile processing, paper & print, machine tools, construction, etc. However, this strategy involves knowing the market trends of the industrial users and their clients.

  The automotive sector is an important example of how the metals sector can improve its sustainability performance towards the end market. The metals sector can contribute to improving the recyclability and fuel efficiency of vehicles by collaborating with the OEM in the automotive sector with strategies to reduce vehicle weight through reducing thickness, material density, or surface. Such technical innovations could involve strategies to develop new high strength steels, aluminium alloys or composite material.

  For example, the machinery & equipment manufacturing sub-sector can target industrial sectors with high energy consumption and offer products and services to reduce energy consumption, save operational expenses, increase renewable energy usage, and decrease GHG emissions.

  Another example of a strategy for improving the sustainability performance of customers is to prioritize aftersales services in addition to the initial product sale. For example, in the machinery and equipment subsector, such services could include optimisation support to minimise energy consumption and reduce operational costs for the customer. This strategy has the added benefits of strengthening customer relationships and provides an additional revenue stream.
- Partnerships with strategic actors across the value chain offer new sustainable solutions
  Companies in the metal value chain are building platforms for successful networking and cooperation. Breaking down market access barriers, establishing supply and value chain long-term partnerships, cutting down maintenance costs, sharing R&D investment efforts are among others topics in the focus of the innovative networking activities.

  Partnering with other subsectors or actors in the value chain and offering bundled product/service-systems (PSS) is a strategy that can offer a competitive advantage. For example, the high quality

cleaning of high precision metal parts is a common process in many high value industries (e.g. aerospace, medical, etc.) that is both energy intensive and can consume high amounts of expensive solvents. Metals sector equipment suppliers have cooperated with chemical companies to offer advanced cleaning services.

Other examples include bundling equipment and technology services across different value chains. For example, metals sector companies selling material recovery technologies (e.g. pigging technologies for liquids in chemical, beverage, and pharmaceutical industry) partner with metals sector equipment suppliers (e.g. energy efficient pumping technologies) to cover new, bundled products with added-value sustainability performance – in this case a pumping/material product-service system leading to improved energy efficiency and improved material efficiency.

- Apply 'Blue Ocean' strategies
  A strategy equally applicable to the metals industry is the 'Blue Ocean' strategy described in the Eco-innovation Manual. The following example is from within the metals industry, where a specific regulatory and market situation inspired a company to develop a technology to improve the End-of-Life (EoL) product management of batteries.

Industry Example 2: Blue Ocean Strategy

AkkuSer, Finland, a company specialized in recycling of hazardous End-of-Life consumer batteries, was driven by an opportunity of turning an environmental need into a business case when they set their strategic goals:

- Provide solutions to upcoming regulatory pressures (EU, Finland, worldwide)
- Be a pioneer in development of a technology that ensures high recycling rate with low impact to the environment.

With the entire EoL value chain in consideration, Akkuser introduced innovations across several dimensions of their business: product development, process innovation and value chain cooperation. They invested in development of innovative products – recycling processes for hazardous batteries and accumulators in partnership with the Finnish innovation funding agency. The product innovations helped the company to achieve substantial business benefits and growth with the added value of supporting efforts to raise the degree of material recovery from EoL batteries and accumulators, help preserving natural resources, and reduce waste generation across the value chain. The company started applying BEPs to ensure safe handling of EoL consumer portable batteries and accumulators including WEEE-items during all stages of the recycling process. Further, they initiated cooperation with the EoL value chain and producer organisations to improve the product life cycle management specifically related to improving cost efficiency, sourcing strategies and dialogue between design, manufacturing and recycling.

ECONOMIC BENEFITS:

- Being ahead of competitors and regulation
- Within 5 years (2005-2010) company's turnover has grown by almost 1000%

ST.9 Define the strategic goals

- Partnering with Tekes, the Finnish funding agency for technology and innovation facilitated R&D efforts to develop the alkaline technology
- Increased profitability across the EoL batteries and accumulators value chain

ENVIRONMENTAL AND SOCIAL BENEFITS:

- Dry-Technology®
  - Material recovery rate of above 90% - metals are recovered and other parts like plastic and cardboard are utilized in energy production
  - Reduced energy consumption compared with conventional recycling technique (nearly 90% less)
  - 100% elimination of waste water
  - Minimizing amount of solid waste
  - No CO2 emissions
- Method for chemical processing of alkaline batteries
- Energy consumption reduction is taking place at room temperature
- Enable the recycling and reuse of approx.. 100% of its material
- Channels for communicating the green aspect to the customers: ISO 14001 and ISO 9001
- Developed partnership relationships across the value chain
- Investments in raising awareness about issues related to EoL batteries

References

- Akkuser website – http://www.akkuser.fi/en/index.htm
- Cefic European RC Awards 2011 – http://www.cefic.org/Responsible-Care/Awards/Awards-2011/
- Blue Ocean Strategy https://www.blueoceanstrategy.com/

ST.10

Generate ideas for new products, markets and selling points

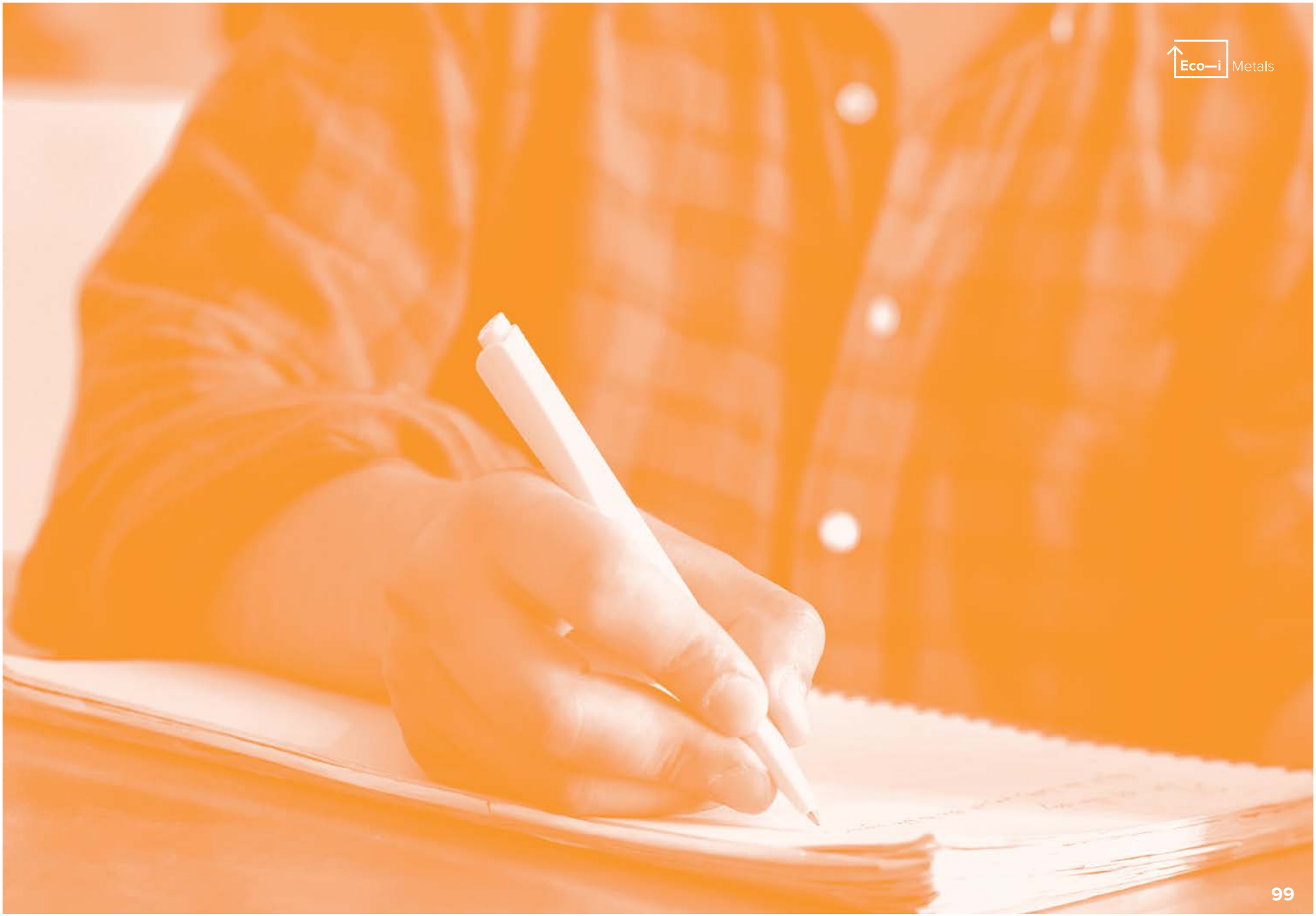
Eco—i Metals

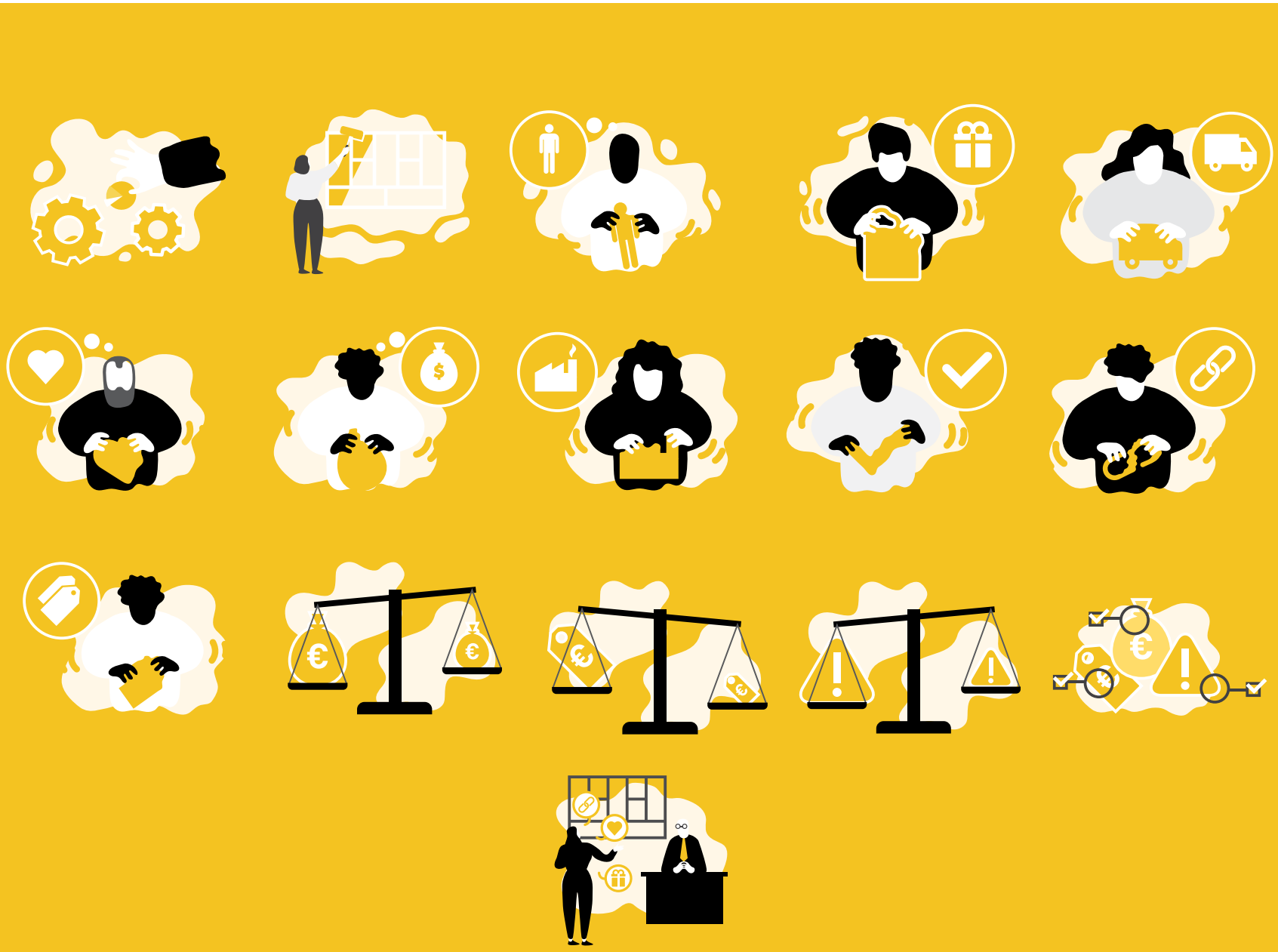
ST.10 Generate ideas for new products, markets and selling points

