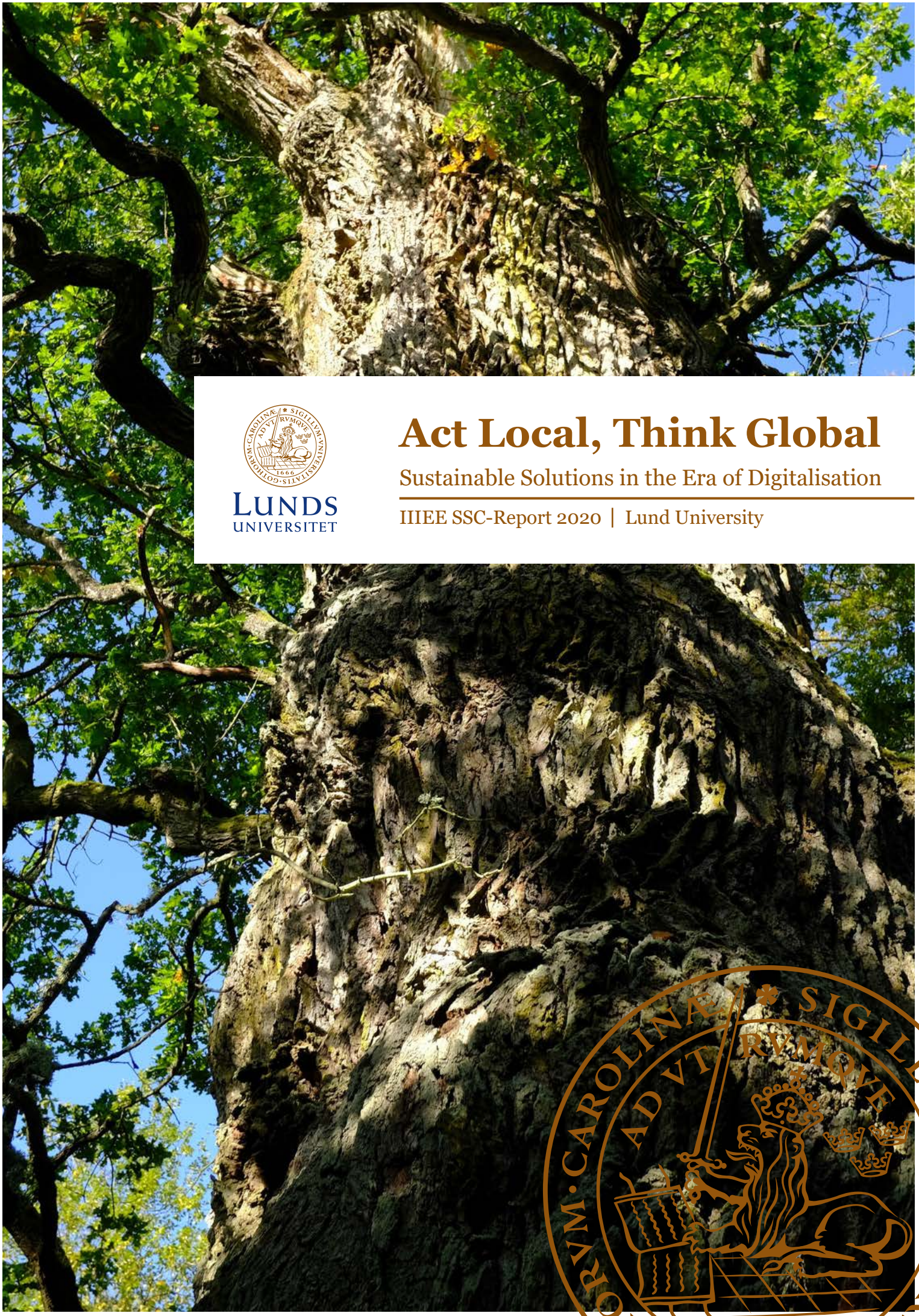

LUNDS UNIVERSITET

Act Local, Think Global

Sustainable Solutions in the Era of Digitalisation

IIIEE SSC-Report 2020 | Lund University

Introduction

Batch 26, Environmental Management & Policy, IIIEE

What measures can we employ to drive positive change? How can we enable both companies and public authorities to prevent and solve environmental problems *and* help them see the value in doing so? These are just some of the questions we ask ourselves on a daily basis as master's students of Environmental Management and Policy (EMP) at the International Institute for Industrial Environmental Economics (IIIEE) in Lund, Sweden.

The IIIEE (or simply "the Insti" as it is fondly known by many who pass through its doors) is focused on producing and sharing actionable knowledge to accelerate the transitions to climate-neutral and resource efficient economies. The EMP programme sets students on a path to inspire and drive change by developing their abilities to evaluate, design, and implement management and policy responses to complex environmental challenges. A capstone course on the master's program is Sustainability Solutions in Context (SSC), which gives students the opportunity to work closely on client projects over a five-week period, culminating in this joint report of eight projects.

2020 has been an unusual year for all of us, with COVID-19 forcing us to rethink the way we live and work, not least on the EMP program. The SSC course usually sees students sent on assignments across the globe, from Portugal to Kenya. This year however, we had to take on solving our client's sustainability challenges from home. We found that by working in different ways, using digital tools, holding online meetings and collaborating with Swedish brands and organisations, we could have a global reach without stepping foot outside of Lund. *Act local, think global* has never felt more fitting. Our clients this year have ranged from relatively small-scale national schemes, to mega global brands. Each project has demonstrated how change can

be made whether it is at a local level leading by example, or it is a project with the potential to impact multiple international markets.

The pandemic has shown us more than ever that we need to utilise digital tools to not only stay connected, but also to help us stay on track to tackle climate change and environmental degradation. Many of the projects this year found that digitalisation plays a part in solving the problems at hand and that this trend will just keep growing. In fact, a recent report from the World Economic Forum observed that the pace of technology adoption is expected to remain high and may accelerate in some areas. That's why we've included a special feature section of this report, "Living in a digital world", which examines key digitalisation trends.

We worked with clients on the following projects:

- *Axis:* Exploring how surveillance cameras can contribute to urban water management solutions.
- *Diab:* Using ESG to connect a small company to the dynamic world of sustainable financing.
- *El-Kretsen:* Investigating ways of upgrading reuse and repair opportunities and improving WEEE treatment.
- *Inter IKEA Group:* Investigating the traceability of conflict minerals in the electronics supply chain, emerging technologies and current industry best practices.
- *Oatly:* Finding systematic approaches to efficiency - current and future trends to increase water and energy efficiency in liquid food processing.
- *Stockholm+50*: Examining global factors affecting youth access to green jobs around the world.
- *Volvo Penta SDGs:* Proposing a pragmatic framework rooted in the UN SDGs, for assessing new projects and other investments from the perspective sustainability.
- *Volvo Penta CO_2*: Benchmarking best practices for CO2 targeting measurements and reporting for Tier 1 companies.

All eight of our projects have been an opportunity to show that despite widespread turbulence, we have the tools, the ideas and the perseverance to initiate change and champion the green transition. That even when we have to stay at home, we can continue to shape our futures for the better. It is our wish that as you read this report, you too are left with a hopeful outlook.

Cover image (Wanås tree) by Håkan Rodhe.
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Digitalising Urban Water Management

Axis Communications

Team Axis

From left to right: Orsi, Susannah and Veerle.

Acknowledgements

We would like to thank the IIIEE for organising such diverting projects during these unusual and often challenging times, and also for providing us with safe, social-distanced workspace in the Aula to accommodate our many group whiteboard sessions.

We are immensely grateful to our interviewees who met our questions with enthusiasm and energy, provided us with further connections, and spurred us on as we progressed through the project. Also to our very supportive, virtual supervisor Lars who gave us encouragement throughout.

Finally, we would like to thank our contact at Axis, Per Björkdahl for supervising the project and hosting us at the Lund offices.

The Team

Veerle Heijnen is from the Netherlands. She holds a Bachelor's degree in Industrial Design, where she focused on the application of design thinking to environmental and social problems.

Susannah Littlewood is from the UK. She holds a Bachelor's degree in Anthropology. Previously, she worked for a sustainability consultancy supporting the development of software solutions.

Orsolya Nyárai is from Hungary. She holds Master's degrees in English and Communications. Previously, she worked for a multinational company in the energy sector. Later, she gained experience working for environmental NGOs, focusing on biodiversity and agricultural policies.

A New Vision for Urban Water Management

Exploring Opportunities for Network Surveillance Solutions

By Veerle Heijnen, Susannah Littlewood and Orsolya Nyárai

Introduction

Society faces major challenges in water management. The growing water demands of citizens, agriculture and industry in the context of a growing and increasingly urban population are leading to overexploitation of water sources and putting great stress on what is often an already overburdened and aging infrastructure. Moreover, the effects of climate change make the achievement of sustainable water management even more challenging. In this context, many are calling for a digital transformation of the sector, presenting an opportunity for technology companies to contribute to new solutions.

Axis Communications AB (Axis) is a company whose primary offering is in network video surveillance solutions. Founded in 1984 in Sweden, it is now an industry leader with a presence in over 50 countries and more than 15 years of steady growth. The company is already working on a Smart Cities initiative with three focus areas: public safety, urban mobility and environmental monitoring, the latter being a newer area for the company which they are keen to explore further.

While there are multiple possibilities within environmental monitoring, for this project, it was decided that the focus would be on urban water management. This was based on initial discussions with the client and on the digitalisation impetus within the sector. In 2017, with partner Tenevia, a pilot project which used Axis cameras to monitor waterways and create an early warning system for floods was implemented in Greater Toulon, France. The initial task for the team was to explore more possibilities like this, for the use of existing Axis hardware in helping cities improve decision making in urban water management.

Research Approach

We first conducted a literature review focusing on the current state of digitalisation in the water sector, challenges within the sector, and existing or pilot water management projects using cameras. We complemented this with semi-structured interviews with 8 relevant stakeholders, from water utility companies, academia and water-related institutions. We received additional information from a further 8 stakeholders, through written responses, informal discussions and conducting a roundtable.

The short project timeline constrained the range of stakeholders from which we could gather information, meaning our interview data is most representative of water utilities in Sweden, although we have some input from elsewhere.

Our initial research revealed that the complexities of the water sector in

different contexts influence the possibility of finding viable applications for cameras in urban water management. We therefore decided to provide Axis with both a list and a preliminary analysis of 36 potential applications and a report on the contextual factors that can limit or enable the uptake of cameras within water management solutions.

This report will outline: the challenges in water management; the opportunities they present for camera applications; three major limiters/enablers of the uptake of camera-based solutions; and a roadmap for pursuing such opportunities.

Water Management Challenges

The challenges faced in urban water management can be broadly categorised into four problem areas: too much water, too little water (scarcity), polluted water and daily management [1]. Depending on the context, the three former can be due to extraordinary events or be more common and incorporated into the latter alongside maintenance of infrastructure.

Image 1: The four problem areas: too much; too little; pollution; daily management.

These challenges are compounded by the severe consequences of climate change, urban population growth, aging infrastructure, budgetary constraints and increasing regulatory pressure on the water sector in general.

Within this context, organisations working in the water sector are compelled to address all these challenges in creative and cost-effective ways in order to continue to perform the services and functions expected of them by society. This is where companies such as Axis can identify opportunities to contribute to new solutions.

Below we will explore the four problem areas in more detail, illustrating one potential application within each area by means of a case study. Each case study showcases an application considered to be most viable in that city, demonstrating how different contextual factors act as limiters and enablers for the application of cameras in urban water management.