Eco—i Metals

LEARNING CASE STUDY OF STRATEGY IDEA EVALUATION

Idea title: Targeting market segments in which customers are willing to pay premium price		
Type of benefit	**Description**	**Fit with goals**
Economic	*Access to new markets:* • *Domestic business-to-customer bicycles retail market segments worth US$ 600,000 – 1,300,000 that have shown a strong interest in sustainably produced personalised bicycles* • *Export business-to-business bicycle wholesale market segments worth more than US$ 1,000,000 that have shown a strong interest in sustainably produced standardised bicycles*	*Fitting with the goal to increase profit margins by 10% on both domestic and export sales by lowering production costs through waste reduction and higher efficiency in the production process.*
Environmental	*Addresses the key sustainability issue of high amounts of metal waste and hazardous substances along the life cycle*	*Aligned with the goal of reducing metal scrap waste to less than 1% of the input during production.*
Social	*Diversification (e.g. production of customized and/or multi-purpose bikes, introducing a return & reuse scheme) to reach new market segments*	*It contributes to the goal of becoming the local leader in sustainable production of personalied bicycles fitting local needs*



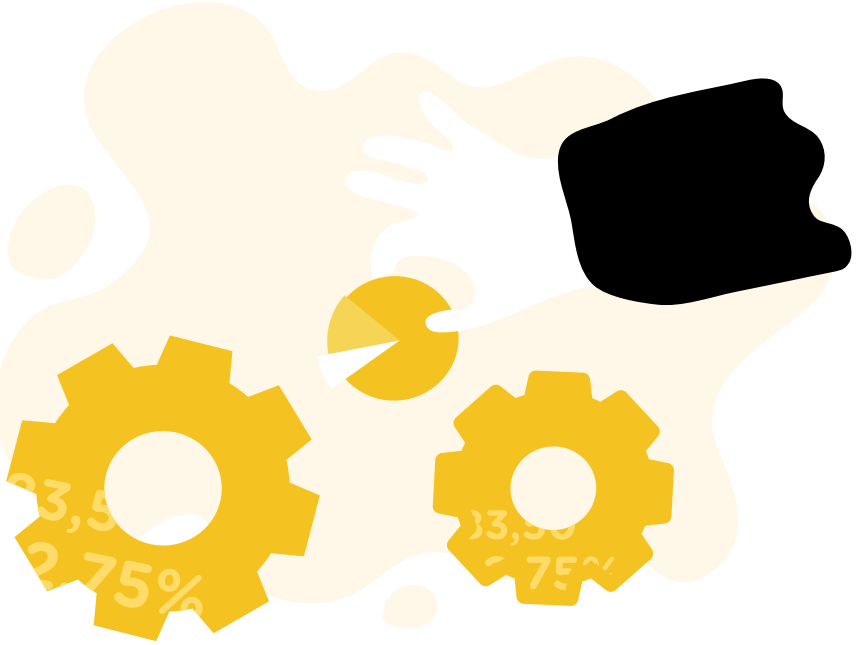


SET BUSINESS MODEL

Defining a new business model
to deliver the business strategy

Eco—i Metals

BM.3
Gather additional data on operational performance



Eco—i Metals

BM.3 Gather additional data on operational performance

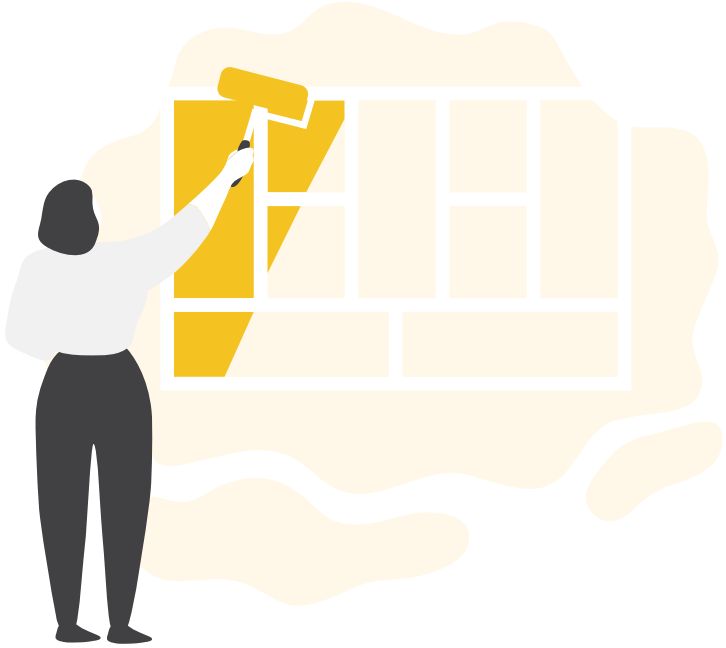
Eco—i Metals

TIPS & TRICKS

SELECT A FLAGSHIP PRODUCT FOR PERFORMING AN LCA

When you decide to perform an LCA to understand in more detail the sustainability impacts of a company's products, then make sure to select one of the company's flagship product since metals sector companies typically offer multiple products and product lines. This helps to maximise the cost-to-benefit of performing the LCA. The results can often be applied to other product lines as well. Furthermore, a LCA of a "flagship" product will serve as a platform for communicating the company's sustainability approach to stakeholders.

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



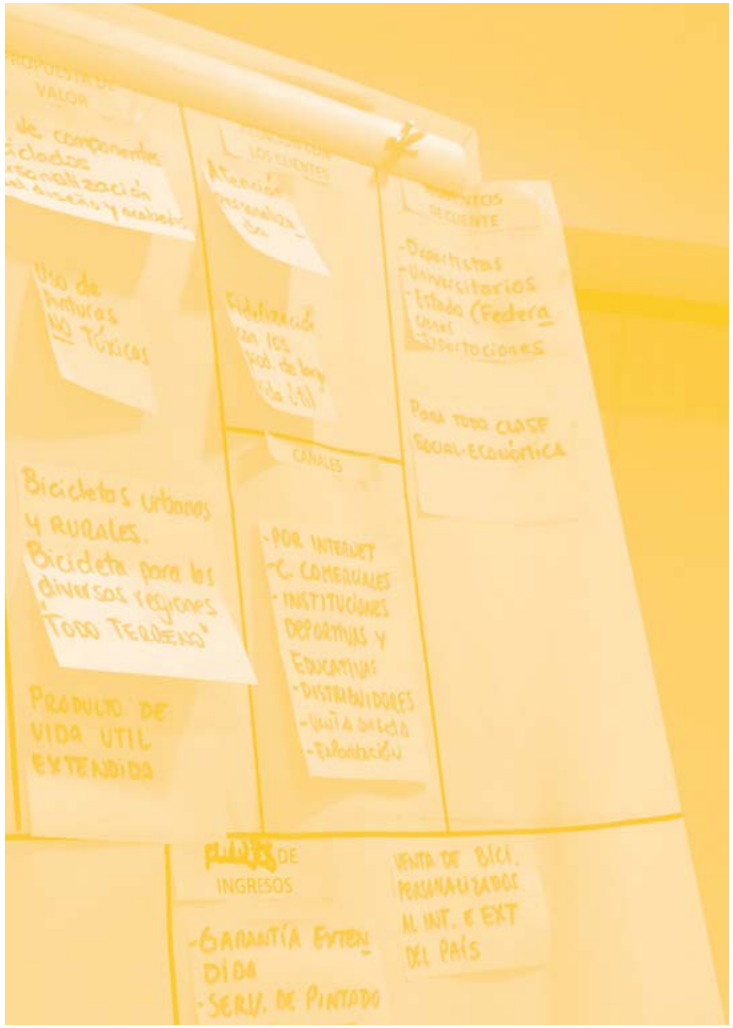
Eco—i Metals

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

Eco—i Metals

LEARNING CASE STUDY OF BUSINESS MODEL CANVAS

The strategic goals for BikeBizz Co. set in *ST.3* and *ST.9* are built upon the SWOT analysis and aim at overcoming sustainability hotspots. All strategic goals are transferred into the *Business Strategy* template and form the overall business strategy (*ST.14*). In order to implement the business strategy, it is necessary to formulate appropriate business models that are aligned with goals, markets, products and selling points specified in the business strategy. The business models implicate ideas, approaches and guidance on how to achieve the strategic goals. Below, three business model options for the BikeBizz Co. are described.



Business Model Option 1: “Return & Reuse”

Driven by the strategic goals on reducing metal waste across the product lifecycle, increasing revenue, and improving profit margin, the “Return & Reuse” business model idea was inspired by the ideas from the TOWS matrix to ‘use the proximity of the shop to the production site for take back actions for end-of-life bikes to enhance recycling’, and ‘use the high demand for repair, maintenance for enhancing the life of a bike to reduce waste’. With this business model, customers bring bikes at end-of-life to BikeBizz Co. where they are either adapted and resold or dismantled for reuse of the single parts. This scheme also comprises a discount scheme, which means that the customer can buy a new bike for a lower price when she brings back her old one. The company starts offering customer services like repair and maintenance to cater for the customer’s demand for this type of service and gains additional revenue.

The new sustainable “Return & Reuse” business model is captured in the following panel (Table 15) using the business model canvas.

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

Eco—i Metals

Key Partners

- *Suppliers of manufacturing equipment*
- *Suppliers of steel and aluminium semi-finished products*
- *Suppliers of process agents and paint pigments*
- *Energy providers*
- *Retail partner(s)*
- *Funding institution*
- *Customers involved in return scheme*

Key Activities

- *Manufacturing of customised bike frame and rims including treatment steps: coating, painting and assembly of bicycles*
- *Servicing during use phase: maintenance and repair*
- *Take back activities: appraisal of returned bikes, repair of bike as a whole or disassembly and reuse of single components*
- *Marketing, awareness creation & selling of products including export*
- *Training employees on health and safety issues and providing personal protective equipment (PPE)*
- *R&D activities*

Key Resources

- *Flexible manufacturing facilities & manufacturing equipment*
- *Materials including recycled and reused material and parts*
- *Non-polluting process fluids used for production: lead free paints, water based solvents*
- *Skilled and dedicated staff (experienced in e.g. recycling possibilities, design or ergonomic issues)*
- *Customer service department (e.g. technicians, service vans)*

Value Propositions

- *Return & Reuse scheme consisting including:*
- *Design and manufacturing of sustainable bicycles customised and accessorized according to the customer's body type, riding style and needs*
- *Bicycle remanufacturing and maintenance*
- *Additional features include:*
- *Different levels of customisation*
- *Different levels of servicing and product warranty*
- *Discount schemes for new bikes when donating other bikes at end-of-life.*

Customer Relationships

- *Personal direct communication with customers and retail partners: face-to-face, telephone, internet*
- *Customer service*
- *Customer retention because of warranty service*

Channels

- *Sales force in own small bike shop*
- *Marketing*
- *Customer services*
- *Associations (e.g. trade/tourism organization, NGOs)*

Customer Segments

- *Local customers*
- *Personal*
- *Companies*
- *Retailers/ wholesalers/ distributors*
- *Partner retail shop in the neighbouring region (export)*

Cost Structure

- *Economic costs (monetary – fixed, variable)*
- *Materials procurement*
- *Management costs: labour, administrative, marketing costs*
- *Equipment costs (including new equipment for process optimization)*
- *Transportation (of materials, products and parts)*
- *Performing of repair services for bikes under warranty without getting monetary reimbursement*
- *Paying of customers who return their bikes*

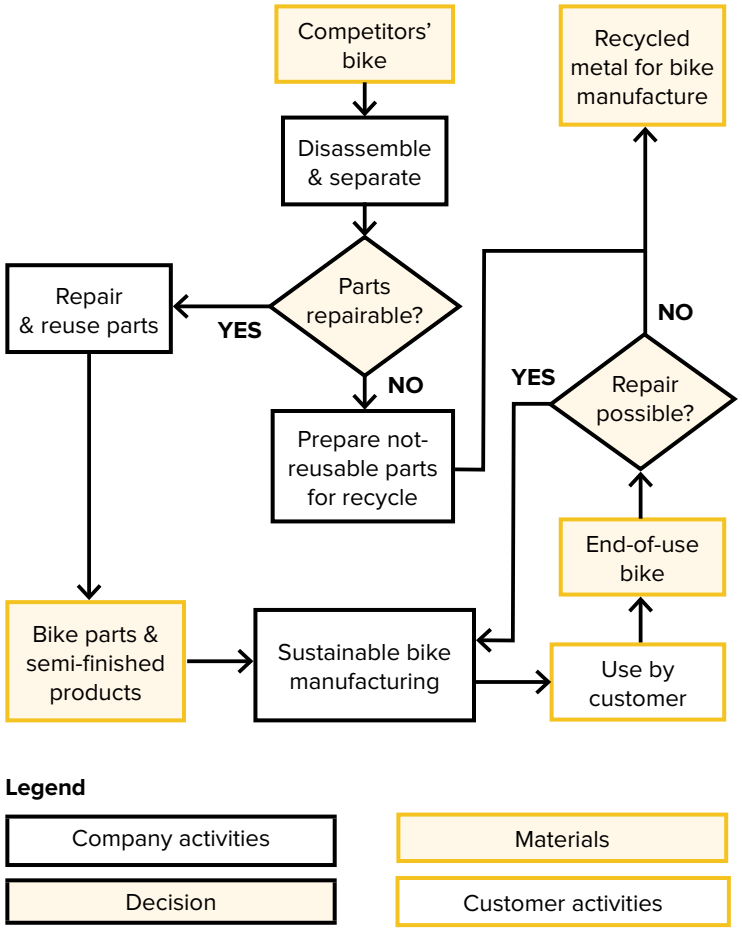
Revenue Streams

- *Sales of sustainably produced bikes – locally and export*
- *Sale of spare parts*
- *Revenue from repair and aftersales services*
- *Revenue from scrap selling*
- *Higher profit margins due to reduced processing costs and offered services*

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

Eco—i Metals

Figure 8: Graphical representation of the new business model of the BikeBizz Co. (Business model option 1: “Return&Reuse”)



Business Model Option 2: “Bike Leasing”

The “Bike Leasing” business model is built upon the strategic goals on increasing revenue and improving profit margin, which can lead to higher financial capital for investment through regular leasing rates and higher total prices. In addition, the model alternatively addresses the demand of customers for more sustainable products and to reducing waste generation and transport emissions. In the case of the BikeBizz Co., a way of implementing eco-innovation could involve developing a new business model option in which the company would cooperate with the public sector through their green public procurement program. The company could offer a bike-leasing scheme to supply sustainably produced bicycles to authorities when equipping their fleet.

Business Model Option 3: “Design for Sustainability”

Driven by the strategic goals on reducing waste generation along the product life cycle, increasing revenue and becoming a leader on sustainable products, the “Design for Sustainability” business model was inspired by the ideas from the TOWS matrix ‘use the proximity to the retail shop for improved customer services (repair, maintenance and warranty)’ and ‘use the high demand for repair and maintenance for enhancing the life time of a bicycle to reduce waste’. An extension of the lifetime of the product can be achieved by applying the Design for Sustainability principles1. In this business model option, the BikeBizz Co. would need to focus on implementing the principles into the design process steps and apply them further down the production process including the management aspects, e.g. the procurement of appropriate materials and components.

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

Eco—i Metals

Based on the Value Management results from the first project, a scheme for the take-back system was devised and is illustrated below. There are two sources of raw materials used in the “Return & Reuse” scheme:

- Bikes that were not manufactured by BikeBizz Co. (competitors’ bike)
- Bikes that were manufactured by BikeBizz Co.

Regardless of the source of the bike, the parts and components’ suitability for reuse are assessed according to standardised tests. Bikes manufactured from BikeBizz Co. are designed for durability, reuse, and ease of repair. The yield of reusable/repairable parts is expected to be 95%. Bike components unable to be reused or repaired are sent to a local recycler so that BikeBizz Co can receive recycled metal materials in return, thereby closing the loop of its local business.

BACKGROUND INFORMATION

Some types of business models that can be found in the metals sector are:

Service business models – These allow extensive bundling of services with products, such as maintenance support and extended warranty, aftersales, customer training, product utility services, etc., that have the potential to bring different benefits for the company including significant impact on overall profitability of the company, strengthening value chain relationships and lowering the environmental impacts (e.g. reducing waste generation by extending life time of products).

Roland Berger carried out an extensive study on evolution of services in engineering companies [Berger, 2014]. Based on the results of the study they identified four types of business models which can be employed with regard to aftersales services for different strategies explained in section ST.1 Plan my data gathering strategy

- Technology leaders benefit in aftersales, too, from their niche products’, patented elements and proprietary customer access. But aftersales has to secure technology leadership throughout the product life cycle.
- Price leaders, by contrast, face tough competition as products are less customer-specific and offer neither patented elements nor proprietary customer access. Customer decisions are driven mainly by price – and services must reflect this.
- Application leaders are characterized by specific process expertise with a strong focus on building prototypes or customer-specific engineered products. In aftersales, they need experts in particular with detailed application and customer knowledge to regularly upgrade the machines.

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

- Efficiency leaders, like price leaders, do not manufacture any patented parts and therefore face tough competition. After sales revenue is mainly generated by billing hours of service personnel's time. To guarantee global aftersales coverage, an efficient service network and the right critical mass are essential.

Closed loop business models – The approach is that products are designed for ease of reuse, disassembly and remanufacturing, or recycling, with the understanding that it is the reuse of waste materials reclaimed for end-of-life products, rather than the extraction of resources, that is the foundation of economic growth. Traditionally, this has been applied to high value metals such as gold and silver, however most metals are easily recyclable making the approach applicable to different metal supply chains. Moreover, the closed loop business model helps companies to become more sustainable by reducing the use and waste of resources, while diminishing possible regulatory burdens (e.g. deposit fees). In the Industry example 3, the Caterpillar case study illustrates how a company is profiting from applying a close loop business model.

Industry example 3: Remanufacturing – a sustainable solution

Caterpillar is the world's leading manufacturer of construction and mining equipment, machinery and engines. Their business strategy is focused on ways to maximise the life cycle benefits of their products, while minimising the economic, social and environmental costs of ownership in close cooperation with stakeholders across the value chain of their products. Caterpillar's remanufacturing programme, Reman, serves as a business model based on an exchange system whereby users return a used component (core) in return for remanufactured products. CAT remanufactured parts and components offer like-new performance, have a long, reliable service life and a same-as-new Cat parts warranty.

ECONOMIC BENEFITS

- Reman operations contribute to lowering 65% of the costs found in the actual parts and components and increasing profit margin, whilst still producing components of the highest quality
- CAT Reman activity is employing over 3600 people worldwide

ENVIRONMENTAL BENEFITS

- Remanufacturing dramatically lowers the volume flow of resources to more than 60,000 tonnes of end-of-life iron recycled annually and reduces landfill pollution to more than 85 million tonnes per year across the value chain
- 2.3M units (78M kg) are recovered contributing to keeping non-renewable resources (e.g. metals) in circulation for multiple lifetimes
- For example remanufacturing a cylinder head leads up to 61% fewer emissions of greenhouse gases and 86% reduction in energy used compared to making a new product2

SOCIAL BENEFITS

- Customer services that go beyond selling, from financing to providing safety information and videos
- Demonstrating commitment to community stakeholders and the environment by taking the corporate social responsibility initiatives
- Innovative organizational systems that facilitate cooperation with the supply chain stakeholders – CAT Proprietary Core Management System

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

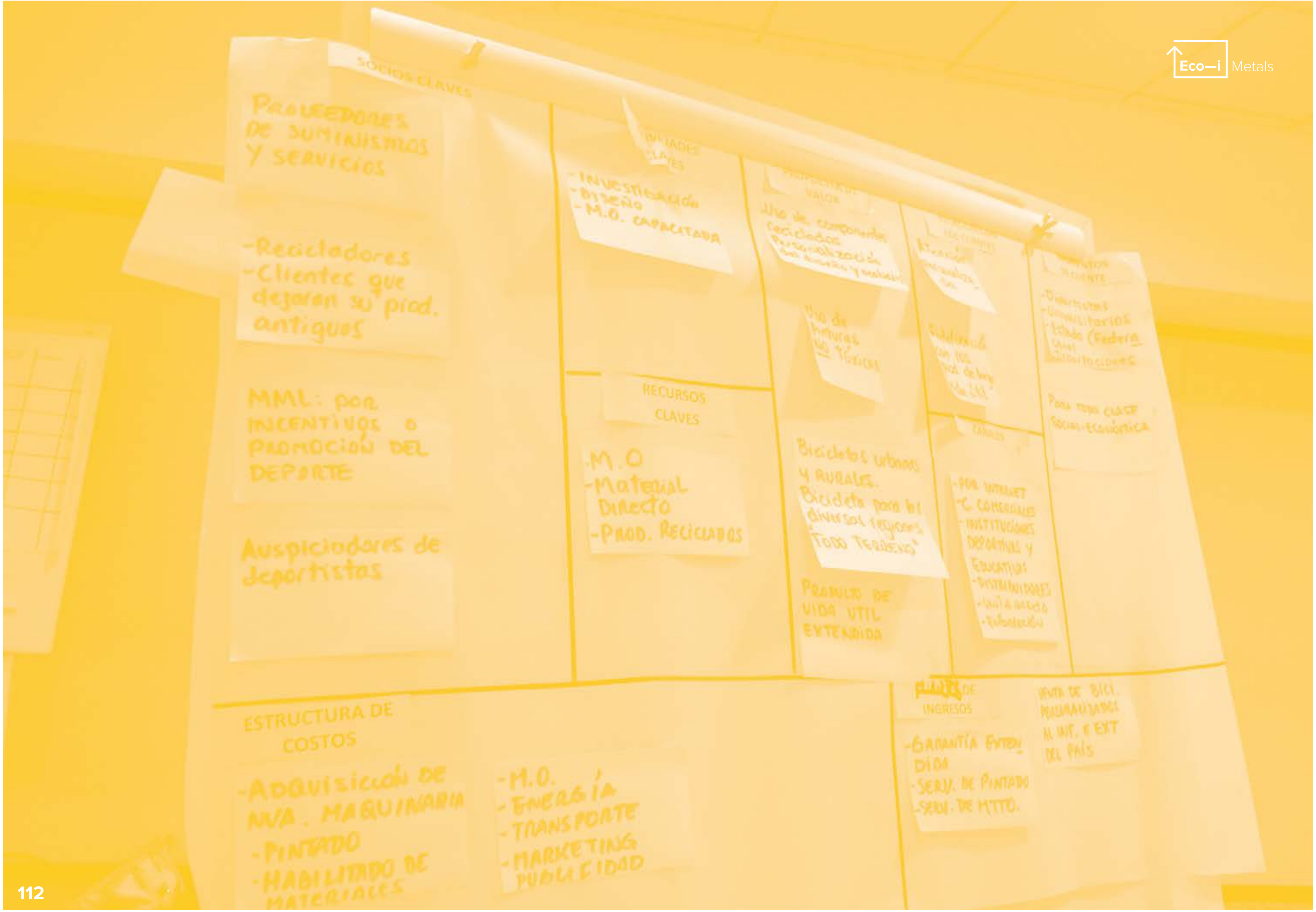
Eco—i Metals

The "Leasing business model" – An approach, in which metals are leased for their use in the end-products or customers lease the end-products. These types of models often give manufacturers a reason to think about the product's life cycle. A good example is the cooperation initiated by the Dutch consultancy Turntoo between the German precision engineering giant Bosch and Eigen Haard, the Amsterdam social housing provider. Their new leasing business model is based on the Value Proposition to offer washing services to the Eigen Haard tenants, who initially pay €10 per month for the service including water and energy consumption, while the washing machines are provided by Bosch, who retains ownership of the machines. In this business model Bosch provides energy saving and recyclable washing machines, cater for their functioning as well as maintain them to secure the machines life cycle. As a result, the company pays for energy and equipment costs and not the customer as in conventional business models.