Too much water	***Water scarcity***
Monitoring: - Water flows and levels in water bodies - Surface water levels and flows - Precipitation	Detecting leakages Monitoring water flows and levels
Water pollution	***Daily management***
Detecting: - Visible pollution - Particles - Harmful substances Monitoring water temperature	Monitoring pipe condition: - Internally - Externally Measuring precipitation and surface water

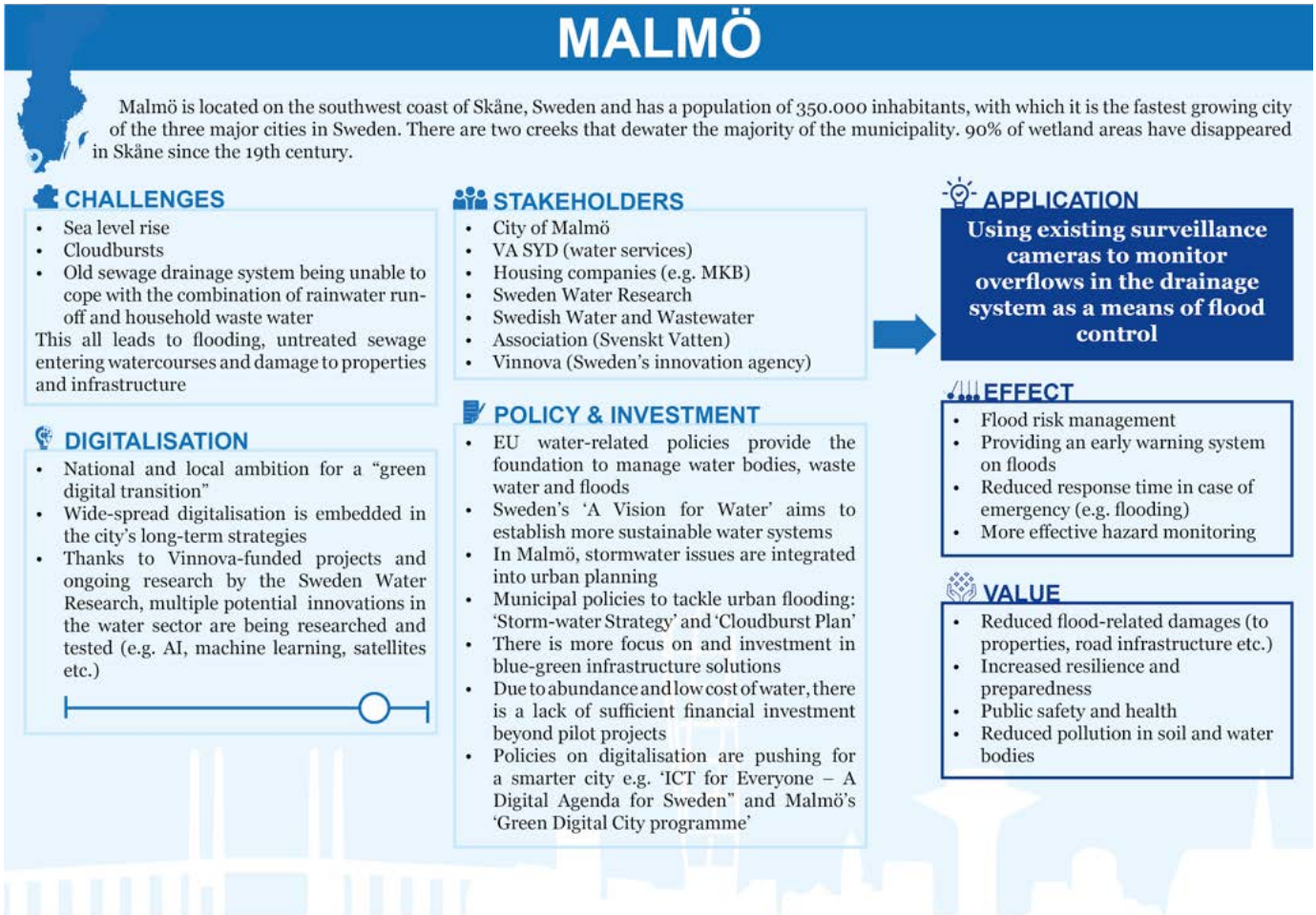
Table 1: Identified fields of application per problem area.

Too Much Water

Extreme weather events are becoming increasingly frequent in cities globally. As illustrated by the 5th assessment report by the *Intergovernmental Panel on Climate Change* (IPCC), global warming contributes to more frequent, intensive rain events in multiple regions of the World, among them in Scandinavia [2]. Projections show that the number of people at risk from floods will increase by about 0.4 billion by 2050, especially in coastal cities [3]. Extreme weather events are incredibly costly. When it comes to the economic value of assets at risk of floods, it is projected to grow by 340% between 2010 and 2050, reaching USD 45 trillion [1].

Urban flood risk is further increased by various local drivers, such as an aging infrastructure, traditional building practices that are not flood-resilient, decreasing permeability in densely built-in urban areas with insufficient green space coverage, urban sprawl, lack of nature-based solutions, unresponsive engineering and more generally, a lack of long-term thinking and sense of ownership by decision-makers [4].

From the list of camera applications that we have provided to Axis, 11 apply to the challenge of having too much water in an urban environment. The case study of Malmö presents one in more detail. Supported by ambitious long-term strategies and collaborating stakeholders, Malmö has the potential to become a pioneer in digital water management, if sufficient investment is also provided.



Water Scarcity

In spite of the rapidly increasing risk of floods due to sea-level rise in coastal areas and cloudbursts in urban areas, paradoxically, cities are facing high risk of drought, as well. By 2030, almost half of the global population of 7.5 billion people is predicted to live in areas that are suffering from severe water scarcity. Compared to current figures, this reflects an increase of more than one billion people experiencing a lack of water [5].

Water shortage or scarcity in cities can be the consequence of multiple factors. Among them are: extended periods of drought with low precipitation, with depleted reservoirs as a result; the overconsumption of water by competing sectors, such as agriculture, industries and, of course, domestic use; uncontrolled water losses due to leakages and inefficiencies from an aging or insufficiently maintained water infrastructure [6].

We identified 8 camera applications that apply to the challenge of water scarcity. This includes applications for the daily management of the water distribution network, which can save water by quickly detecting and repairing leakages. The case study of Sofia presents one in more detail. With the required financial and political support, Sofia could potentially turn its strategic digital ambition into action in the water sector.

SOFIA

Sofia is the capital city of Bulgaria with about 1.2 million inhabitants. The city is situated in a valley, is surrounded by mountains from which rivers flow in the city. There are several mineral and thermal springs and there are artificial and dam lakes, from which most of the drinking water comes from. There is continental climate, which together with the topography has great influence on the water resources.

CHALLENGES

- Water supply problems
- Water shortage due to historically low precipitation
- Severe droughts since the 1990s which lead to water rationing
- Outdated and inadequate water supply facilities
- Sewer maintenance inefficiency
- Depleted reservoirs
- High competition among different water users (domestic, industrial and agricultural)

DIGITALISATION

- SCADA system is implemented (monitoring, management, control and data collection)
- Robotic cameras
- Manual cameras & CCTV
- Digital monitoring of the water volumes supplied to the distribution network
- Smart metering system

STAKEHOLDERS

- Sofiyska Voda JSC: provider of water supply and sewerage services
- Ministry of Regional Development and Public Works
- Ministry of Environment and Waters
- Innovation Hubs (e.g. Sofia Tech Park, DXC's Sofia Digital Transformation Center)
- Private sector actors

POLICY & INVESTMENT

- National strategies on water management encourage the application of water-saving technologies, particularly in regions affected by drought
- Sofia's regional strategy is pushing for the development and improvement of the water infrastructure
- Currently, Sofia still focuses more on compliance issues and end-of-pipe solutions in its urban water system
- New strategies on digitalisation could push smart solutions in water sector, as well
- Digitalisation is encouraged as an end in itself rather than in being applied to enhanced water management
- Innovation Strategy for Smart Specialisation: seeks to stimulate private investment into applied technological innovation

APPLICATION

Robotic camera inspections and manual camera surveys used in the maintenance of the sewer network

EFFECT

- Reduced water losses
- Improved water supply efficiency
- Better status of the sewage network by improved maintenance

VALUE

- Less frequent water shortages
- Increased resilience of the municipal water supply systems
- Improved customer service
- Reduced damages to properties and infrastructure due to a better maintained sewer network

Water Pollution

Next to the quantity of water, the quality of water also plays an important role in water management. Over the years, the water quality in cities has deteriorated and water pollution is a rising problem [7]. There are different types of urban water pollution, each with a different source:

- Agriculture - eutrophication
- Factories - warm water; chemical pollutants
- Water infrastructure - bacteria (e.g. due to still standing water)
- Illegal waste dumping - waste including plastics/ microplastics)
- Wastewater - bacteria, oils, salts, chemicals, grease, debris

All these types of pollution can have severe impacts on society and the environment: they harm biodiversity; create health risks for humans and animals; facilitate the spread of diseases; affect the odour, colour and taste of the water; and are responsible for the increasing amount of microplastics in our waterways [5] [7]. The increase in the frequency and intensity of extreme weather events will lead to more pollution, exacerbating the problem.

We found 12 applications that apply to the challenge of water pollution. The case study of Mumbai presents one in more detail. In the case of Mumbai, the limiting factors are quite significant, thus we believe it is not a suitable context to act as a frontrunner in the uptake of camera solutions.

MUMBAI

Mumbai is the capital of Maharashtra State and India's principal port on the Arabian Sea. It is one of the most densely populated urban areas in the world and half of its inhabitants live in slums. One fourth of the city is located below sea level, as the city is built on the peninsular site on Bombay Island and 7 islands. There is a warm and humid climate, with a monsoon season. The water supply comes from dams outside the city.

CHALLENGES

- Alarming rise in water (and air) pollution levels
- Lack of proper (waste)water infrastructure
- Largest source of water pollution is untreated sewage and industry
- Aging pipe network also leads to contamination of clean water
- Ranked 49 out of 50 on the Arcadis Sustainable City Water Index (Arcadis)
- Population growth
- Prioritisation of other major challenges such as poverty and hunger

DIGITALISATION

- Very limited digitalisation in urban water management
- Increasingly important information technology component
- Recently, implementations of digital solutions for the water sector, such as a digitised base map (GIS) of Mumbai with e.g. water supply network, sewage network, solid waste disposal, storm water drains, water bodies
- Need for reform in institutions and governance, where digitalisation and cameras could play a role

STAKEHOLDERS

Involvement of many different (and often clashing) governmental authorities:

- The Municipal Corporation of Greater Mumbai
- Mumbai Metropolitan Region Development Authority
- Mithi River Development and Planning Authority
- Maharashtra Pollution Control Board (has weak position and low enforcement)
- Maharashtra Water Resources Regulatory Authority
- Ministry of Environment, Forest and Climate Change
- Environmental Protection Agency

POLICY & INVESTMENT

- Several recent policies with promosing agendas on local, regional and national level concerning water management, waste management and digitalisation
- But, large gap between policy and actual implementation
- Resulting in limited funding possibilities (priorisation of other problems in the city)

APPLICATION

Thermal cameras to detect illegal warm (and sometimes polluted) water discharged in water bodies by industry

EFFECT

- Trace industrial pollution
- Less illegal water discharge
- Possibility for setting up fines for polluting industries, from which the money could be re-invested in the water infrastructure

VALUE

- Accountability of industry
- Increased water quality of water bodies
- Could lead to a change; industries could push for water treatment plants and waste management schemes.
- Less money needed to clean the river, if the pollution can be prevented.

Daily Management

The World Bank defines water resources management as *"the process of planning, developing and managing water resources, in terms of both water quantity and quality, across all water uses. It includes the institutions, infrastructure, incentives, and information systems that support and guide water management"* [8].

What constitutes daily management of water therefore differs depending on the context but it often includes activities such as water treatment and monitoring and the upkeep, management and maintenance of the infrastructure and assets of the industry (e.g. pipes, pumping stations, water treatment plants). This presents a significant challenge since the water sector tends to be very asset heavy with an aging infrastructure.

With the uncertainty brought by climate change, and as growing populations put more pressure on an already stressed water system, the problems of too little, too much, and polluted water increasingly become part of daily management in every context.

We found 15 applications of cameras for the daily management of water. The case study of Singapore presents one in more detail. In Singapore, the aligned water management, and commitment to digitalisation demonstrated by favourable policies and pre-existing projects including some using cameras makes the city-state particularly viable as a leader in the uptake of digital solutions, including those using cameras.

SINGAPORE

Singapore is located at the southern end of the Malay peninsula and consists of one main island and several small islets. Almost two-thirds of the city is situated less than 15m above sea level and precipitation occurs almost throughout the entire year, as the city is located in the monsoon region of Southeast Asia.

CHALLENGES

- Very frequent precipitation
- Heavy rainfall leading to flash floods (more frequent in recent years)
- Cleared land and more built-up areas lead to greater run-off increasing likelihood of floods
- Limited land space to manage and store water
- Dense population
- Extensive sewerage system

DIGITALISATION

- Government committed to accelerating innovation and digitalisation and supporting the digital economy as a growth sector, and to raising the digital capabilities of enterprises
- PUB already have a well established water infrastructure and some digital solutions in place: digitalisation is a priority
- Historically, 14% of R&D projects in smart technologies
- Latest R&D publication focused totally on embracing digital transformation. Some applications involving cameras are already being explored

STAKEHOLDERS

- Public Utilities Board (PUB) Singapore: Singapore's National Water Agency. Manages water supply, water catchment and 'used water'. Therefore, there is clear ownership of assets and integrated approach across water management
- PUB's R&D partners
- Singapore Government
- Application is not using traditional surveillance cameras therefore is likely to rely on a partnership with another company who make the robots

POLICY & INVESTMENT

- Long term water security is a major concern - city-state has developed and executed creative policies and solutions in all areas of water resources management considering long time horizons.
- Emphasis on demand and supply management; strong political will; effective legal and regulatory frameworks; experienced and motivated workforce.
- Alignment in policy: entire water cycle managed by PUB, with a strong R&D department committed 700M SGD to R&D since 2002.
- Space for innovation

APPLICATION

Robot crawler with an attached camera (and other sensors) to inspect inside of sewage pipes (combined with image analysis)

EFFECT

- Detecting faults and determining fault type
- Giving information on remaining service life of the pipes
- Enabling preventative maintenance
- Reduced likelihood of blockages
- Reduced leakages into surface water, groundwater and soil

VALUE

- Protection of soil and water quality
- Public health and safety
- Cost savings (currently in use in many contexts but requires manual image checking)
- Resource savings on dealing with serious blockages

Enablers and Limiters

The case studies demonstrate that every city context is different: they all have different factors that can work as limiters or enablers in the uptake of cameras and other digital solutions. As a result, some cities, like Malmö, Sofia and Singapore, are more suitable to act as a frontrunner in digitalisation of the water sector, whereas other cities, like Mumbai, are not yet ready for such changes. Our multi-case study analysis allowed us to draw out three key limiters/enablers of the uptake of camera solutions: the state of digitalisation, the policy context and levels of investment, and the characteristics of relevant stakeholders.