BACKGROUND INFORMATION

References:

- Evolution of service, 2014, Roland Berger
- UN Environment Design for Sustainability: http://www.unep.org/resourceefficiency/Business/SustainableProducts/DesignforSustainability/tabid/78845/Default.aspx
- Source: Caterpillar website - http://www.caterpillar.com/en.html
- CAT REMAN - https://catreman.cat.com/
- Remanufacturing: Towards a Resource Efficient Economy, Policy Connect, UK - http://www.policyconnect.org.uk/apsrg/sites/site_apsrg/files/apsrg_-_remanufacturing_report.pdf
- EC Eco-innovation website: http://ec.europa.eu/environment/ecoap/about-eco-innovation/good-practices/netherlands/201211126-turnto-final_en.htm


SOCIOS CLAVES
PROVEEDORES DE SUMINISTROS Y SERVICIOS
-Recicladores
-Clientes que dejaron su prod. antiguos
MML: por incentivos o promoción del deporte
Auspiciadores de deportistas
-INVESTIGACIÓN
-DISEÑO
-M.O. CAPACITADA
RECURSOS CLAVES
-M.O
-Material Directo
-PROD. RECICLADOS
Bicicletas urbanas y rurales.
Bicicleta para los diversos terrenos "Todo Terreno"
PRODUCTO DE VIDA UTIL EXTENDIDA
Para todo clase social-económica
ESTRUCTURA DE COSTOS
-ADQUISICIÓN DE NVA. MAQUINARIA
-PINTADO
-HABILITADO DE MATERIALES
-M.O.
-ENERGÍA
-TRANSPORTE
-MARKETING PUBLICIDAD
INGRESOS
-GARANTÍA EXTENDIDA
-SERV. DE PINTADO
-SERV. DE MTTO.

BM.5
Generate ideas for the customer segments block

Eco—i Metals

BM.5 Generate ideas for the customer segments block

Eco—i Metals

TIPS & TRICKS

CONSIDER ENGAGING KEY PARTNERS

You can consider inviting key partners from the value chain, including suppliers (materials, services, equipment) and customers to workshops in order to gain insights on which product functions and service offerings provide most value to customers. Furthermore, you can use such opportunities to quantify life cycle impacts downstream and upstream of the company. Incorporating suppliers in the workshop also raises awareness to the sustainability concerns of their end market and can provide incentive to collaborate on sustainable solutions. Companies often use Value Analysis/Value Engineering (VAVE), which identifies priority product functions, their relative cost, and overall value to the customer. VAVE activities have been known to reduce material costs by 30%.

BACKGROUND INFORMATION

The metals industry serves both “mass” markets (e.g. production of various metal and metal containing products) and “niche” markets (e.g. car batteries). In addition, an increasing number of companies in the metals value chain are moving towards offering tailor made solutions to specific Customer Segments, often including services. This migration helps to align the companies’ marketing and sales approach to the values of their customers, thereby improving their ability to provide customers with what they truly want and are willing to pay for.

Collaboration with suppliers and customers is becoming more common in the metals value chain, especially integrating customers into the cost and resource reduction process.

BM.6

Generate marketing ideas for the value proposition block

Eco—i Metals

BM.6 Generate marketing ideas for the value proposition block

Eco—i Metals

TIPS & TRICKS

THINK OF SPECIFIC CUSTOMER NEEDS THAT YOUR PRODUCT SATISFIES

Some innovations emerge when you consider the Value Proposition from a customer's perspective. For example:

- Closing the material cycles by offering take-back schemes and re-mining and/or reusing metals and metal components from the returned products (e.g. CAT Reman business model described in BM.4) to alleviate the customer's need to deal with the product at the end of its life and put back valuable material back in your operations.
- Leasing products or services for their use to customers instead of selling a physical product. and overall value to the

COMMUNICATE YOUR VALUE PROPOSITION THROUGH ECO-LABELS

Eco-labels can add value to the end product by certifying that it meets specific sustainability criteria. For example, the Green Label Singapore Category 043 is a certificate that ensures that products are made from at least 50% mixed recycled materials including iron, copper, nickel and zinc.

PROVIDE ADDITIONAL TECHNICAL SERVICES TO YOUR CUSTOMERS TO ENHANCE THE VALUE PROPOSITION

Providing technical services can enhance the Value Proposition for your customers and also address sustainability hotspots.

For example, maintenance services can improve the operating efficiency of machinery, which reduces energy consumption and increases customer satisfaction.

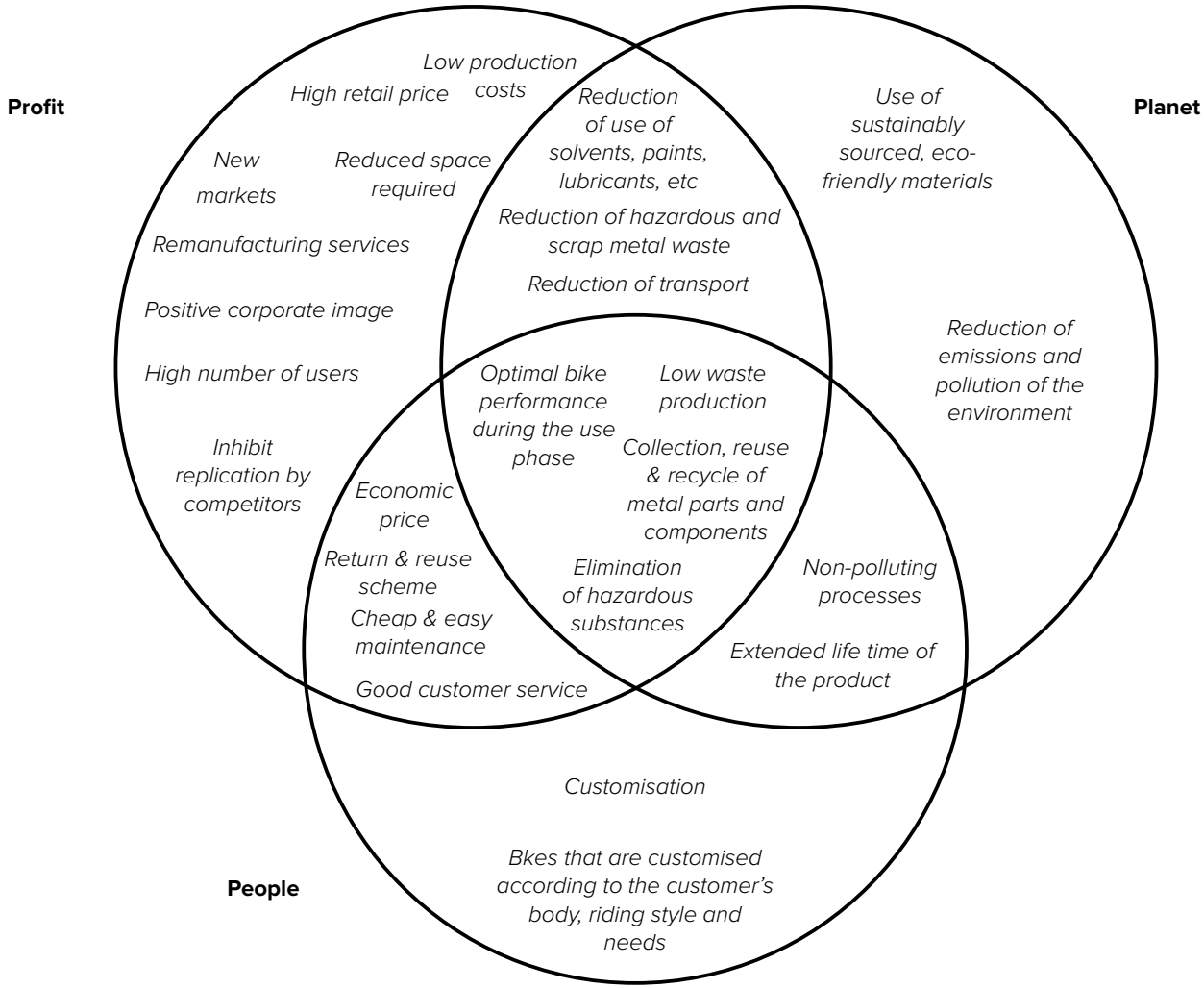
Other examples of technical services include:

- Aftersales services including remote monitoring and diagnosis of defects by using wireless transmission of data for installed equipment to the manufacturer.
- Industrial services for B2B engineered products industry including:
  - Maintenance for the reduction of metal scrap (including inspection, repairs and optimisation of production plants)
  - Technical cleaning of production facilities to reduce environmental impacts such as emissions to air and water
  - In-house logistics (handling and monitoring incoming goods, in-house supply of production factors, management of raw and recycled materials)
  - Production support to optimise quality control (provision of appliances and personnel, building up the production organisation, quality control, finishing services such as galvanisation)
  - Industrial assembly (disassembly, relocation and assembly of individual machines, parts of operation and entire production facilities without newly constructing plants).

BM.6 Generate marketing ideas for the value proposition block

Eco—i Metals

LEARNING CASE STUDY OF PEOPLE, PLANET, PROFIT



BM.8
Generate ideas for the channels block

Eco—i Metals

BM.8 Generate ideas for the channels block

Eco—i Metals

TIPS & TRICKS

CONSIDER ECO-LABELS TO ENHANCE COMMUNICATION CHANNELS WITH YOUR CUSTOMERS

There are several opportunities that allow for the information of consumers about the sustainability performance of a particular product and support purchasing decisions. Some examples are:

- Eco-labels
- Industry standards
- Voluntary initiatives

For example in Malaysia, the SIRIM QAS is an international eco-label often used as a marketing tool to enable a company to position its metal end-products as environmentally-friendly, which gives them a competitive advantage over other similar products in a consumer market that is increasingly becoming more environmentally conscious.

For instance, ECO 32 for coated flat steel products and ECO 38 for metal decking and panelling are some relevant labels in the metals sector. Another common way of communicating with customers is via an integrated customer relationship management (CRM) system and having dedicated key-account managers that maintain business-to-business (B2B) relationships.

BACKGROUND INFORMATION

Metals sector companies typically provide their products and services through a broad range of distribution channels: direct sales, e-commerce, customer service, aftersales, technical support, and third party distribution. However, many metals sector companies commonly include value-added technical services and sales support within their current Value Propositions. In fact, they offer them for free and even to companies that do not necessarily require these value-added services. This can be due to the presence of such actions in the business model, allowing the company to achieve their strategic goals. Industrial services play an increasingly important role in value-based corporate management and are a strategic success factors for machinery and equipment manufacturers, according to [Berger 2014].

References

- Evolution of service, 2014, Roland Berger

BM.8 Generate ideas for the channels block

Eco—i Metals

LEARNING CASE STUDY OF CHANNEL IDEAS

Value proposition

Marketing

- *Communicate the sustainable aspects of the company, such as extended lifetime of the bicycle designed on the principles of the 'Design for Sustainability'*
- *Engagement with local NGOs involved in promoting sustainable transportation*
- *Introducing sustainable procurement practices.*

Sales

Delivery

Customer segment

BM.9
Generate ideas for the customer relationships block

Eco—i Metals

BM.9 Generate ideas for the customer relationships block

Eco—i Metals

BACKGROUND INFORMATION

Just-in-time Delivery (JIT) and lean manufacturing are production approaches prominent in the metals industry, particularly in the automotive sector. These approaches help the automotive industry to achieve various benefits including: productivity improvement, waste management, better production scheduling, increased emphasis on supplier relationships, synchronised and optimised production processes leading to increased resource efficiency (energy material), etc.

Another example specific to metals industry companies is using different customer services to strengthen the customer relationships and generate sales e.g. take-back schemes, rental and leasing services, repair and reuse programmes, industrial services, etc. As mentioned in BM.7, aftersales services offer possibilities to maintain customer relationships and bring benefits to both producers and customers. These services might include: analytical tools, performance-boosting programmes, advisory services, and remote diagnostics. These further offer great business potential and should be taken into consideration at the strategic level to leverage previously untapped profit potential.

BM.10

Generate ideas for the revenue streams block

Eco—i Metals

BM.10 Generate ideas for the revenue streams block

Eco—i Metals

BACKGROUND INFORMATION

The revenue stream(s) mainly depend on the value proposition and the customer segment. As seen in the Industry example 3 in BM.4, Caterpillar reports that their CAT Reman remanufacturing programme allowed them to dramatically reduce costs for raw materials and thus increase profits.

Aftersales business offers vast profitability potential:

- at least 30% in revenue for machinery and equipment engineering
- up to 65% in profits for engineered products

As stated in the Value Proposition block, such aftersales services can include spare part replacement, improvement of product performance, or consultancy – each with a different business model, level of customer relationship, and revenue stream.

References

- Roland Berger Engineered products/High Tech: http://www.rolandberger.com/expertise/industries/engineered_products_high_tech/Aftersales_services_of_engineered_products.html

BM.11
Generate ideas for the key resources block

Eco—i Metals

BM.11 Generate ideas for the key resources block

Eco—i Metals

TIPS & TRICKS

CONSIDER SECONDARY MATERIAL USE

The use of secondary raw materials is quite common in the metal value chain and serves as a response to diverse sustainability challenges the industry is facing, such as raw materials scarcity, price volatility, demand for more sustainable products, waste reduction, etc. It therefore entails a great potential for innovation. For the usage of secondary raw materials the *Life-cycle Stakeholder* template used in activity PR.3 can help to identify potential partners that could help to increase the availability and quality of secondary raw materials. For example, recyclers can provide new processes for recycling starting with the customer demand for sustainable products. These secondary raw materials can be gathered through take-back schemes, which reduce the amount of metal disposed of and increase the amount of scrap metal available as a secondary raw material.

BACKGROUND INFORMATION

The following is a list of key resources typical of the chemical industry to help you think about how to generate new eco-innovative business models:

- Raw materials: price, volatility, availability – importance of procurement principles
- Customer Relationships: marketing, sales, channel offerings.
- Physical equipment: move towards multi-functional and modular plants (e.g. F3 factory project). Furthermore, process intensification can lead to smaller, more compact and reliable plants reducing the ecological footprint of production.
- Staff: Marketing and Sales, R&D, EHS, procurement
- IT-based CRM or customer interface (depending on business model)

BM.11 Generate ideas for the key resources block

Eco—i Metals

LEARNING CASE STUDY OF KEY RESOURCES IDEAS

SWOT

- *Dependent on the supply of high quality, sustainably sourced metals and volatile prices.*

Additional data on the bussines model

- *Can decouple from the volatile metals market*

Additional data on operational performance

- *New skills in working with customers as well as new partnerships with metal waste collectors to capture the required quantity of end-of-life metals*

Key resources

Physical

- *Physical resources such as fixed assets (property, plant, and equipment; e.g. machining equipment) or materials required to make the product (steel bars, aluminium parts, industrial cleaning agent)*

Intellectual

- *Brands, design or manufacturing know-how, customer knowledge, etc. (BikeBizz Co. brand name, expert system for customizing bikes to customer's body type and riding style)*

Human

- *Employees who are particularly important to the success of the company (bike designers, marketing manager, buyer responsible for procuring sustainably sourced metal parts)*
- *new skills in remanufacturing end-of-life bikes and their components*

Financial

- *Access to financial resources as listed in the Eco-innovation Manual (e.g. green credit line for switching to an environmentally friendly surface cleaning technology)*


- DOWN SANTA MONICA
- LEFT ONTO N. CANON
- RIGHT ONTO BRIGHTON
BRIGHTON + CANON
9405 BRIGHTON
- UP SANTA MONICA
- RIGHT ONTO SANTA MONI
- LEFT ONTO SAN VICENTE
- RIGHT ONTO SUNSET
2813 SUNSET
- DOWN SANTA MONICA
- LEFT ONTO BEDFORD
- RIGHT ONTO BRIGHTON
- RIGHT ONTO N. ROXBURY
433 N. ROXBURY
- BACK ONTO SANTA MONICA, BACK UP
- SLIGHT RIGHT ONTO WILSHIRE
9601 WILSHIRE
- DOWN SANTA MONICA
- ONTO WILSHIRE
12301 WILSHIRE
-UP SANTA MONICA (3.6mi)
- LEFT ONTO VINE
1132 VINE ST
- DOWN MELROSE
- RIGHT ONTO NORMICH
548 NORWICH
- LEFT ONTO SANTA MONICA
- SLIGHT RIGHT ONTO WILSHIRE
CENTRAL PHARMACY
900 WILSHIRE #104
- DOWN SANTA MONICA
- LEFT ONTO S. BEVERLY GLEN BLVD
- RIGHT ONTO PICO
10800 PICO
WESTSIDE PAVILION
- DOWN SANTA MONICA
- LEFT ONTO RODEO
201 N. RODEO DR
BULGARI
- DOWN S.M.
- RIGHT ON DOHENY
- LEFT ON SUNSET
in 3rd BLOCK
9200 SUNSET
- DOWN LA CIENEGA
- 10 W (5.3 mi)
- CLOVERFIELD EXIT
- RIGHT ONTO CLOVERFIELD
- LEFT ONTO BRENTWAY
2038 BRENTWAY
- DOWN ALMONT
ALMONT + BEVERLY
9001 BEVERLY
- DOWN SANTA MONICA
- LEFT ONTO AVENUE OF THE STARS
- RIGHT ONTO PICO
10201 W PICO
- DOWN LA CIENEGA
- RIGHT ONTO VENICE
- LEFT ONTO NATIONAL
- RIGHT ONTO ENSHAM
- UP SANTA MONICA
- LEFT ON LA CIENEGA
- RIGHT ONTO SUNSET
- 4.2 MI ON SUNSET
BEVERLY + ORLANDO

BM.12

Generate ideas for the key activities block

Eco—i Metals

BM.12 Generate ideas for the key activities block

BACKGROUND INFORMATION

Typical key activities in the metals industry can be focal points for eco-innovation:

- R&D – particularly in designing for sustainability. 3D printing can be used to quickly and efficiently make prototypes and reduce resource consumption
- Production – sustainability performance can be substantially improved by using advanced manufacturing techniques such as 3D printing (e.g. parts from titanium powder), additive manufacturing, as well as integrated production techniques (industry 4.0)
- Customer Relationship Management (CRM) – channels, sales, and marketing are key activities for successful metals industry companies and are integrated with production.
- Spectrum of activities related to closing the loop models (return, reuse, remanufacturing, separation and recycling)
- Quality control – of raw materials, semi-finished inputs, and final products are critical in reducing off-spec products which lead to high life cycle economic and environmental costs
- Procurement – green procurement principles can be mainstreamed into purchasing forms
- Extended product responsibility – particularly critical for take-back systems, especially EEE products.

Industry example 4: Closed loop business model

The Kingfisher Group has developed a new, closed loop business model to deliver improved Value Propositions to their customers. The Value Propositions of the company are relevant, better, sustainable and affordable products and services for the customers. It also resulted in a healthy annual dividend for the shareholders and created additional employment for society. The key activities concerning this approach include responsible sourcing, design for reparability and recycling. Some examples from the Group would be the re-mining of materials from power tools containing metal parts, which is done by Screwfix UK, subsidiary of Kingfisher group. Another example is the rental and repair services offered by Castorama, another affiliate to the group. The idea originated due to many people owning these tools, however only used them rarely, resulting in resource inefficiency, hence the provision of a rental service. The company created partnerships with its suppliers who design durable products for rental which have a longer life span and are easier fixed by authorized professionals. The offering of these services also strengthens the customer relationship.

References

Kingfisher report: http://www.kingfisher.com/netpositive/files/reports/cr_report_2014/2014_Net_Positive_Report.pdf

BM.13
Generate ideas for the key partnerships block

Eco—i Metals

BM.13 Generate ideas for the key partnerships block

Eco—i Metals

BACKGROUND INFORMATION

Typical key partnerships in the metals value chain are:

- Suppliers of raw materials (metals) and other products used in the production processes including chemicals (coatings, paints, lubricants, etc.). In example 1 (described in PR.5), Adelca illustrates how the company invested in building up its network of recyclers to ensure sufficient supply of scrap metals
- Technology service providers such as equipment suppliers (core and supporting processes), IT data management, process optimisation experts, etc.
- Distributors and wholesalers
- Local and national governments can also be important partners in supporting eco-innovation activities by implementing policies to support sustainable practices in SMEs.

BM.14
Generate ideas for the cost structure block

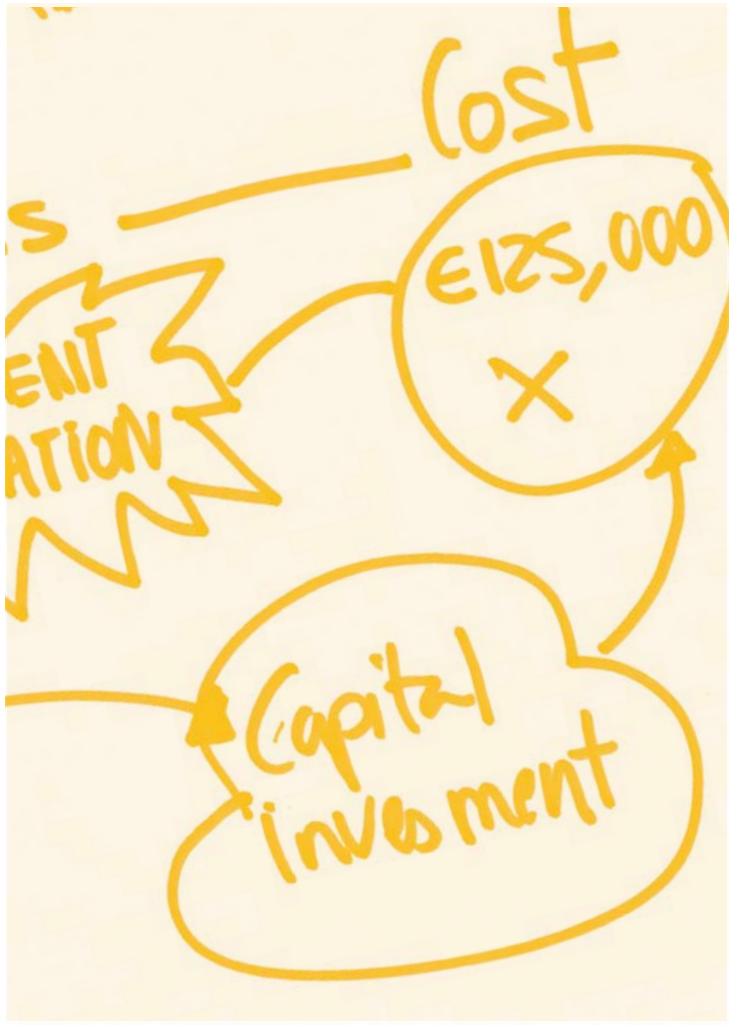
Eco—i Metals

BM.14 Generate ideas for the cost structure block

Eco—i Metals

BACKGROUND INFORMATION

Raw materials traditionally constitute the highest cost position in a metals sector company (typically 30% of total costs); metals with volatile prices can have a significant negative impact on a company's profitability. Therefore, business models that minimize the amount of material used or have take-back / remanufacturing schemes not only offer potential for significant lifecycle savings but also reduce the variable operating costs of the company (see the Adelca and CAT Reman case studies in PR.5 and BM.4 respectively).