Digitalisation: General Trends and Potential Barriers

In the sustainability transition, improvements in efficiency and reductions in waste or losses of an essential resource, like water, offer the largest leverage effects [9]. With the help of digitalisation, essential services can be delivered in a more resource-efficient way.

Whether digital solutions, like cameras, have a widespread uptake in a particular city, however, depends on multiple factors that can both enable or limit their adoption. The integration of smart technologies is heavily influenced by the level of digitalisation in general, and therefore by the presence of an existing IT infrastructure. The level of urgency or imminent threat in problem areas can potentially further increase the speed by which digital solutions are adopted in certain sectors [10].

In the water sector, digitalisation is often still lagging behind other industries, such as energy and transportation. This is also true for connecting urban water supplies to the smart-city strategies and systems of cities, if there are any already in place. When it comes to the required operational changes towards digitalisation, the water industry is known to be conservative, slow, and risk averse. This reluctance partly comes from the non-competitive nature of the water industry, among other factors. Too often, utilities only address shortages when a crisis hits [11].

As a consequence of increasingly frequent extreme weather events and water-related emergencies, water utilities are slowly recognising that water is indeed a crucial commodity and are beginning to utilise the vast amount of network data available to improve customer service, reduce water loss, and improve water efficiency [11].

Digital water-management tools represent a paradigm shift for the water industry from being reactive to being proactive and optimised [11]. This digital transformation can be supported by establishing the technological foundation of smart systems, by employing or training skilled personnel who are able to analyse complex data from such systems, and of course, by constructing and implementing a digital strategy with an action plan. Such strategies can be a push for digital water management on a national, municipal or even a sectoral level.

Investment and Policy Context

Of course, the uptake of digital solutions in the water sector also depends on financial investment from different stakeholders in these technologies. Our research suggests that there are some barriers to investment in innovation in the water sector, to varying degrees

depending on the type of water management.

Firstly, the availability of, and impetus for investment may differ depending on the complex network of stakeholders involved in water management in each context. Secondly, investment decisions in water infrastructure have long term implications and thus require long-term planning and investment.

Drinking water presents a particular challenge due to the diamond water paradox, the idea that although water is a vital finite resource, it sells for inordinately less than relatively useless diamonds, and that this is precisely because of its vital nature. Those supplying water are compelled to keep prices low because access to water is for the most part, seen as a right. This constrains utilities' budgets, since they do not want to drive water prices above what consumers can pay, and it reduces the incentive for external investment, since returns on investment are likely to be low.

Moreover, investment in drinking water infrastructure can be challenging where water is relatively abundant. In these cases, non-revenue water from system inefficiencies may cost a utility less than identifying and remedying these inefficiencies.

However, there may be more opportunities within wastewater, stormwater and flood management where damage risks and associated costs provide a greater incentive. This is likely to enable investment in some contexts as parties look to protect the trillions of dollars worth of assets put at risk from floods by 2050 [1].

Indeed, with climate change, the industry is recognising the need for greater and more accelerated investment, as extraordinary events become more commonplace and the associated risks become more apparent. For example, Copenhagen saw a sudden push for investment after unprecedented flooding in 2011, as did Cape Town after the water crisis in 2017. Moreover, the projections for required investments over the next 30 years are enormous, as can be seen in table 2.

Context	*Projected investment need*
Total water supply & sanitation 2019-2050	**USD 6.7 Trillion** [1]
Total water supply, sanitation & wider water related infrastructure 2019-2030	**USD 20.1 Trillion** [1]
Water supply & sanitation in Europe 2016-2025	**USD 526 Billion** [12]
Water infrastructure in the US 2020-2040	**>USD 1 Trillion** [13]

Table 2: Projected investment needs in the water sector.

Reaching this level of investment may not be straightforward, and of course much of it will need to be dedicated to basic infrastructure. However, our research suggests that investment potential can be increased by favourable policies, for example, if digitalisation is embedded in long-term strategy, both in general and in water management, with policies that provide for government investment in innovation as well as stimulating private investment.

Moreover, the context for investment in new water management solutions may be more promising in cities or countries with a strong focus on long-term climate change and resilience planning for which

specific funds are often set aside. Additionally, forming partnerships and coordinating with other stakeholders can open doors to investment, for example, through the creation or expansion of pilot projects, joining pre-existing projects and establishing digital solutions using cameras as part of a mix of solutions.

Stakeholders

The stakeholder network can not only determine the availability of investment, it also plays a crucial role in the speed of making decisions towards digital solutions. The amount, type and responsibility of each stakeholder varies per country, and sometimes even per city, requiring individual analysis.

The water sector is fragmented and often the relevant stakeholders tend to work in silos. For example, public governance for water management is characterised by a multilevel system from local to supra-national levels. Each of these levels has a political agenda, that often has a short time perspective of 3-4 years, whereas decisions in the water sector require a long-term perspective. The aims and agendas of other stakeholders complicate the creation of a shared vision. This can make it challenging to align the needs and interests of the different stakeholders.

The extent to which the different stakeholders work together, can be an enabler or limiter for the uptake of digital solutions. In general, the water sector lacks coordination, making it difficult to get fragmented stakeholders around the table to make decisions. However, with good coordination, the presence of many stakeholders can work as an advantage, as many groups are pursuing a shared vision. Coordination can be encouraged by industry bodies and fora, such as the Smart Water Networks Forum (SWAN), who are taking the lead in advancing smart, data-driven solutions in the water sector, working with a wide variety of stakeholders and encouraging collaboration.

A Digital Water Roadmap

Overall, our findings show there are multiple potential urban water management applications for Axis technology. We provide a roadmap for pursuing these opportunities in Figure 1.

Figure 1: A digital water roadmap.

Conclusion and Future Outlook

Based on our findings, digital surveillance technologies can create social, environmental and economic value for cities by:

- Contributing to cities' climate change adaptation activities
- Increasing cities' resilience to extreme weather events
- Playing an integral role in early warning systems
- Improving water consumption efficiency
- Improving urban water management systems and infrastructures
- Reducing response time to disruptions in urban water infrastructures
- Saving time and resources in urban water management
- Playing an essential role in implementing cities' Smart City-strategies
- Contributing to waste- and pollution reduction to water bodies.

Whether digital solutions in the water sector will be widely adopted and integrated, however, depends on multiple technological, regulatory and organisational factors, as demonstrated in the case studies and the discussion of the key enablers and limiters to digitalisation in the water sector.

It is important to note that digital technology never represents a catch-all solution and their benefits and drawbacks need to be carefully weighed up against the alternatives. Furthermore, digital solutions need to be integrated into a more holistic, long-term urban planning process for resilience and sustainability. Any effort can only lead to success if stakeholders are ready to build strong partnerships, sufficient financial means are available and organisations and authorities involved in urban water management are committed to build capacity to align with the requirements of a more digital future.

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Henrik Aspegren. CEO, Sweden Water Research. 15th October 2020.

Ingmar Clementson. Digitalisation Strategist, NSVA. 20th October 2020.

Jesper König. Project Coordinator, Sweden Water Research. 15th October 2020.

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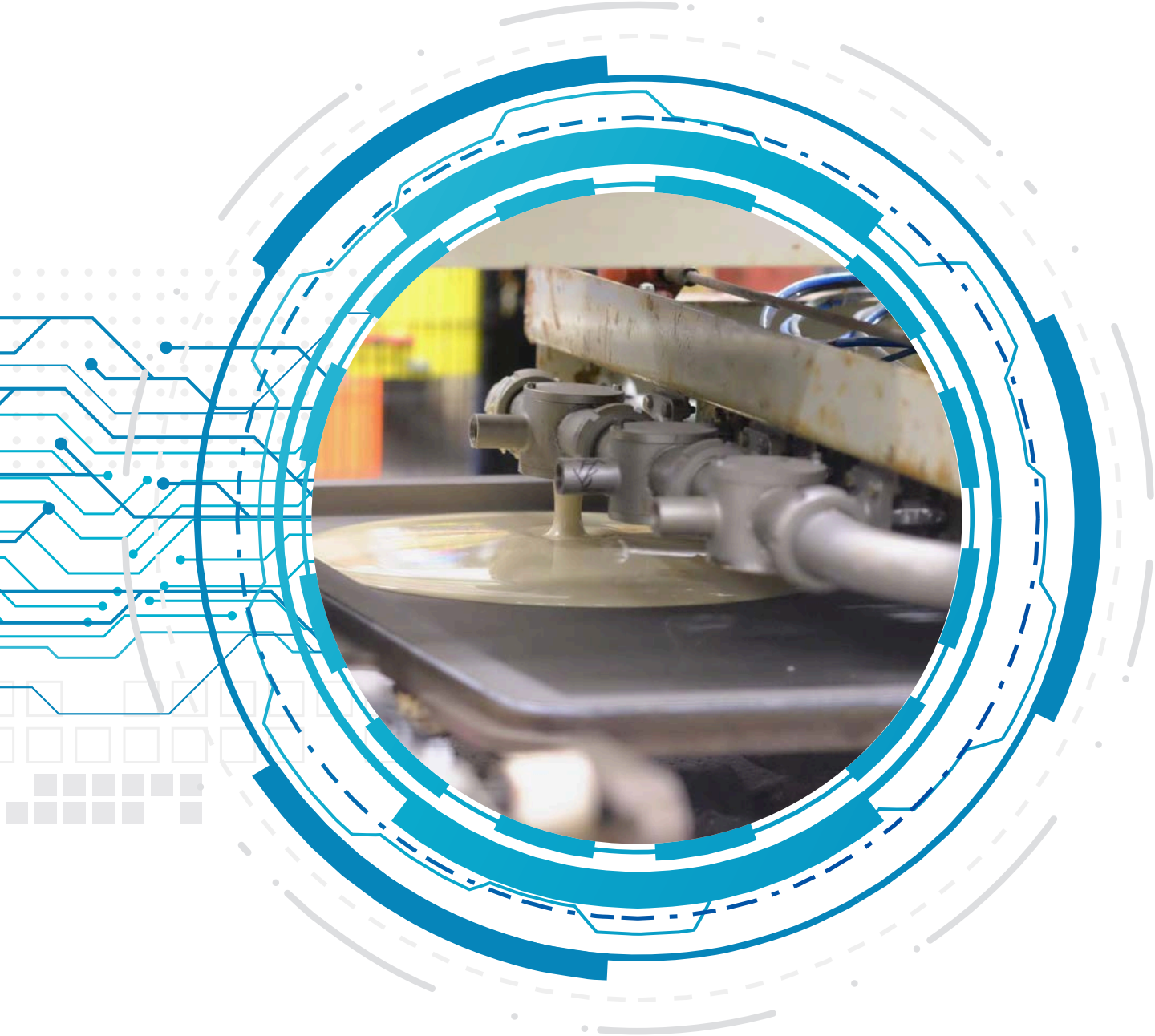
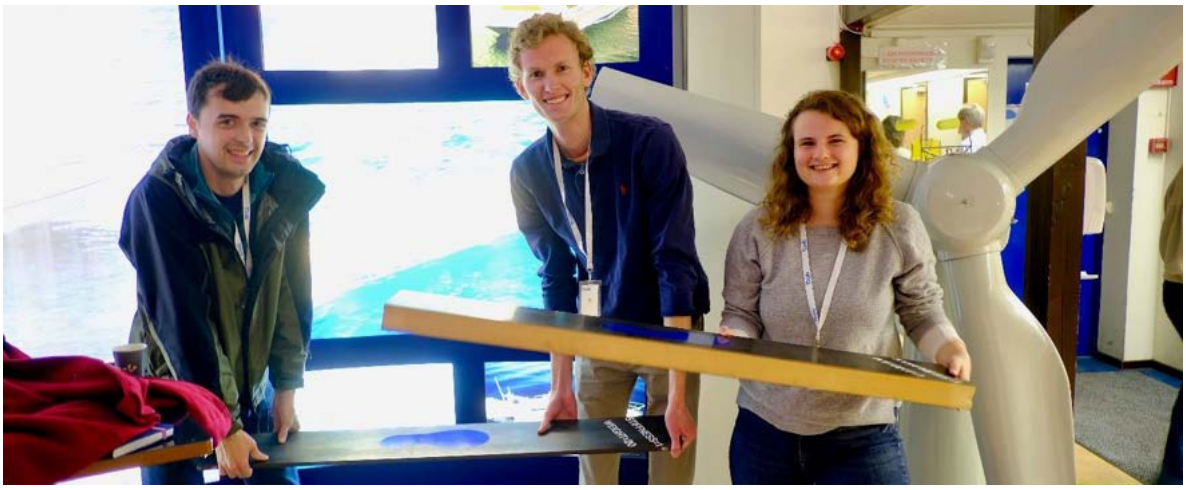
Sustainable Finance



Diab

Team Diab



From left to right: Christian, Johan and Lea at a production site visit at Diab in Laholm, Sweden.