BM.15
Evaluate the benefits

Eco—i Metals

BM.15 Evaluate the benefits

Eco—i Metals

LEARNING CASE STUDY OF LIFE CYCLE BUSINESS BENEFITS

	Environmental impacts	**Social Impacts**	**Economic impacts**
Materials			
Production	• *Reuse of parts leads to reduced metal waste generation across the product lifecycle*		• *Goal of more sustainable bikes can be achieved*
Transportation			
Use		• *Personal direct communication with customers and retail partners: face-to-face, telephone, internet* • *Benefits for customers through discount scheme*	• *Economic benefits through reuse of parts* • *Increased revenue* • *Stable customer base and higher customer loyalty*
End of life	• *Maintenance and repair services lead to reduced raw material consumption* • *Recycling and reuse of end-of-life bikes* • *Less waste disposal*		

BM.16
Evaluate the costs

Eco—i Metals

BM.16 Evaluate the costs

Eco—i Metals

LEARNING CASE STUDY OF BUSINESS MODEL CANVAS

Key Partners

- *Suppliers of manufacturing equipment –*
- *Suppliers of steel and aluminium semi-finished products –*
- *Suppliers of process agents and paint pigments +*
- *Energy providers +*
- *Retail partner+*
- *Customers involved in return scheme –*

Key Activities

- *Manufacturing of customised bike frame and rims including treatment steps: coating, painting and assembly of bicycles –*
- *Servicing during use phase: maintenance and repair –*
- *Take back activities: appraisal of returned bikes, repair of bike as a whole or disassembly and reuse of single components –*
- *Marketing, awareness creation & selling of products including export –*
- *Training employees on health and safety issues and providing personal protective equipment (PPE) –*
- *R&D activities -*

Key Resources

- *Flexible manufacturing facilities & manufacturing equipment +*
- *Materials including recycled and reused material and parts –*
- *Non-polluting process fluids used for production: lead free paints, water based solvents –*
- *Skilled and dedicated staff (experienced in e.g. recycling possibilities, design or ergonomic issues) –*
- *Customer service department (e.g. technicians, service vans) –*

Value Propositions

- *Return & Reuse scheme consisting including:*
- *Design and manufacturing of sustainable bicycles customised and accessorised according to the customer's body type, riding style and needs*
- *Bicycle remanufacturing and maintenance*
- *Additional features include:*
- *Different levels of customisation*
- *Different levels of servicing and product warranty*
- *Discount schemes for new bikes when donating other bikes at end-of-life.*

Customer Relationships

- *Personal direct communication with customers and retail partners: face-to-face, telephone, internet +*
- *Customer service –*
- *Customer retention because of warranty service–*

Channels

- *Sales force in own small bike shop +*
- *Marketing*
- *Customer services*
- *Associations (e.g. trade/tourism organization, NGOs)*

Customer Segments

- *Local customers*
- *Personal*
- *Companies*
- *Retailers/ wholesalers/ distributors*
- *Partner retail shop in the neighbouring region (export)*

Cost Structure

- *Economic costs (monetary – fixed, variable)*
- *Materials procurement*
- *Management costs: labour, administrative, marketing costs*
- *Equipment costs (including new equipment for process optimisation)*
- *Transportation (of materials, products and parts)*
- *Performing of repair services for bikes under warranty without getting monetary reimbursement*
- *Paying of customers who return their bikes*

Revenue Streams

- *Sales of sustainably produced bikes – locally and export*
- *Sale of spare parts*
- *Revenue from repair and after sale services*
- *Revenue from scrap selling*
- *Higher profit margins due to reduced processing costs and offered services*

Performance gaps highlighted in yellow

BM.17
Evaluate the risks

Eco—i Metals

BM.17 Evaluate the risks

Eco—i Metals

LEARNING CASE STUDY OF RISK REGISTER

Risk Register for for BikeBizz Co. Sustainable "Return&Reuse" business model								
Risk code and name	**Impact description**	**Probability (1-3)**	**Impact (1-3)**	**Risk**	**Mitigation**	**Contingency**	**Action date**	**Action by**
Risk01 *Not enough interest in sustainably produced bicycles*	• *Poor product sales* • *Loss of customers*	*2*	*2*	*4*	• *Develop and invest in appropriate marketing and awareness raising campaign*	• *Work with large companies and public sector stakeholders to try to interest them in buying your products*	*2 months before scheduled date for bringing product to the market*	*BikeBizz CEO and BikeBizz sales and customers manager*
Risk02 *Using secondary raw materials and reused parts results in lower quality of products*	• *Loss of reputation* • *Loss of key suppliers* • *Increase of final product prices* • *Poor product sales*	*1*	*3*	*3*	• *Check material carefully before deciding to reuse it* • *Ensure technical staff has sufficient level of skills and experiences to overcome challenges involved* • *Provide necessary equipment*	• *Just use secondary material of high quality, accepting the resulting higher use of primary material* • *Recruit a specialist* • *Invest in additional equipment*	*2nd month of the BM*	*BikeBizz CEO*

BM.17 Evaluate the risks

Eco—i Metals

Risk Register for for BikeBizz Co. Sustainable "Return&Reuse" business model

Risk code and name	Impact description	Probability (1-3)	Impact (1-3)	Risk	Mitigation	Contingency	Action date	Action by
Risk03 *Customers are not interested to join in the return & reuse scheme*	• *Loss of revenue.* • *Loss of key suppliers of secondary raw materials* • *Lack of material for production* • *Loss of investment money*	*2*	*3*	*6*	• *Develop and undertake awareness raising campaign* • *Intensively engage in promotion activities (e.g. through media, specialised events)*	• *Continue to offer current business model during transition period to maintain revenue if uptake is slow* • *Supply secondary raw materials through alternative source, e.g. other companies involved in recycling*	*After 6th month of the BM*	*BikeBizz CEO Sales and customers*
Risk04 *Difficulties to find suppliers of non-hazardous chemicals (e.g. solvent free paint)*	• *Inability to reduce VOC emissions* • *Health issues for workers* • *Problems with compliance*	*1*	*2*	*2*	• *Contact consultancies, universities or research institutes for advice how to find suppliers*	• *Employ a technical manager who will be responsible to ensure this is realised.* • *Continue fabrication with hazardous chemicals*	*1st month of the BM*	*BikeBizz CEO*
Risk05 *Recovered parts from returned bicycles do not always fulfil the requirements for the new bicycles requested*	• *Lack of material for production*	*2*	*2*	*4*	• *Employ skilled technicians and designers who are able to find solutions to adapt the parts or the bicycle configuration so that the recovered parts can still be used*	• *Use more parts produced specifically and just those recycled parts which fit (maybe the others can be stored and used later on)*	*After 6th month of the BM*	*BikeBizz CEO Leader of the technical team*

BM.18

Integrate all the evaluations and make the final selection

Eco—i Metals

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

Eco—i Metals

LEARNING CASE STUDY OF BUSINESS MODEL EVALUATION

	Metric	Current situation	Business Model Option 1: "Return&Reuse"	Business Model Option 2: "Bike Leasing"	Business Model Option 3: "Design for Sustainability"
Benefits	*Energy intensity*	*2*	*5*	*4*	*4*
	Material and water intensity	*2*	*5*	*4*	*4*
	Human health and toxicity	*2*	*5*	*3*	*5*
	Other social issues	*2*	*4*	*4*	*4*
	Profitability	*2*	*4*	*3*	*4*
	Job creation and security	*2*	*3*	*2*	*2*
Risks	*Long term risk (after mitigation actions and successful implementation)*	*2*	*3*	*3*	*4*
	Implementation risk (High/Medium/Low)	*(None)*	*Medium*	*High*	*High*
Costs	*Upfront capital investment (state cost estimate)*	*(None)*	*Medium*	*High*	*Medium*
	Implementation effort (High/Medium/Low)	*(None)*	*Medium*	*High*	*Medium*

BM.19

Pitch the new business model to the CEO

Eco—i Metals

BM.19 Pitch the new business model to the CEO

Eco—i Metals

LEARNING CASE STUDY OF BUSINESS MODEL PITCH

Business model name

Return&Reuse

Business model in a nutshell

Providing the repair and maintenance services as well as dismantling and reassembling the returned bikes.

Effort

- *Recovering bike parts and the skilled staff that perform the service activities*

Operations

- *Promoting the return and reuse scheme in order to guarantee that the customers will participate*
- *Maintaining a good customer relationship, which is mostly done by direct communication.*
- *Recovering aluminium parts of the bicycle.*
- *Communicating the sustainable aspect of the company and promoting the customer services through the sales forces in the shop as well as the media used for marketing or different associations*

Benefits

- *Lower raw material consumption and reduction of waste along the bicycle life cycle, contributing directly to the realisation of the new strategic goals to produce sustainable bicycles and reduce of metal waste along the bicycle life cycle by 75% in 5 years in cooperation with the value chain partners*
- *Makes the customers key partners of the company*
- *Raw material saving also implies reduced energy consumption.*

Costs

- *Additional labour costs, but brings economic benefits both to the company, due to cost saving through reuse of parts, and the customer, who can turn their end-of-use bike into money, as well as environmental benefits because of the reduced raw material consumption and waste disposal*

BM.19 Pitch the new business model to the CEO

Eco—i Metals

Business model name

Bike Leasing

Business model in a nutshell

Bicycle life cycle service through the leasing scheme

Effort

- *Being in line with the green procurement programmes*

Operations

Benefits

- *Contribute towards the requirement to reduce the waste generation along the bicycle life cycle through the leasing scheme.*
- *Reduce the emissions resulting from transport*
- *Reducing emissions and hazardous waste generation*

Costs

-

BM.19 Pitch the new business model to the CEO

Eco—i Metals

Business model name

Design for Sustainability

Business model in a nutshell

Producing bicycles with an extended life time

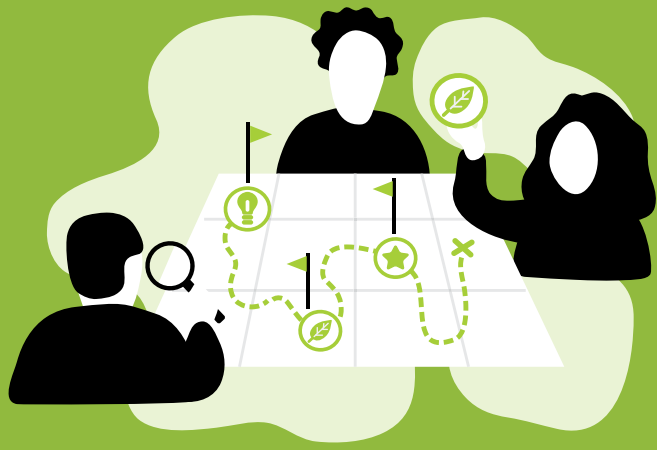
Effort

Operations

Benefits

- *Reduced resource consumption and waste generation*
- *Higher durability of the bicycle and thus safe money due to increased lifetime of the bicycle*
- *higher retail prices that are justified by using high quality materials to produce longer lifetime products.*

Costs



BUILD ROADMAP

Defining a new business model
to deliver the business strategy

Eco—i Metals

BR.1
Prepare for the roadmapping workshop

Eco—i Metals

BR.1 Prepare for the roadmapping workshop

Eco—i Metals

LEARNING CASE STUDY OF ROADMAP DEVELOPMENT MATRIX

Innovation idea title	Benefits	Capital costs [US$]	Implementation effort [Person Months, PM]	Implementation risk (High/Medium/Low)	Scheduling considerations
Value management of product and processes in the value chain: • *Process Value Stream Mapping* • *Product Value Analysis/Value Engineering* • *Prototype development with customers and suppliers*	*Measurement of key manufacturing performance indicators to identify waste (time, material, labour) in all production steps.* *Identification and analysis of product/service priority function and contribution to overall value.* *Customer and supplier engagement in reducing life cycle impacts.*	*US$ 20,000*	*5 person month* *(over 3 months)*	*Low*	*Value management expert required to guide process:* • *Input from following required: production manager, purchasing, sales, logistics, R&D, maintenance, CFO/ CEO*
Develop procurement policy on supplying sustainably produced materials (recycled steel and aluminium) and bicycle components including non-hazardous raw materials	*Immediate reduction of environmental impacts across the value chain (e.g. elimination of lead containing paints)*	*US$ 500*	*2 person months* *(over 6 months)*	*Low*	*First establish compatibility requirements with technological improvements planned for the production equipment.*

BR.1 Prepare for the roadmapping workshop

Eco—i Metals

Innovation idea title	Benefits	Capital costs [US$]	Implementation effort [Person Months, PM]	Implementation risk (High/Medium/Low)	Scheduling considerations
Production optimisation and introduction of technological improvements in the production line	*Improved material efficiency* *Immediate production costs reduction.* *Waste reduction (e.g. scrap metal, overspray sludge, lubricants/swarf sludge).* *Lower environmental impact (elimination of lead in paint)* *Improved health conditions for workers.*	*US$ 10,000-100,000 (range depending on detailed engineering analysis)*	*2-5 persons months* *(over 3 years)*	*Medium*	*Finish Value Management first.* *Simultaneously build capacity of technical staff.* *Coordinate selection of new technologies with the new procurement policy.*
Reduction of metal waste along the bicycle life cycle in cooperation with value chain partners	*Reduction of environmental impact by using secondary raw materials and reused bicycle components* *Contribution to overall waste reduction* *Cost savings* *Increase profits – revenue from offered repair services*	*US$ 1,000*	*5 person months* *(over 24 months)*	*Medium*	*Designate responsible person first.* *Train skilled technical staff (appraisal of return bikes, repair and separation) first.*
Marketing campaign to launch sustainably produced bicycles and "Return&Reuse" model	*Stepping stone to selling of sustainably produced bikes*	*US$ 5,000*	*3 persons* *(over 12 months)*	*Low*	*Establish the new procurement and technology first.* *Select identify appropriate marketing channels first.*

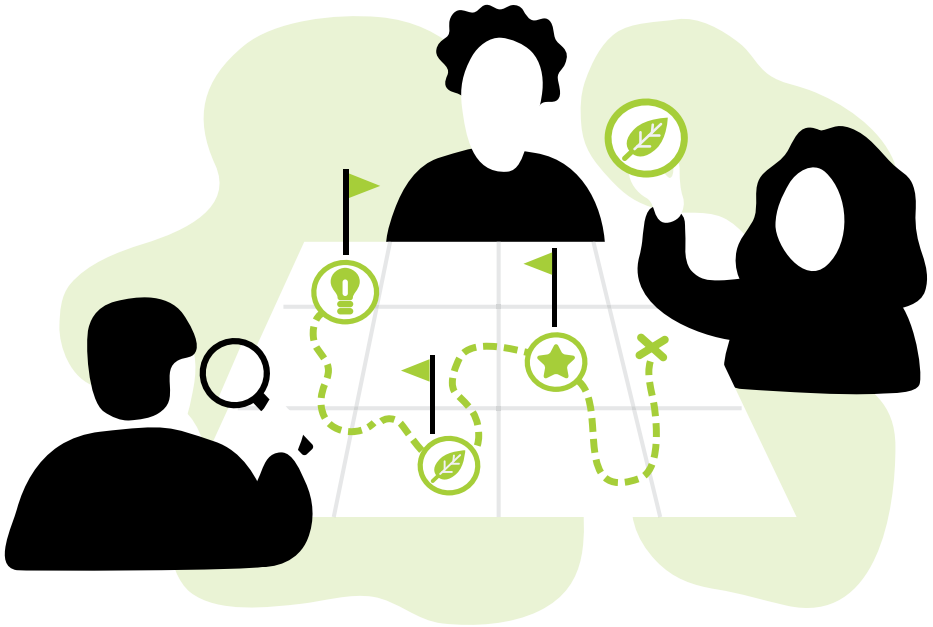
BM.4 Generate business model concepts at the big picture level

Eco—i Metals

Innovation idea title	Benefits	Capital costs [US$]	Implementation effort [Person Months, PM]	Implementation risk (High/ Medium/Low)	Scheduling considerations
Reduction and substitution of hazardous wet textile processing chemicals	*Immediate reduction in brand risk* *Immediate reduction in occupational health risks* *Provides added value and possibility to obtain ecolabel certification*	*15,000-35,000*	*10 Person Months*	*Medium*	*Detailed screening of all chemicals used required.* *Processed textiles and wastewater to be analysed for Restricted Substances*
Screen technologies for chemical recycling of polyester	*Provides economic and technical data to determine feasibility of concept*	*0*	*1 Person Months*	*Low*	*none*
Pilot test chemical recycling of returned polyester material	*Immediate reduction of raw material costs* *Proof-of-concept for customers* *Regional market leader in the chemical recycling of polyester fibres*	*50,000-125,000*	*5 Person Months*	*Medium*	*Critical for implementation of Fibre Leasing business model*
Develop web-based LCA tool to help customers (designers) reduce chemical footprint of designs	*Potential to significantly decrease hazardous chemicals and improve sustainability performance of the entire value chain* *Provides customers with the ability to improve their sustainability performance*	*15,000-25,000*	*4 Person Months*	*Low*	*The finished LCA tool is part of the business model value proposition and should be combined with marketing of the new Fibre Leasing business model.*

BR.2

Do a roadmapping workshop with input from value chain partners

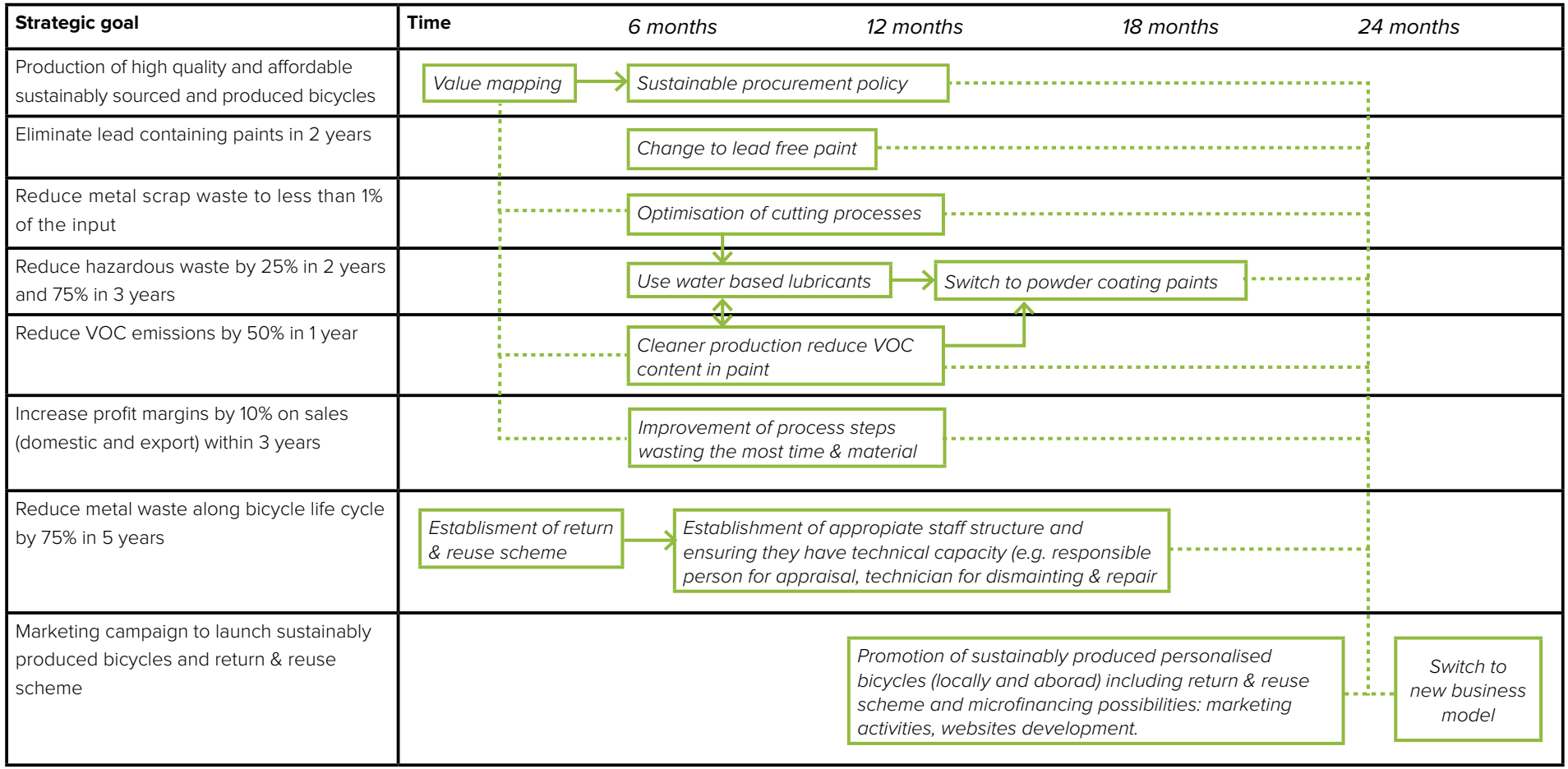


Eco—i Metals

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

Eco—i Metals

LEARNING CASE STUDY OF ROADMAP



BR.3

Define and prioritise the requirements of the first project

Eco—i Metals

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

Eco—i Metals

TIPS & TRICKS

START WITH LOW HANGING FRUITS TOWARDS OF AN AMBITOUS PATH

Ideally the first project should not focus on incremental improvements within the company, but rather a kick-start to the eco-innovation process moving towards a sustainable business model. If possible, you can consider incorporating profitable quick-wins into the first project in order to demonstrate early success to team members and management. KPIs should be defined to measure and monitor the progress of the project and its sustainability impact.

LEARNING CASE STUDY OF REQUIREMENTS SPECIFICATION

Value Management project 01

The value management project engages value chain actors (suppliers and customers) and integrates them in the process of designing and manufacturing the new bicycle as well as the specific “Return&Reuse” business model elements such as types of services to be provided. In particular, workshops will be used to identify customer priorities with respect to primary and secondary functions and engage the value chain in providing sustainable solutions.

This project will also provide opportunities for BikeBizz to establish deeper links with the value chain with the possibility for training suppliers on green procurement principles and improving their own sustainability performance.

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

Eco—i Metals

Requirements specification for TipTop Textiles Company **Reduction and substitution of hazardous wet textile processing chemicals**					
Number or code	**Requirement**	**Comments**	**Priority (MSCW)**	**Review date (Project Month)**	**Reviewed / Approved (All Managers)**
Req01	*Training on VAVE, Value Stream Mapping and Lean Manufacturing best practices*	• *Provides background to conduct a Value Analysis/Value Engineering activity* • *Provides background to conduct a Value Stream Mapping activity*		*1*	• *Senior Production Engineer* • *HSE Officer* • *Production Manager*
Req02	*Identification of important business and production goals and definition of representative Key Performance Indicators (KPIs)*	• *The business and production goals will be taken from the new Business Strategy* • *Key Performance Indicators must be defined so that the input data are accessible and reliable. Furthermore, the KPI's must be "fit for purpose". Acceptable variance in KPI outputs should also be defined* • *E.g. for Process Cycle Efficiency (= Value added time / Total Lead Time), this KPI should be defined for different products including variance of the KPI.* • *Based on the required data needed for the KPI's, identify contractors necessary for specialized measurements (e.g. for BikeBiz, VOC concentration, amount of swarf from cutting process).*		*1*	• *Lean Project Manager* • *BikeBizz CEO* • *Production and HSE managers* • *Financial, purchasing, logistics, sales officers*

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

Eco—i Metals

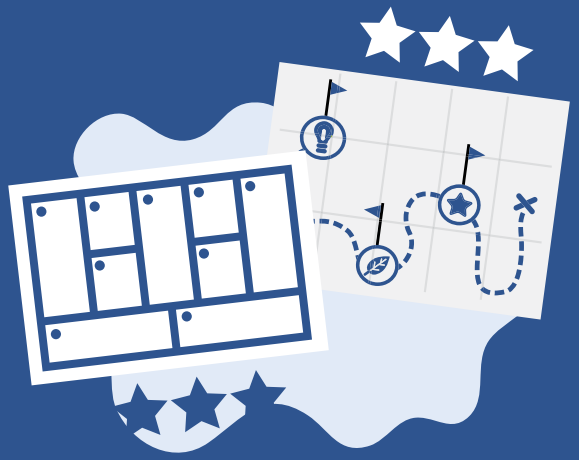
Requirements specification for TipTop Textiles Company
Reduction and substitution of hazardous wet textile processing chemicals

Number or code	Requirement	Comments	Priority (MSCW)	Review date (Project Month)	Reviewed / Approved (All Managers)
Req03	*Identification of priority product/service functions (VAVE)*	• *Conduct a VAVE workshop with customers and network of suppliers* • *Define Product/Service KPIs to translate customer values to product functionality. Distinguish between the use, aesthetic, basic and secondary functions.* • *Identify specific customer segments and their valued products & services, and suitable revenue streams* • *Engage suppliers in sustainability measures to reduce material loss during production and improve durability of metal components during bike use.*		*1*	• *Designer* • *Production Engineer* • *Sales and marketing* • *Purchasing, CEO*
Req04	*Data measurement for Value Stream Mapping, calculation of KPI's, identification of key areas for cost and waste reduction*	• *Purchase thermocouple for measuring parts temperature in oven* • *Contract necessary external companies to measure e.g. VOC concentrations, submit analysis of overspray sludge to lab, etc.* • *Record relevant Value Stream Mapping data (e.g. cycle time, turnover time, waste produced, # employees, inventory, energy, etc) for each process step and calculate KPI's.*		*2*	• *Lean Project Manager* • *Support from: Production HSE, purchasing, sales, logistics*
Req05	*Verification of KPI accuracy and fit-for-purpose*	• *The Value Stream Mapping and the developed and calculated KPI's should guide and verify the effectiveness of most future business decisions (e.g. investment in new technologies)*		*3*	• *Lean Project Manager* • *BikeBizz CEO* • *Production and HSE managers* • *Financial, purchasing, logistics, sales officers*