Acknowledgements

We want to thank the IIIEE for giving us the opportunity to delve into the world of sustainable finance. A special thanks goes out to our supervisor Håkan Rodhe, who offered advice at every turn and made a site visit at Diab's production facilities possible.

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Finally we want to thank all those that have agreed to an interview with us and gave us invaluable insights into their daily work and the world of sustainable finance.

The Team

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Johan Michelet is from Oslo, Norway. He obtained a Bachelor of Science in Engineering Plus (Environmental Emphasis) and a Business Minor from the University of Colorado Boulder (2019). He has previous internship experience with Energy Recovery Inc. in San Leandro, California (2018), where he researched potential on-site energy solutions and mapped out the company's energy usage.

Diab's Path to Sustainable Finance

A Discourse on ESG and Sustainable Finance Products

By Christian Bakken, Lea Fahrnberger and Johan Michelet

Introduction

In today's world sustainability considerations are moving to the forefront of corporate planning, and perhaps no sector is as necessary in every sustainability problem and solution - or as invisible as a sustainable actor - as finance. While finance is less traditionally associated with the environment, it has started to re-examine its contribution to environmental degradation and human rights abuses, giving birth to the field of sustainable finance.

We believe sustainable finance has tremendous potential to influence the future of sustainable development. Understanding sustainable finance gives us the skills to help businesses and policymakers alike to tie environmental and social action to economic benefit.

Among companies newly interested in sustainable finance is Diab AB (Diab), a Swedish manufacturer of composite materials. Diab, one of a number of companies owned by the Ratos AB private equity firm (Ratos), is deeply linked to sustainability due to its close connection with the wind industry. However, with limited experience in sustainable finance markets, Diab has engaged us to research how it can gain access to financing connected to Environmental, Social and Governance (ESG) characteristics and what access to that financing would mean for the company.

Project Overview

The goal of this project is to a) provide a thorough overview of the key aspects of ESG and sustainable finance that affect Diab and b) provide concrete suggestions for Diab and/or Ratos to access ESG-linked finance.

This project was conducted in three main phases:

1. Literature review
2. Interviews and alumni roundtable
3. Application of findings to Diab's business

For *Phase 1* we reviewed relevant literature on ESG and sustainable finance, sustainability reporting at Diab and Nordic financial institutions, and reports from national and international bodies reporting on sustainable finance and ESG. We also built off the 2019 consultancy for Diab conducted by past IIIEE students [1]. The purpose of the literature review was to gain a clear idea of the definition of ESG, the different financial options linked to ESG, and how relevant parties to this project approached sustainability considerations broadly.

For *Phase 2* we conducted more specific interviews with relevant stakeholders at Diab and Ratos and within the sustainable finance sphere including a virtual

roundtable with IIIEE alumni providing insights from their work in ESG and sustainable finance. Due to the many proprietary aspects of ESG frameworks and internal financial analyses, as well as complexity in sustainable finance across geographies and industries, interviews could provide more tailored information than the literature review and allow us to directly examine specific considerations for Diab and/or Ratos.

For *Phase 3* the combined findings of Phase 1 and Phase 2 were used to identify key areas where ESG could impact Diab's business activities.

Diab – Company Overview

Founded in 1950 in Sweden, where Diab AB still has its headquarters and their main production site. They have since then expanded internationally, operating six production facilities globally with one more under construction. Besides producing core materials with various finishing and cutting options, Diab also provides composite engineering services, passing on their technical expertise through the Composites Consulting Group. [2]

The core materials produced consist mainly of three types of polymers/polymer composites, which are PES, PET and IPN, a polymer composite made of PVC and PET. PET is shaped in a thermo process, while IPN and PES have to be thermo-set in an around 2 week long baking and showering procedure. They also produce core material made out of Balsa wood in their production site in Ecuador. The polymer core materials are highly versatile and depending on their composition can display a variety of properties and therefore appropriate for multiple purposes. All their core materials display extremely low weight, strength and durability, making them preferable to alternative materials such as steel, which can be up to 20 times heavier when presenting the same level of stiffness and strength. [Interview 1]

Image 1: Composite materials produced by Diab.

The main industries Diab services are the wind energy industry, aerospace, marine, subsea, transportation and construction. The largest part of their sold products however are used as core materials in wind turbines, currently making up 75% of their sales. In the long term, Diab predicts that their products will increasingly be applied in various transportation vehicles, as their light weight could provide advantages in terms of energy and fuel efficiency compared to the now commonly used steel. [Interview 1]

Sustainability at Diab

Diab's mission is "to provide stronger, lighter, and smarter composite solutions realising a more sustainable world." And yes, their product is rooted in providing more sustainable solutions – saving fuel and energy. However, sustainability challenges remain within their production.

Diab's sustainability reporting is based on GRI reporting standards, they are a signatory to the UN Global Compact, and follow certified management systems in

accordance with ISO 14001 and ISO 9001. Diab's sustainability efforts are divided into four areas – strategy and governance, human and labour rights, business ethics, and the environment. Diab is the first company within their industry to have their GHG emissions reduction targets approved by the Science Based Targets Initiative. [3]

Diab's biggest sustainability challenge is waste and circularity. As materials are well combined, there is currently no good solution at end-of-life, with products being incinerated or landfilled. Further, their production utilises raw materials (plastics) and chemicals, creating yet another challenge for circularity. Waste or low yield during production is another problem. At their Swedish production site in Laholm, a 25% material-loss takes place in shaving into standardised sheets. On top of that there is material loss in carving out and customising final products [Interview 1].

Image 2: Waste from cutting custom products.

Despite these challenges, progress in sustainability is being made: at their Laholm facility, a wood-fired boiler was recently installed, phasing out natural gas in all of their production, a clear CO_2-reduction plan for the company is in place, a commitment to zero waste, and several initiatives in place for Diab's social and governance areas [3].

Sustainable Finance

With connections to all other sectors of the economy, finance is tied to almost all of today's environmental and social issues. Yet the direct environmental impacts of financial institutions are much more limited. Thus, sustainable finance has evolved to focus on promoting sustainability among recipients of finance and shifting capital to positive impacts, excluding controversial sectors, and incorporating sustainability screening to an increasing extent.

Sustainable finance can be divided into two main components, debt and equity finance. Both are relevant for Diab's interests, though there are different considerations, processes, and frameworks for both.

Debt Finance

Debt finance comprises the financial products offered by corporate banks and similar institutions, primarily loans and bonds, which incorporate interest payments from the financed entity. There are three common "sustainable" debt finance products.

Green bonds are the most well-known part of sustainable finance, though "social bonds", "blue bonds" and others with different focuses are included under the sustainable bond framework. Bond funding is provided by investors and is tradeable, thus increasing visibility [4].

Green loans have similar goals as green bonds, though are provided directly by a bank. Both green bonds and green loans must be used for projects that meet certain sustainability criteria, they cannot be used for general corporate purposes regardless of the company's overall sustainability status [4]. Otherwise, they generally function like

a standard loan and can be accessed by companies across the sustainability spectrum.

Distinct from green loans, *sustainability-linked loans* can be used for general corporate purposes. However, interest rates on these loans are connected to the recipient's progress towards various sustainability goals. Successfully meeting these goals can result in interest rates below market levels, while failing to meet targets can result in higher interest rates [4].

Each of these three products are offered by Diab's current bank, Handelsbanken, as well as most other Nordic banks [Interview 2], though specific terms and eligibility processes likely differ.

Green financial products serve multiple purposes. For one, they provide access to capital for projects that may not have otherwise been financed. Secondly, they may provide cheaper interest rates compared to traditional equivalents, though this is not always guaranteed [Interview 2].

However, green bonds especially are used for a market signal and to build a firm's sustainability reputation through a public commitment to green activities. These reputational benefits are the most popular reason for green bond issuance in a recent study [5]. Green finance also can be a key tool to integrate sustainability into the financial strategy of a firm and incentivise existing sustainability initiatives.

Equity Finance

Equity finance is contributed by investors as shares of ownership in the company, with returns linked to the company's market performance.

Sustainable investing can take on different forms: value-based investing (align with norms and beliefs), impact investing (desire to drive change on social and environmental issues), and ESG integration to improve risk-return profile [6]. These risk considerations are a significant component of the financial rationale behind ESG investing.

In both cases financiers and investors look at a variety of factors linked to sustainability. Many of these fall under the broader field of ESG, as discussed below.

Image 3: Baked PES sheets waiting to be showered.

ESG Rating

ESG criteria, as mentioned before, are environmental, social and governance factors that can be used to evaluate a company's sustainability performance, usually used for ESG ratings by socially conscious investors, as well as banks and ESG rating institutions [7]. Examples of ESG criteria according to Nordea can be found in the table below [8].

Environ-mental	Social	Governance
• GHG emissions • Energy and water use • Waste gener-ation	• Human rights • Health & Safety • Diversity	• Trans-parency • Corrup-tion • Tax Planning

Table 1: Examples of ESG criteria Nordea) [8].

The exact criteria for ESG ratings and weighting of the individual factors differs widely across financial institutions and depends largely on the priorities set by the investors or rating agencies. This also poses challenges for ESG ratings in sustainable finance, as the same company could be rated as doing well and as doing poorly by different rating agencies. Efforts to reach a global standardisation are on the way, however. The upcoming EU taxonomy on sustainable finance will create a common classification system for deeming what economic activities (investments) are to be considered environmentally sustainable. In addition, the big four accounting firms along with the World Economic Forum recently released a proposal for a standardised reporting framework, but the timeline and impact of this is still uncertain. [9]

Mrs. Marton [Interview 3] of Sustainalytics, one of the major ESG rating agencies, as well as a short review of their website, provided an example of how an ESG rating works in practice. At Sustainalytics, companies are rated on their ability to mitigate financial-material risks related to ESG issues. To determine the ESG rating, Sustainalytics looks at the company's total exposure to ESG risk. This can be separated into manageable risk and unmanageable risk. While manageable risks are any risks that could affect the company but could be addressed by the company's sustainability policy, unmanageable risks are those risks that cannot be avoided. For example an airline will always have some CO_2 emissions from its planes, regardless of the efficiency of their motors. The next step is then to identify the management gap, which is the difference between issues that are being addressed under the company's sustainability policy and those that are not but could be managed. [10]

Figure 1: ESG Risk Rating Equation adapted from Sustainalytics [10]

The final rating is calculated by subtracting the risks already managed from the total exposure to risk, giving a score out of 100. The lower the score, meaning the more risks are already managed well by the company, the better the score. The ESG ratings can then be used as a communication tool to the public/the industry, increasing corporate credibility or gaining access to sustainable finance products. [10]

Accessing Sustainable Financing

Green loans and bonds are relatively straightforward to access, assuming a company's bank offers these products. Green loans and bonds are usually developed according to the international Green Loan Principles, which identify areas suitable for this sort of financing [11]. A green loan must meet criteria relating to Use of Proceeds, Process for Project Evaluation and Selection, Management of Proceeds, and Reporting [11]. As green loans and bonds are not linked to overall company sustainability, analyses are primarily limited to the projects that would receive the funding, though broader sustainability reviews may be incorporated in the process [11].

However, for equity financing, the process becomes much more complex. Each investor has a different set of criteria used for analysing the sustainability of clients.

However, in Phase 2 a number of main sources for these analyses were identified:

1. Company public reporting (CSR, financial and non-financial reports)
2. News and public announcements about the company, especially regarding controversies
3. Third-party ESG rating services (e.g. Sustainalytics, MSCI)
4. Existing ESG funds and public company ratings (e.g. Dow Jones Sustainability Index)
5. Sector-specific benchmarks and considerations
6. Direct relationships and communication between clients and financial institutions or investors

Using this data, most investors will score the company based on sustainability factors relevant to the investor or the form of financing. Determination of sustainability often follows a similar path [Interview 7]:

1. Screening for controversial or immoral sectors (e.g. tobacco, pornography, coal)
2. Presence of sustainability reporting and measurement, especially following standardised international frameworks such as GRI
3. Sector comparisons - does a company do better than its competitors on the sustainability metrics analysed?
4. Public activity in the sustainability sphere - issuing previous green bonds, participating in sustainability conferences, etc.
5. Differentiating impact - showing positive benefits to the environment, such as through producing renewable energy or bio-based materials
6. Above and beyond considerations - areas such as biodiversity, social impact, or corporate tax that are challenging to measure but show a clear commitment to sustainability across the firm

However, financial considerations are also essential. Except for dedicated impact investors or some public sector investment, most lenders or ESG investors still expect returns that meet or exceed market averages [Interview 4]. A very sustainable company with significant financial challenges will find it more difficult to access even sustainable financing than a financially healthy but less sustainable firm. Some investors will passively select companies that meet their sustainability standards, others will actively work with engagement managers to pressure companies into more sustainable positions or continuously monitor a company's commitment to sustainability [Interview 5].