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

Eco—i Metals

Requirements specification for TipTop Textiles Company Reduction and substitution of hazardous wet textile processing chemicals					
Number or code	**Requirement**	**Comments**	**Priority (MSCW)**	**Review date (Project Month)**	**Reviewed / Approved (All Managers)**
Req06	*Design and build prototypes for specific customer segments and validate with Workshop*	• *Work together with suppliers to complete different prototypes based on VAVE approach incorporating customer and supplier inputs* • *Conduct a feedback workshop to validate product/service offerings with customers*		*3*	• *Customers, suppliers* • *Designer* • *Production Engineer* • *Sales and marketing* • *Purchasing, CEO*



REVIEW

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

Eco—i Metals


Eco—i Metals

RE.1
Do a project review workshop

Eco—i Metals

RE.1 Do a project review workshop

Eco—i Metals

TIPS & TRICKS

REVIEW THE ECO-INNOVATION KPIS

As part of the project review you should evaluate the KPI's used for the project. This includes evaluating whether the set KPI's are adequate according to what they should measure. Furthermore, it will be important to examine whether the input data is representative and meaningful, thus allowing appropriate tracking of the success. The UNIDO Cleaner Production Toolkit suggests a template for a short report on the KPI's (UNIDO CP Toolkit volume 7), which can be used and adapted for this purpose. relationship with key clients.

RE.1 Do a project review workshop

Eco—i Metals

BACKGROUND INFORMATION

Table 8 shows several indicators to measure sustainability in the Metals sector. The financial, business, environmental and social indicators constitute important KPIs for the Metals sector.

The KPI's defined for the Value Stream Mapping project should be revised at different points in time to ensure the direction of the project and to evaluate the progress. In the case of BikeBizz Co., the fulfilment of the requirements listed in Table 21 need to be reviewed along the process (see BR.3).

After the first project month, requirements 1 and 2 were evaluated. As a result, requirement 1 has been fulfilled: three training sessions have been conducted for selected staff involved in the value stream mapping. Regarding requirement 2, eleven KPI's have been set for being able to quantify the value streams. Among those were the Process Cycle Efficiency (PCE), the Overall Equipment Efficiency (OEE), the quantity of VOC emissions at the painting booth, the total amount of scrap produced during production. The business and production goals have been taken over from the business strategy.

After project month two, it was ascertained whether it had been possible to collect all the data required for having values for the KPI's. Different instruments had been acquired, like thermocouples for measuring the oven temperature, while some other measurements (paint sludge composition) had been assigned to external companies.

After obtaining all critical data from relevant departments, the PCE (value added time/total process time) was calculated to be 12%, which is well below the industry best practice lean manufacturing standard of 25%. Analysis of the turnover time for each process revealed that the process for cutting off the tube-ends for assembly required two workers when one could suffice with minor capital investment.

Additional identified processes with a low cycle efficiency was the surface cleaning and painting step where significant resources are spent on equipment cleaning (for colour changes) as well as management of hazardous waste. It was estimated that the PCE could be increased by 5% just by improving existing practices and with minor capital investment.

The KPI's were deemed fit-for-purpose after cross-referencing them alternative methods of calculation, e.g. using purchasing and sales records.

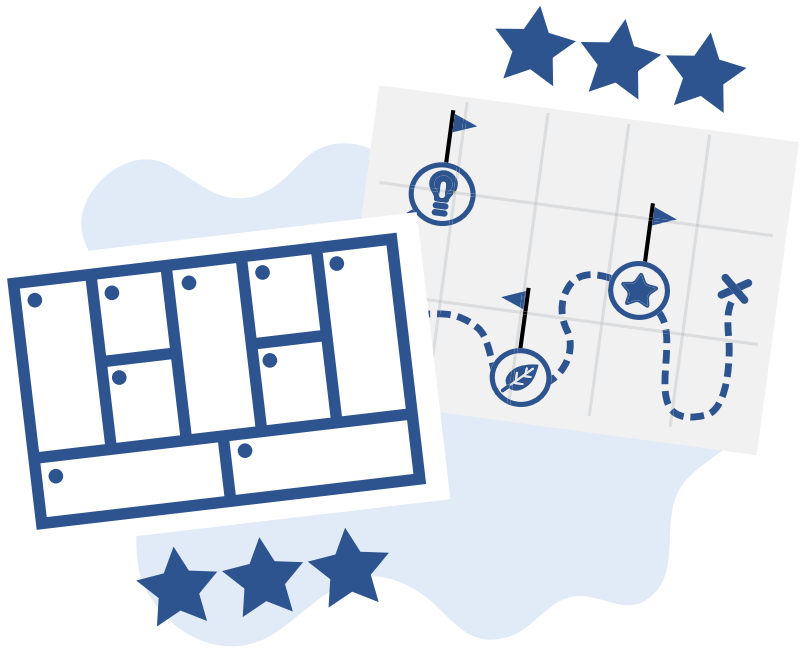
RE.1 Do a project review workshop

Eco—i Metals

Table 8: Examples of different indicators to measure sustainability in the Metals sector.

Group of indicators	**Examples of indicators**		
Financial indicators To track sales and costs	• EBITDA: Earnings before interest, taxes, depreciation, amortization • ROI: Return on investment • COGS: Costs of goods sold • R&D: Research & Development expenditure (%)		
Business performance To gauge operational performance, market and marketing efforts	Operational • Overall Equipment Effectiveness • Lean metrics: batch cycle time, inventory days supply (IDS), process velocity...	Market • Market growth rate • Market share • Brand equity	Customers' relationships • Customer satisfaction Index or the Net Promoters Score • Customer retention rate • Marketing effectiveness
Environmental indicators To measure the interaction with or impacts on the environment	• Inputs • Restricted substances intensity • Recycled/reused content	• Operations • Water/Energy intensity • Renewable production of energy • Residuals intensity • Air/water releases intensity	• Products • Recycled/reused content • Restricted substances content • Recyclability • Energy consumption intensity • Water/Carbon/Chemical footprint
Social indicators To account for the impacts on the society including employees	• Number and rate of employee turnover by age group and gender • Number of accidents related to unforeseen risks, injuries, lost days, absentee rates and fatalities • Staff value & satisfaction • Average hours of training per year per employee • Assessment and management of impacts of operations on communities		

RE.3
Review the business model and roadmap



Eco—i Metals

RE.3 Review the business model and roadmap

Eco—i Metals

LEARNING CASE STUDY OF BUSINESS MODEL & ROADMAP REVIEW

Results from project review

- *In the course of transition to the new business model, the BikeBizz Co. faced considerable changes regarding different company aspects.*
- *The new Value Proposition includes the aspect of sustainable sourcing and producing bicycles, as well as the whole service section ("Return&Reuse" model and maintenance services).*

Validity of roadmap

Progress on sustainability hotspots

- *Progress on the procurement of sustainably sourced material including different metals (e.g. steel and aluminium) and non-hazardous chemicals (e.g. lead free paints, water based lubricants); using sustainable production methods; and offering a range of new services (e.g. maintenance, "Return&Reuse", microfinancing).*

Performance gaps

- *New costs also arise, such as newly employed staff for the "Return&Reuse" work, or the costs related to the changes for making the production process more sustainable*

Validity of business model

- *Channels do not undergo significant change, while the customer relationship is strengthened through the establishment of the services and the return schemes.*
- *On a positive note, revenue is increased via additional earnings from the service provisions and monetary savings due to increased resource efficiency.*

New ideas to roadmap

Roadmap order

Next project for the company

Glossary of key terms

Business model

Describes how 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

Describes the long term goals of the company and the markets in which the company will operate (i.e. vision and mission) (adapted from Andrews, 1997).

Gender

Describes the 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

Describes any distinction, exclusion or restriction made on the basis of sex which has the effect or purpose of impairing or nullifying the recognition, 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).

Gender equality

Refers to the 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-sensitive

Rescribes an attempt to redress existing gender inequalities when designing and implement development projects, programs or policies.

Life cycle

Consecutive and interlinked stages of a product (good or service), from the extraction of natural resources to the final disposal (adapted from ISO 14040:2006).

Life cycle assessment

It is a 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 ISO 14040:2006).

Life cycle thinking

It is a 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, 2004).

Glossary of key terms

Eco—i Metals

Marketing

It is the 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

It is the 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.

Organization structure

It refers to the range of activities and key resources (human and financial) within the company, in addition to those relating directly to production, that are dedicated to supporting the business model. These include procurement processes, distribution, key partnerships, customer relationships and interfaces, research and development, internal communication, and revenue generation.

Partners

It refers to parties in the value chain that provide or receive value including suppliers, outsourced workers, contractors, customers, consumers, clients, members, and others (ISO 26000:2010).

Roadmap

It is a planning tool used to support the implementation of strategies. It is made-up of a series of projects that will help to progress the organization from the company's current position towards fulfilling the organization's goals (adapted from Phaal R et al, 2007).

Stakeholder

It s any group or individual who can affect, or is affected by, an organization or its activities. Also, any individual or group that can help define value propositions for the organization (Stakeholder Research Associates Canada Inc., United Nations Environment Programme, AccountAbility: Stakeholder Engagement, 2005).

The supply chain

It is a system of organizations, technology, activities, information and resources involved in moving a product or service from supplier to customer (Michael Porter 1985) are the most significant impacts in the value chain or the life cycle of a product or service system, which can be used to identify impact improvement opportunities and to prioritize impact reduction actions (UN Environment/SETAC, 2014).

Value

It is understood to involve creating economic value (the revenue that a firm gets in return for its goods or services) in a way that also creates positive Outputs for society by addressing its needs and threats, taking into account economic, environmental and social considerations (adapted from Porter & Kramer, 2011).

A value chain

It is the entire sequence of activities or parties that provide or receive value in the form of products or services (e.g. suppliers, outsource workers, contractors, investors, R&D, customers, consumers, members) (ISO 14001 CD2, 2013). See also Partners definition above.

Value proposition

It refers to the products or services that an organization offers to a specific market segment that the organization believes will create value for that specific market segment.

List of Tables, Figures and Industry examples

Eco—i Metals

Figures

Tables

List of Tables and Figures

Eco—i Metals

Industry examples

Image credits

All images unless the ones stated below are property of UN Environment and licenced under Creative Commons BY 4.0.

Page 10 www.flickr.com/photos/vek/2651430531
Page 30 www.flickr.com/photos/ilri/12815449944
Page 45 www.flickr.com/photos/thewavingcat/10122244056
Page 53 www.flickr.com/photos/ilri/8718039654
Page 99 www.flickr.com/photos/danielfoster/14813000931
Page 62 www.flickr.com/photos/ilri/12814673613
Page 58 www.flickr.com/photos/ilri/8718039654
Page 75 www.flickr.com/photos/ilri/4228371350
Page 104 www.flickr.com/photos/ioelondon/8551643580
Page 122 www.flickr.com/photos/ilri/6585775497
Page 124 www.flickr.com/photos/unosdp/8066987974
Page 130 www.flickr.com/photos/hoyvinmayvin/639029050
Page 144 www.flickr.com/photos/vasta/10003055343
Page 151 www.flickr.com/photos/ilri/4227456515
Page 168 www.flickr.com/photos/ianvarley/402818461
Page 170 www.flickr.com/photos/83831933@N00
Page 175 www.flickr.com/photos/filmvanalledag

United Nations Environment Programme
P.O. Box 30552, Nairobi 00100, Kenya
Tel: +254-(0)20-762 1234
Fax: +254-(0)20-762 3927
Email: uneppub@unep.org
Web: www.unep.org