Thus, green investment is impossible to guarantee, and there is no single path to attain it. However, meeting the criteria outlined above and providing easy access to a firm's sustainability data and goals can make it easier for a company to get on sustainable investors' radar

Image 4: Sheets in the shower chamber.

The Impact of ESG

Financial Impact

Countless studies have looked at the link between sustainability and financial

performance of companies. [12], a comprehensive report from 2015 based on more than 200 research sources found that 90% of the studies showed a lower cost of capital for companies with a sound sustainability focus, 88% of the research showed that solid ESG practices result in better operational performance of firms, and 80% of the studies showed that stock price performance of companies is positively influenced by good sustainability practices. [13] investigated the relationship between ESG ratings and financial performance of Nordic publicly-listed companies. Their study showed that "ESG ratings have a significantly positive relationship with financial market performance" [14, p.65]. [6] not only present a positive correlation between strong ESG focus and financial performance, but dive into the 'how', outlining three financial impact rationales:

A strong ESG profile leads to better risk management, resulting in lower risk of severe incidents and lower tail risk. 'Good ESG' companies are less likely to suffer from severe incidents such as human rights abuse, bribery and corruption, and unforeseen environmental damage. This lower 'incident frequency' leads to less downside and ultimately tail risk for the company. That means lower volatility of the company's cash flow and reducing negative expenses.

The second rationale is based on a strong ESG profile leading to lower systematic risk, a lower cost of capital, and ultimately a higher valuation. A lower systematic risk means investors are willing to take on a lower rate of return, resulting in a higher valuation. Both these risk arguments tie into the notion that a high rated ESG company allows for a wider investor base – attracting an investor base that is risk-averse and environmentally and socially conscious [6]. Further, a strong ESG company is likely to be more transparent. This transparency reduces company-investor information asymmetry, providing better grounds for investing, increasing investor confidence.

Another financial rationale is rooted in competitive advantage. A good ESG integration leads to a competitive advantage. An advantage that leads to better returns, resulting in a higher profitability, and ultimately higher dividends for shareholders. A competitive advantage could come from lowering risk as outlined above, increased performance, and enhanced reputation. Increased performance could stem from better process innovation as well as product innovation [12].

Organisational Benefits

We have come across several other potential benefits of an ESG integration. Mr. Madlani [Interview 4] pointed out that you can shade ESG and financial performance in many ways, but it is difficult to argue against the notion that 'ESG companies are better run.' This organisational value stems from better risk management, an increased understanding of material issues affecting a company, and the implementation of processes and initiatives to respond to these issues and risks. A second benefit stemming from this is improved human capital: both retention of current employees (decreasing turnover rate) and attracting new employees [Interview 5]. A better social focus will lead to increased employee well-being, enhanced firm reputation, leading to greater employee commitment and productivity [12]. Another potential benefit is better product innovation, innovation

management, and thus a more efficient use of resources. Lastly, a strong ESG profile is rooted in transparency. Transparency in all issues and risks impacting a company, and how it deals with them. An ESG integration does not mean a company has all the solutions in place, but it offers signalling to investors and stakeholders about its commitment to these issues.

Image 3: Cutting process baked & showered sheets.

Recommendations

Green Finance

Our research into sustainable finance revealed the following options that Diab could use in the near future based on their corporate structure and business activities.

1. Sustainability-linked loans for refinancing or general activities. Given Diab's large debt burden, refinancing with a sustainability-linked loan with lower interest rates for progress in sustainability could provide meaningful financial savings
2. Green bonds/loans for future projects with sustainability components. As Diab is rapidly growing and has made many recent capital investments that tie into sustainability (e.g. its biomass boiler or PET lines), green bonds or loans could make sense for future projects as Diab continues to adapt to meet the growth of the wind industry.

While ESG investment is a valuable component of the sustainable finance sphere, we note that only Ratos, as Diab's full owner and a public company, can access this sort of financing given the current group structure. If Ratos received additional ESG investment, however, some of this funding would be passed down to Diab, enabling growth there as well. Only with Ratos' coordination and leadership will the potential financial impacts of an ESG integration become visible on the equity side.

ESG Integration

There is no one obvious solution to how Diab can improve their own sustainability efforts in line with ESG metrics. However, from our research and interviews, we have the following recommendations for Diab.

First of all, they can continue to prioritise climate and environmental efforts. In their study, [13] found environmental factors to have the strongest relationship with financial performance in the Nordics. Diab has set approved science based targets in alignment with the Paris Agreement. However, Mr. Madlani [Interview 4] pointed out that increasingly investors want to know "when and how you will reach carbon neutrality" and "what carbon offset mechanisms are in place". Outlining a strategy for this along with further communicating how Diab is part of making a positive impact on the climate crisis are crucial next steps.

Second, the 'S' and the 'G' should not be neglected. This year has put increased spotlight on social issues - inclusivity, diversity, and employee well-being. "Diversity and inclusivity, those kind of indicators, investors are now talking more about" [Interview 5]. And here Diab can do

better, and need to ensure progress. Two social issues that stand out for Diab are gender diversity and employee safety (accidents). Diab has a higher worker-accident occurrence than its industry peers. With a lost time accidents rate of 14.7 in 2019, Diab is far from their target of a LTA of 5. This is an urgent social issue. Second, gender diversity remains low. In total, about 18% of the employees are women. Ways to increase gender diversity should be a focal point. As for governance, transparency is the key word. Keep focusing on anti-corruption and bribery measures. What improvements could be made to the current whistle-blower system? A future area should be responsible corporate tax policy. Total tax paid and by country should be integrated into sustainability reporting [Interview 5].

Third, circularity should be a key focus. Diab needs to stay committed to and gradually improve raw material usage and waste management. 'Circularity' was classified as an expanded metric in a recent report released by the World Economic Forum. Thus, this area will gain increased focus in the years to come as it develops from an expanded to a core metric.

Fourth is collaboration with suppliers (plastic and chemicals). Circularity (both waste management and raw material usage) are large industry issues. Engaging with suppliers will signal commitment and put pressure on expediting more sustainable solutions.

Image 5: Finished sheets waiting for transport.

Sustainability Communication

Recommendations on how Diab can better communicate their efforts in sustainability, with the industry but especially investors and other actors from the financial sector have been structured according to what can be achieved in the short term to what could be an aspirational target in the future. They were compiled according to advice given by [Interview 4,6,7,8] and depicted in the timeline in Figure 2.

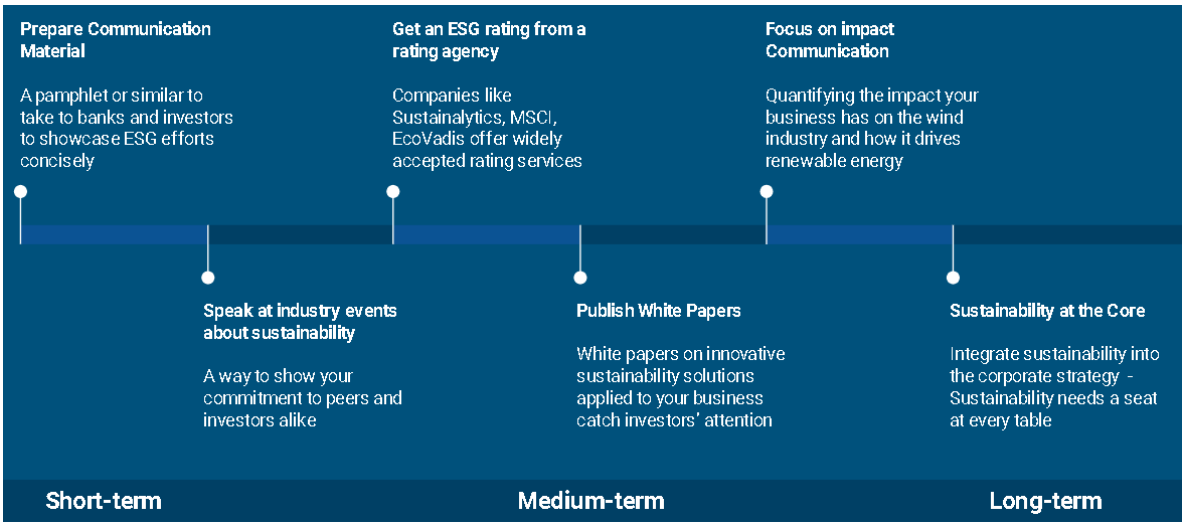

Figure 2: Recommendations on Diab's sustainability communication.

Conclusion

This project explored the concepts of ESG and sustainable finance to provide insights that would drive Diab's future sustainability and financial planning. We found that green debt products were the most relevant for Diab, and could likely be accessed with relatively minor changes in the business activity (such as receiving a third-party ESG rating). However, given the rapidly changing sustainable finance landscape and the complexity of Diab's relationship with Ratos and its other portfolio companies, larger changes that do more to integrate sustainability into the core of Diab's business may also be valuable in the long run.

Overall, sustainable finance is an extremely dynamic and diverse industry. There is no standardised or simple approach to achieve ESG success, but it is clear that companies who understand and are able to navigate the ESG landscape are well-positioned for future success.

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List of people interviewed

[1] Per Hökfelt, EVP Sustainability & EHSQ, Diab, multiple dates

[2] Karin Lagerstrand, Vice President Sustainability, Handelsbanken, 28 October 2020

[3] Anna Marton, Senior Associate Quality Management, Sustainalytics, 22 October 2020

[4] Rupesh Madlani, Co-Founder, Global Sustainable Capital Management, 14 October 2020

[5] Keiyau Sin, Senior Engagement Manager, Engagement International, 16 October 2020

[6] Mike Toulch, Senior Engagement Analyst, SHARE, 21 October 2020

[7] Michael Schlup, Managing director, Sail Ventures, 23 October 2020

[8] Antoine Bonnamy, ESG Analyst, ISS-Ethix, 21 October 2020

[10] Malin Bjurvald, Corporate Responsibility Manager, Plantagen, 21 October 2020

[9] Maria Medved, Group Business Controller, Diab, 15 October 2020

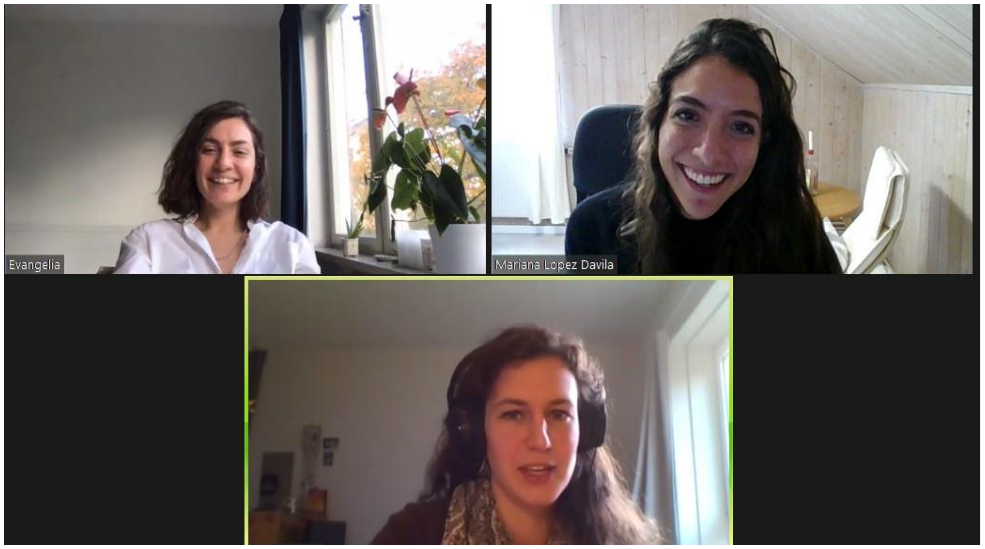
[11] Agathe Bolli, Sustainability & Communications Manager, PSP Swiss Property, 21 October 2020

[12] Jonas Marking, Senior Product and Sustainability Manager, HL Display, 21 October 2020

Improving W/EEE Circularity

El-Kretsen

Team El-Kretsen



Clockwise from top left corner: Evangelia, Mariana and Holly on casual zoom meet

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Mariana López Dávila is from Mexico. She holds a B.A. in Psychology and Political Science and a M.A. in Public Administration and has working experience as a management consultant for international development organisations. She is passionate about sustainable production and consumption systems and the transition to a circular and decarbonised economy.

Evangelia Paschalidou is from Greece. She holds an LLB in Law and an LLM in Law and Economics and has work experience in sustainable product design. She is interested in researching ways of upgrading the practice of EPR systems, as well as in concepts that redefine consumption and cultural human experience.

Improving W/EEE Circularity

Upgrading Reuse and Repair of EEE in Sweden, by El-Kretsen

By Holly Griffith, Mariana López Dávila, Evangelia Paschalidou

Waste Electrical and Electronic Equipment (WEEE) is reportedly one of the fastest growing waste streams. In 2019, almost 53.6 million tonnes of WEEE were generated globally. Sweden plays a large role in this generation, with one of the highest per capita WEEE generation rates of 20.1 kg, matched against the European mean generation of 16.2 kg and a global mean generation of 7.3 kg in 2019 [1].

These numbers reveal the finer issues of the WEEE problem that extent beyond collection and recycling. To achieve the European Union's (EU) goal of transitioning to a Circular Economy, within Sweden there is a need to shift the throwaway mindset of society and reduce the overall generation of WEEE.

Closing material loops of e-products, as well as the consequent environmental, human health, and social benefits from the avoidance of virgin materials extraction, could be achieved by cultivating a lifecycle approach that would extend across the value chain to production, consumption, and end of life management as well as through forwarding new business and ownership models [2].

A first step towards this loop closure can be made by targeting solutions higher in the Waste Hierarchy and promoting reuse and repair before recycling of e-waste. But are there any ways to work towards this goal from a Producer Responsibility Organisation (PRO) point of action? This was the challenge presented to us by El-Kretsen, Sweden's primary e-waste PRO.

Task Description

El-Kretsen, is interested in investigating further ways to adjust to the constantly changing landscape of product design and emerging circular business models. Our task was to come up with recommendations on (1) how to leverage reuse and repair opportunities of Electrical and Electronic Equipment (EEE), in order to extend products life span, and (2) how to enhance collection and pre-treatment of WEEE to increase the value of resources extracted.

This report begins with an overview of the nature of the organisation, and then presents the methodology and the approach of the research. The main body of this report is structured around five intervention areas that will be introduced separately, each one followed by specific recommendations. Finally, we will conclude with a consolidation of our findings, highlighting the necessity of dynamic partnership, creative market development, and a restructuring of user mindset to foster more circular models.

Image 1: Final presentation to El-Kretsen

Client

In 2001, El-Kretsen was founded in response to incoming Swedish producer responsibility regulations, which required the producers of EEE to take a more complete responsibility for the WEEE generated by the use of their goods. For al- most 20 years, El-Kretsen has worked to "take responsibility for the collection and recycling of things that no longer work" on behalf of their over 2,000 producer partners, acting as the primary PRO for WEEE in Sweden by a broad margin [3].

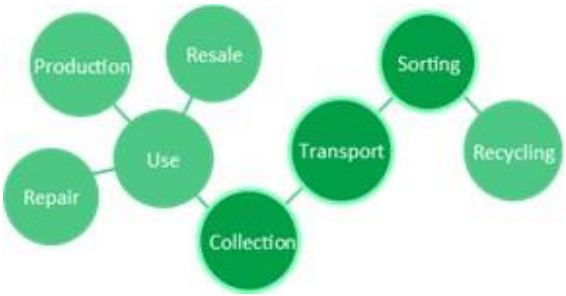

Figure 1: Areas of El-Kretsen's direct influence

As a 13-employee company, El-Kretsen is largely a logistics company for several parts of the value chain. The dark, outlined circles in *Figure 1* are the areas where El-Kretsen possesses some direct influence. However, even there in many cases work is only subcontracted and *managed* by El-Kretsen, limiting their direct influence, which makes affecting the circular economy on the full EEE value chain a difficult task. El-Kretsen does, however, have contact with the majority of actors in the value chain, and acts as a logistics support for many stages outside their control. It is their job, as they state, to "keep an eye on the flows" [3].

Methodology and Research Approach

Due to the exceptional circumstances of the COVID-19 outbreak during the course of this project, our research was conducted largely online. Research included on-line meetings held with the Business Development Man- ager of El-Kretsen; desktop research con- ducted to define and deepen our under- standing of the focal research areas; and on- line interviews with experts from within the industry and academia.

After having collected and processed our data, we identified five key areas of intervention and developed 14 recommendations, as showcased in *Table 1*. The numeric order of the recommendations in the table does not suggest any evaluation of effectiveness or causal relation among them, instead it outlines a *facilitating prerequisite background* from the first to the following.

For instance, by raising awareness on EEE usage and WEEE management issues

01	Teach the public about W/EEE	• In-school education programmes • Behaviour change media campaigns • Enhance public understanding of end-of-life • Create a communications division
02	Secure market for repairable EEE	• Producer refurbishment and resale • Partner with resale and repair organizations
03	Increase collection of W/EEE	• E-waste mail in service • Call a neighbour campaign
04	Improve EEE collection structure	• Create new collection streams • Repair at collection points
05	Invest in innovation	• Green Vision Association development • Support good sorting practices • Create a consulting services offering • Assign a budget for research and development

Table 1: The five key intervention areas identified

through *Behaviour Change Media Campaigns* there is higher likelihood for the recommendations of the following area to perform better. In this case, by creating higher demand for repair activities from people that want to maintain the functionality of their EEE, incentives are given to the Organisation for establishing partnerships with repair shops and providing them with spare parts. A deeper look at these interlinks can be further explored in *Figure 2*.

Findings and Intervention Areas for El-Kretsen

Area 1: Teach the Public about W/EEE

One of the key issues identified both in the literature and by some of the interviewees in determining the public's attitudes on W/EEE is its lack of knowledge around how WEEE is managed. Lack of awareness on best-use, repair options, and the environmental impacts of product life cycles drives the public's inefficient use of EEE. It is also the case that the broad public, as well as actors within the industry, have different understandings of what recycling means and a gap can be spotted between the public's perceived impacts of its actions and reality.

A smart communication strategy, based on simple, coherent, and clear information on W/EEE and its management has been identified as one of the key success factors of high performing countries [4]. To achieve this, El-Kretsen could redefine their responsibility as a PRO, stepping out of business-as-usual and investing in the communication of information and education of end-users. More specifically four main recommendations have been identified:

In-school Education Programmes. The results of an informational campaign can be sustained in the long run if El-Kretsen ap- plies the campaign with a bottom-up approach, focusing on the age group of elementary school children. Apart from building the foundation of a more holistic

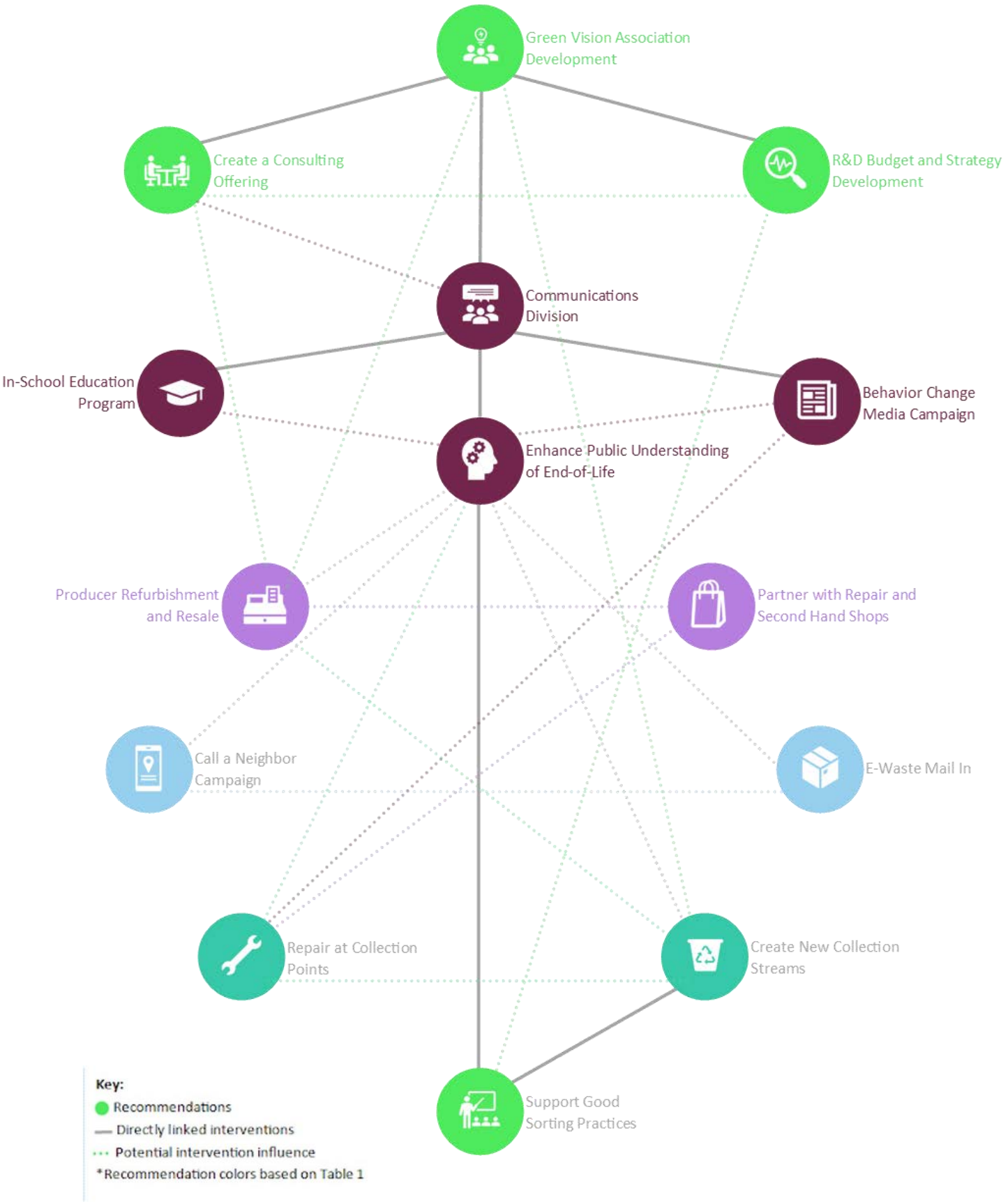

Figure 2: An overview of the interlinks between recommendations

understanding regarding EEE management in future generations, children can also intergenerationally influence their parents' attitudes.

To this end, El-Kretsen could design, in collaboration with the Swedish National Agency for Education, a twofold educational project. This project is recommended to consist of: (1) the development of multimedia material for building students' understanding around EEE and the best ways of handling it; and (2) the launching of an *e-waste race,* a competition among schools to collect the most and best-sorted WEEE according to functionality, repairability, and recyclability. This way, both collection and appropriate sorting are taught but also, children are able to connect theory to practice by experiencing WEEE management themselves.

Behaviour Change Media Campaigns. In a similar vein, it was identified that users' behaviour and the ways in which they engaged with their products influences the circular potential of EEE [5]. In this respect, this strategy recommends the creation of mixed media campaigns focusing on durability concerns, attachment, repair, and recyclability of EEE, encouraging users to provide a longer use phase and improved end of life for their products. The focus of these campaigns is altering consumer behaviour, and as such the four highlighted aspects in *Figure 3* can be mobilised to assist in targeted behaviour improvement interventions. The efficiency of these campaigns can be increased when bundling with a fun, social activity launched in social media, like a photo competition of name-tagged appliances, for example.

Figure 3: The Eco-Design principles.

Enhance Public Understanding of End-of-Life. Looking closer at public understanding of the end of life management of WEEE, we found that the public's perceptions of what happens after the use-phase deviates from reality, so relatability between user action and end results should be engaged with. An effective informational campaign will address this by informing the public of the process that follows after WEEE is gathered at collection points. This campaign would also provide easily attainable alternatives, even on spot at collection points, like on site repair options of appliances intended to be thrown away, and can be tied with more than one relevant recommendation mentioned later in this report.

Communications Division. The final recommendation for this intervention area stresses how crucial keeping communication activities organised is and gives El-Kretsen an inroad to social media activities. This could be facilitated by creating a Social Media and Communications division, that will be in charge of (1) running communication and education campaigns, (2) coordinating them with the external stakeholders, and (3) establishing and managing the Organisation's profile on social media platforms. Such a strategy can be quite efficient

as the human resource demands for this work are low, while the impacts are high.

Area 2: Secure Market for Repairable EEE

Our interviews and literature review revealed that the market for used EEE as well as the demand for repair services of EEE in Sweden has not been studied in sufficient depth. We identified that the leading players in the business of used EEE in Sweden include Giab (IT equipment), Inrego (IT-products), Swappie (iPhones), and Begagnade Vitvaror (white goods), and the market segments that are most interested in used EEE are offices and students. Despite the acknowledgement that more research is needed, all our interviewees agreed that the market for used EEE and EEE repair services has great potential which is yet to be fully exploited.

The barriers preventing the EEE reuse and repair market from flourishing include: (1) high price of spare parts and repair services relative to the price of new products; (2) lack of consideration of reuse in product design and in collection and recycling schemes; (3) shortage of repair professionals; and (4) unfavourable consumer perceptions around reuse and repair.

For El-Kretsen, securing demand for spare parts and used electronics is key to their ability to enable reuse and repair of the EEE that enters their system. Our research discovered that even though the market for used EEE and EEE repair services is yet to mature, EL-Kretsen can tap into this market and secure demand for its products through strategic partnerships with producers and reuse and repair organisations.

Producer Refurbishment and Resale. This recommendation is designed to involve producers more fully in circular processes and create a market for lightly used products and harvested components through the producers of those goods.

To achieve this, we propose that El-Kretsen identifies a producer that is looking into reclaiming and reselling their lightly used products and work with them on the collection, sorting, and logistics of EEE that enter El-Kretsen's system but could be resold. This idea stems from our finding that some producers are increasingly interested in repair, refurbishment, and resale of EEE, with Electrolux and Ikea being two such examples.

Partner with Resale and Repair Organisations. This idea is designed to meet the same goal as the recommendation above, which is to secure buyers for the products that El- Kretsen collects and to revive the market for used EEE and spare parts.

To achieve the goal above we propose seeking partnerships with a used electronics business such as Inrego or with repair professionals to provide them spare parts and used electronics. The used electronics businesses or repair professionals would harvest the useful materials and proceed to repair and resell them. El-Kretsen would receive a percentage of the profits and would also collect data to understand how much is being diverted from the waste stream.

In addition, El-Kretsen could partner with repair cafes. An interesting partnership could involve connecting repair cafes with corporate social responsibility programs from El-Kretsen's member organisations. In this way repair cafes could access electrical engineers and other professionals on a volunteer basis to improve the quality of their repair workshops. In return, repair cafes could provide El-Kretsen with data on what devices they received, what the fault

was, if the item was fixed, and if they needed spare parts.

Area 3: Increase Collection of W/EEE

Two primary challenges with users bringing WEEE to collection points were identified as needing further action: (1) Residents commonly hold onto higher value items with valuable internal components such as cell phones and laptops due to attachment, despite the fact that those items are no longer in use and (2) one of the highest environmental impacts in collection comes from transportation, due to each individual transporting their WEEE to a central collection point rather than aggregating collection [6].

Image 2: Collected PCs

Computers are the least received items in the El-Kretsen collection system, however these are the items that possess the most value and have a high amount of potential when it comes to component harvesting. Finding ways to extract that value, and bring it into the collection stream, could help support El-Kretsen's management of lower value goods, as well as ensure that all items are being appropriately managed instead of stagnating in resident households.

There are currently several collection options available for WEEE in Sweden—residents can bring their WEEE to small or large retailers for collection, to a Hazardous Waste Truck that travels to certain neighbourhoods in the autumn and spring, or to recycling centres located near populated areas [Rustan Nilsson, p.c. 15 October 2020]. However, recycling centres are still one of the most frequented options, and while there are 580 different recycling centres, residents still often need to drive to bring their electronic goods in for collection. As such it was identified that there is a need for creative collection implementation.

E-Waste Mail In. This strategy is designed to increase the collection of high-value items such as laptops and cell phones which often remain in resident homes after residents have ceased to use them. To remove barriers to collection of such small items this proposal suggests creating an at-home collection option.

To make collection of these items easier, we suggest partnering with an e-commerce distributor or postal organisation to provide residents with a parcel bag and a letter asking residents to fill the bag with electronics they wish to dispose of and place the bag in their parcel box. More parcel bags could be made available at the nearest post office or could be delivered to residents upon request.

Call a Neighbour Campaign. This intervention will address the number of vehicles traveling to collection locations, the highest emission point in the collection process, as well as to increase the collection opportunities for high value electronics. To reduce resident travel, this proposal suggests creating an e-waste carpooling option.

To decrease the number of vehicles traveling to collection centres for WEEE disposal, we propose creating a "Call your

Neighbour" phone application that allows residents to post when they are traveling to the e-waste collection point and offer to deliver other resident's WEEE on their way. The business model for this could be structured like Uber, creating a regional or local e-waste delivery market for a nominal fee as a way to reduce transit to collection points and increase collection convenience.

Area 4: Improve EEE Collection Structure

El-Kretsen collects approximately 70,000 tonnes of small appliances annually, and about 147,627 tonnes of WEEE overall, the remainder being freezers, refrigerators, white goods, and other personal electronics [3]. A high percentage of this material can still be used and is not actually waste, it is within this percentage that improved collection opportunities lie.

Image 3: An example of collected e-waste

Typically, at collection points, WEEE is all thrown into a single bin together, then transported by truck to sorting facilities where it is disassembled for first depollution. The current collection process assumes all materials are broken, and as such does not preserve goods that can be potentially repaired or reused. the opportunity to separate out those goods lies at the collection phase.

Of course, the best way to ensure repairable and reusable items do not end up being sorted into WEEE is through altering the behaviour of the disposer, which several other recommendations work to address. However, we recognise that often consumers will fail to repair their goods if it is believed to be too difficult and time consuming to do. Therefore, these recommendations work to remove the barriers to good behaviour by offering some repair and reuse opportunities at the same location as collection, to reduce the level of effort and time in the early establishment of repair culture.

Create New Collection Streams. This recommendation will address the challenge that often, repairable or reusable goods are brought to collection locations, thrown in the WEEE collection bin, and are damaged beyond repair upon transport to sorting facilities. To capture these repairable and reusable goods, we recommend adding new collection options for WEEE.

Image 4: An example of differentiated collection bins

This additional collection option will be dependent on partnerships with municipalities and collection sites to ensure reduced strain on the existing system. Additionally, this recommendation is best supplemented

by having a professional present to assist with resident sorting. Additional bins can be provided in two ways: (1) Providing two bins, one for repairable and one for reusable items that can be collected by repair and second hand shop partners or (2) providing bins for specific, product types collected at high volume and with a high potential for repair, such as speakers or computer accessories that are desired by repair partners [2].

Repair at Collection Points. This strategy is designed to address two issues: (1) the limited repair infrastructure in Sweden and (2) the barrier for residents of visiting both a repair and collection location for their electronic goods. To improve accessibility for repair options, we recommend adding a repair option at select collection locations.

This can be done in one of two ways depending on resource availability and municipal partnerships: (1) Pop-up repair stations at scheduled intervals at select collection points to teach residents about repair options or provide small repair support or (2) fixed repair shops connected to collection centres, much like what exists at Alelyckan in Göteborg, Sweden.

In the case of option 1, funding is the largest challenge, which can be addressed through: (1) Partnerships with repair cafes; (2) Pro-bono work by repair professionals; or (3) Grant funding obtained with partnerships.

Area 5: Invest in Innovation

Innovation is key to achieve El-Kretsen's vision to redefine their role as a PRO. El-Kretsen is uniquely positioned to incentivise innovation by improving information flows and collaboration among producers and other players such as municipalities. However, this will only become a reality if El-Kretsen creates an enabling environment and assigns resources to develop and test new concepts. The following recommendations propose only a few ways in which El-Kretsen can leverage its advantageous position to spark innovation and improve the circularity of EEE.

Green Vision Association Development. El-Kretsen could initiate a collaboration between interested producers to encourage collaboration in designing circular strategies, potentially also inviting municipalities and other relevant stakeholders to participate depending on association focus and membership. This group could meet quarterly, semi-annually, or annually depending on initial buy-in. Possible actions could involve designing pilot programmes to improve EEE circularity, developing a research agenda, and acting as a platform to share challenges and success stories.

Support Good Sorting Practices. This rec- ommendation proposes working with sorting partners to incentivise better sorting practices through education and innovation. Incentives could be creating a "company of the month" award which gives the winner partner some interesting benefit. Collaboration could be done in many ways, from organising training for employees, to connecting sorting partners with reuse and repair organisations. Partnering with academia on research projects on automated and intelligent sorting equipment will also be a key for transitioning into digitalisation.

Creating a Consulting Services Offering. El- Kretsen can leverage its unique position to help producers reduce the impact of their products at end-of-life by providing con- sulting services. Some of the services that El-Kretsen could provide are data for environmental analysis of products, and advice on good design practices in preparation for

end-of-life and on how to integrate recycled materials into new products.

Assign a Budget for Research and Development. In order for all the ideas mentioned above to be possible, El-Kretsen should con- sider assigning a budget for research and development activities.

Conclusions

As the EU is actively working to decrease its carbon footprint and transition to a regenerative and circular economy, the need to extend the life of EEE by enabling reuse and repair before recycling has only become more pressing. Our research uncovered that the key barriers to achieve this are lack of public awareness on best-use, repair options, and environmental impacts of EEE, high price of repair, and lack of consideration of reuse in product design and in collection and recycling schemes.

El-Kretsen can improve the circularity of EEE by focusing on five intervention areas: 1) teaching the public about W/EEE, 2) securing a market for repairable EEE, 3) increasing the collection of valuable W/EEE, 4) improving EEE collection structure, and 5) investing in innovation. While these areas could be pursued on their own, it is by addressing them together and in collaboration with the different stakeholders across the value chain of EEE that real circularity can be achieved.

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List of people interviewed

Begnade Vitvaror, AB. 18 October, 2020.

Fredrik Benson, Vice President of Busi- ness Development, El-Kretsen.14 October, 2020

Jessika Richter, Postdoctoral Research Fellow, IIIEE. October 19, 2020

Laura Fostinone, Innovation Scout and Project Manager, Cleantech Scandinavia. 20 October, 2020

Naoko Tojo, Deputy Head of Depart- ment, IIIEE. October 20, 2020

Noori Saber, Owner, Electronicsmix. October 28, 2020

Rustan Nilsson, Environmental Educa- tor, Sysav. 15 October, 2020.

Tracing Conflict Minerals

Inter IKEA Group

Team IKEA

From left to right: Wan-Chun, Samuel & Milan.

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The Team

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Samuel Walker is from the UK and holds a B.Sc. in Business Management and Geography from Bath Spa University (UK) & Queensland University of Technology (Australia). He has experience working with Electronic Take-Back schemes and promoting sustainability within major retail brands in Australia.

Tracing Conflict Minerals

The Responsible Sourcing of Conflict Minerals in the Supply Chain

By Wan-Chun Hsieh, Milan Loose & Samuel Walker

Introduction

As demand for electronic products, smarter technologies and renewable energies increases, so does the demand for the materials and minerals required to produce them. However, the extraction of a number of these minerals can impact detrimentally on both the social fabric of communities and the environment. In particular Tin, Tantalum, Tungsten and Gold (the 3TG) carry a notorious reputation for the negative impacts they cause: the extraction of these minerals has been linked to the funding of conflicts, organised crime and human rights abuses in mainly (but not exclusively) the Democratic Republic of Congo (DRC) and adjoining countries [1].

The notorious reputation gained by the 3TG has led to the introduction of regulation aimed at tackling these detrimental impacts. In the US, the implementation of section 1502 of the Dodd Frank Act (2010), requires producers to assess and disclose the risk of 3TG being used in their supply chains, based on best available knowledge. In 2021, the EU will implement its own response with the European Conflict Minerals Regulation, which addresses the same issues but differs in its approach; every importer of minerals into the EU will be required to assess the risk of these minerals being used in their supply chain. With the implementation of this regulation, producers are investing in tracing these minerals through their supply chains to the original mining source. But to stay ahead of regulation and to meet stakeholder expectations, organisations a tier or more above producers are also beginning to implement systems or procedures to ensure that these minerals are not included in the products they place on the market.

Image 1. Gold Mining in DRC (Source: Fairphone)

The Client

Founded in 1943, IKEA has grown to become an internationally recognised brand, with 433 stores in more than 50 markets. With suppliers situated across 50 countries, a global multi-tier supply chain has developed. IKEA has a long-standing programme, called IWAY, which is a supplier code of conduct that communicates the minimum requirements on environmental, social and working conditions for its suppliers and encourages them to work towards sustainable sourcing practices.

With a vision to "create a better everyday life for the many people," IKEA launched the People & Planet Positive strategy in

2012. As part of this, IKEA has the ambition to become climate positive by 2030 and build a 100% circular business model by then. IKEA also strives to use only responsible sourced materials in the supply chain.

Raw materials account for the largest proportion (42%) of IKEA's climate footprint. Today, more than 60% of the IKEA product range is based on renewable materials and more than 10% contains recycled materials [2]. IKEA has been diligently working over the past few years towards building a strong and robust responsible sourcing framework for all the materials used in the business including materials used in electronics.

Complexity of Supply Chains

Determining whether electronic products contain CMs can be a complex process, primarily due to the high number of actors involved in the different stages of the supply chain. Within this, the smelting and refining stage is often identified as an important point for the minerals' processing and tracing. This is due to two aspects.

First, the smelters and refiners represent a bottleneck. Due to a relatively small number of smelters and refiners that exist globally, this point in the supply chain is useful for assessing the risks associated with CMs (See Figure 1). Secondly, once the minerals have become mixed in the refining and smelting process, it becomes more difficult to determine their source.

Commonly, organisations that are facing public demands to increase the transparency of their supply chains follow an approach outlined by the OECD [3]. The stages outlined define requirements to:

1) Establish a strong company management system.
2) Identify and assess risk in the supply chain.
3) Design and implement a strategy to respond to risks.
4) Carry out independent third-party audits of supply chain due diligence.
5) Report annually on supply chain due diligence.

Organisations are asked to demonstrate how and if business operations actively exclude materials that are socially and environmentally detrimental. Through implementing policies and supplier requirements for reporting on materials contained in the products, the electronic,

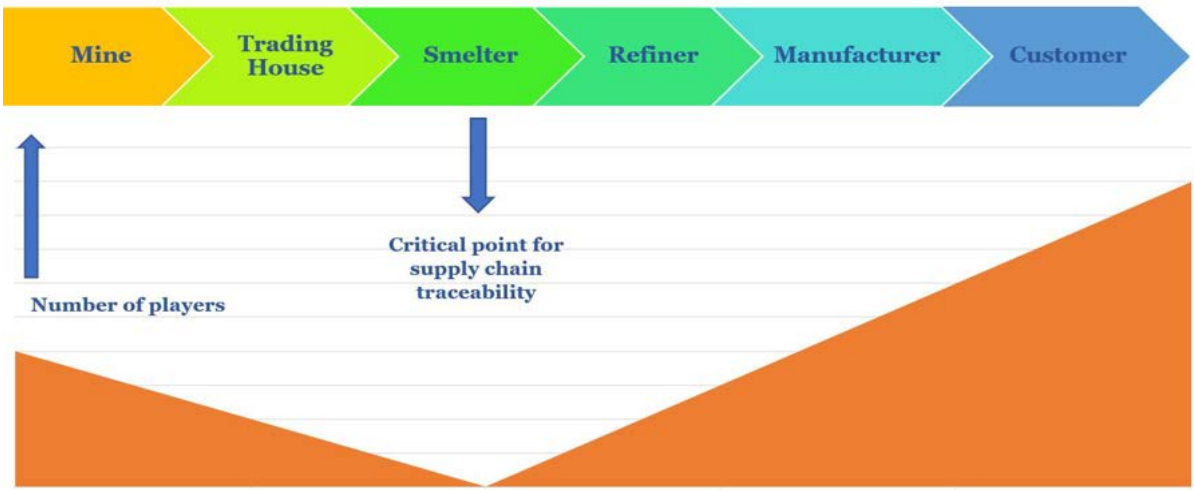

Figure 1: Smelter's position in the supply

automotive and chemistry industry follow a procedure that is seen as the industry standard.

Task & Objectives

Following consultations with IKEA, the scope of our work was defined and the main objective was identified as:

To provide IKEA with an overview of current industry best practices on the tracing of Conflict Minerals, in the supply chain of electronic products.

This was based on the client's request for us to provide an "outside-in" perspective on what IKEA could do to further address CMs in the supply chain. Secondary objectives were also identified. These included:

- To identify emergent (conflict) minerals that could also pose a potential risk to IKEA's operations.
- To provide insight into the current opportunities that exist to recycle CMs.

Based on the above objectives, our team provided a series of recommendations for how IKEA should continue to mitigate risks and manage the use of CMs being used within their products. These recommendations were provided through a presentation, workshop and report.

Research Approach

To achieve the objectives identified above, an iterative research process was adopted. A preliminary literature review was performed to provide a general understanding of CMs, the associated environmental and social impacts, and the efforts currently being employed to address these by governments, civil society and the private sector.

In performing a preliminary literature review, we were able to identify a number of businesses who had implemented a strategy to trace conflict minerals in the supply chain. These operated across a range of industries and included Signify, DELL, Electrolux, Volvo, Apple Inc., and Fairphone. A secondary literature review was used to gain a deeper understanding of industry standards, compare the different approaches adopted and identify best practices. Seven interviews with experts from related industries, consultants, waste management bodies and civil society organisations were also performed. Information gained from the interviews was further used to inform the research. Following a research period of four weeks, the information gathered was analysed. The analysis was strengthened through the use of the online tool "Mural", which allowed consistent themes in the research to be identified.

Image 2: Brainstorming in Stadsparken, Lund.

Limitations

Minor limitations were recognised during the research process. Primarily, we had limited access to informants and resources from the leading electronic suppliers of IKEA, and from smelters and recycling

organisations. To address this, additional literature was used.

Our Findings

The themes identified through the analysis were management systems, procedures or practices that could be considered either common practice or aspects that differentiated the organisation from others; these could be viewed as areas of Beyond Compliance. The identified areas included;

- Stakeholder Collaborations
- Stakeholder Awareness
- Risk Assessment
- Audits and Improvements

Common Practice

At a minimum, all organisations reviewed had implemented a response to CMs that aligned with the OECD five-step guideline. Different levels of success had been reached by each, demonstrated by the smelter approval rate which identified the number of smelters that were using conflict-free minerals. The organisations reviewed commonly achieved an approval rate of between 80%-90%. This showed that although all organisations have implemented a strategy to deal with CMs, additional efforts are still required to effectively trace these across all industries.

Beyond Compliance

Whilst all businesses had adopted a system aligned to OECD guidelines, some had excelled in certain aspects - these were explored to identify best practices.

Stakeholder Collaborations

All organisations were found to be working in collaboration with the Responsible Minerals Initiative (RMI), an organisation that provides resources and support to improve the responsible sourcing of minerals. The RMI provides tools commonly utilised by businesses, such as the "Conflict Mineral Reporting Template" (CMRT), a document sent out to smelters to identify whether CMs are used by their suppliers. In return, the RMI charges a membership fee. However, whilst some organisations only supported the RMI through this, others were identified as being more engaged, working to develop the system for tracing CMs and addressing the issue on a broader level.

Organisations were further differentiated through the collaborations established outside of the RMI. These took shape in a number of forms, including industry led-collaborations that addressed the traceability of CMs across a particular industry. "Drive Sustainability" was one of such initiatives, identifying a list of CMs most relevant to the automotive industry [4]. As was noted by Volvo, the RMI provides advice and tools designed to be used across all industries. Having an initiative like "Drive Sustainability" enables these tools to be tailored for businesses operating in the automotive industry.

Other collaborations targeted issues on-ground. Signify, Dell, and Apple Inc. worked in collaboration through the Public Private Alliance for Responsible Minerals Trade, channelling resources to on-ground mines to improve working conditions. Fairphone also responded to issues through on-ground collaborations but worked directly with the mines. In doing so, Fairphone established a high level of transparency which could be communicated to stakeholders. But it was recognised that this worked as Fairphone

had a smaller supply chain with fewer agents involved [5].

Signify provided the more applicable example of best practice to our research due to the larger number of suppliers and tiers in the supply chain, making the organisation more similar to IKEA. Signify was differentiated from other organisations through the collaborations made with a number of organisations to improve due diligence procedures at industry level and address issues on ground. In particular, a collaboration with the European Partnership for Responsible Minerals (EPRM) contributed towards this. Whereas the RMI provided support and materials to improve due diligence procedures in the supply chain, the EPRM also provides support to mines in high-risk areas. It was the understanding that Signify had that issues related to CMs must be addressed through on-ground projects, industry wide-initiatives and performing due diligence in their supply chain that differentiated Signify's approach.

Image 3: Working directly with the mines, Fairphone provides workers with hard-hats to improve working conditions (Source: Fairphone).

Stakeholder Awareness

Due to the complexity of the electronics supply chain, all of our interviewees mentioned the importance of building a comprehensive understanding of CMs among stakeholders. Even though most organisations had already established regular communications, only a few companies could exert their influence and implement business values into their value chain.

For internal stakeholders, creating a team of employees from different departments is key to supporting the operation of the organisation and to communicate with external stakeholders. To collect diverse perspectives and feedback, companies like Apple Inc. chose to build dedicated cross-departmental teams and establish a direct reporting line with top management. By integrating opinions from design, purchasing, marketing and other departments, companies like Volvo hope that the knowledge around CMs becomes more integrated into conversations and decisions throughout the organisation.

In contrast, external stakeholders are also the foundation of responsible sourcing of CMs. As customers are increasingly expecting more products to be sustainable, the question of how to support them in making informed decisions is crucial to promoting sustainable business practices. Marketing strategies, targeting a change in consumer behaviour, play a vital role in this. Fairphone is one example of beyond compliance as they not only publish CMs mineral reports annually, but also disclose their progress on identifying non-direct suppliers and detailed material composition of their products. By enhancing the transparency of the mineral supply chain, companies hope to boost customers' awareness and differentiate their products from others. Moreover, all organisations emphasised the importance of

incorporating sustainability into suppliers' DNA and making sure they understand buyers' expectations on responsible sourcing, often through a Supplier Code of Conduct. As was noted by interviewees from Volvo and Ericsson, a strong relationship with suppliers is the key to promoting a sustainability agenda since they highly rely on the support of suppliers to verify the source of CMs. Also, since CMs is still an unsolved issue, building a collaborative value, through supplier training or annual meetings, can help update suppliers on the latest benchmarks in the industry, as well as stimulate conversations on the current challenges of tracing minerals.

Risk Assessment

Performing a risk assessment to assess whether CMs may occur in the supply chain was identified as common practice. However, some organisations stood out through the set-up of a more established system. Both Ericsson and Volvo emphasised the need to set up a comprehensive process to collect information from suppliers and to understand what materials are used in products. Once organisations have formulated a detailed product list and identified the materials used, they can define the most relevant materials or regions that can be focused on.

Apart from 3TG, other minerals such as cobalt and mica had been considered by organisations such as Volvo, Signify and Samsung. Also, in addition to the DRC and adjoining countries, other regions such as Indonesia had been included in the scope of assessment by Samsung [6]. It was a combination of all these elements adopted in the risk assessment system, that enabled organisations to effectively monitor and mitigate risk and set examples of forward thinking strategies.

Audits and Improvement

After organisations collect information on suppliers via the CMRT, consideration is given to how accurate these can be, due to the number of agents involved past the smelter point. This is a problem recognised by most organisations, and as such, all businesses reviewed had implemented some form of audits to partial suppliers as common practice.

Volvo stood out as an example of beyond compliance in that apart from auditing suppliers after they are selected, they also perform pre-audits during the selection phase. Potential suppliers are required to fill in a self-assessment questionnaire. Volvo will then conduct pre-audits to verify the accuracy of the information provided by suppliers. The purpose of this system is to enhance suppliers' willingness to change prior to a contractual agreement, as Volvo emphasised how buyers have more purchasing power during the supplier selection process. This also provides an opportunity to better communicate supplier expectations and motivate change.

After implementing audits, it is also relevant how organisations respond to non-conformities. Rather than delisting suppliers, Ericsson noted that it is more beneficial for the whole value chain to assist suppliers in improving practices as most CMs are connected to the most vulnerable groups and their wellbeing. As a result, Ericsson attempts to invest additional resources through training platforms to address these non-conformities. This was also identified with Volvo who discussed how the raw material itself is not the dominant issue, but rather how it is

managed at the source. Therefore, responses should focus around how to conduct responsible sourcing and working with non-conformities, not walking away from them.

Blockchain

In addition to identifying best practices, we were requested to investigate the potential usage of blockchain technology to increase the traceability of CMs in global supply chains and to present proof of their provenance. The question we were thus trying to answer was: is this technology adaptable to tracing CMs?

The blockchain technology has widely been perceived as a promise for more transparency in the traceability of financial or material transactions. Since its application to Bitcoin in 2008, it has been discussed as a potential technological innovation to address very different challenges. Industries like the financial and food industry have identified potential applications of the technology and implemented them [7].

Our findings indicate a mixed assessment of whether the technology can help companies establish transparency in their CMs supply chains. Our interviewees indicated that their organisations have investigated the possibilities of using the technology to trace CMs but have mostly decided that it faces more difficulties than it helps to overcome challenges. Our interviewees mentioned that it is too difficult to determine whether the minerals traded are "conflict-free", if they are declared as such, because the material itself does not carry this information. An example used to illustrate this difficulty is the labelling of green electricity. It is difficult to determine whether the single electron stems from a renewable energy source or not, because you can not tag the electron with the information of its source. Thus, blockchain was not perceived as a viable solution to verify the provenance of minerals like using third parties, nor does it in itself establish transparent relationships in the supply chain.

On the other hand, we found that companies such as Volvo Cars and Atea have found successful applications of blockchain technology. Whereas Volvo Cars is using blockchain to trace cobalt, which is used in the batteries of its first electric automobile [8], Atea teamed up with IBM to establish a better traceability of fish stemming from Norway.

We were influenced equally in our recommendations by both findings. For the current situation, it appears that blockchain technology is implemented in businesses that depend on the traceability of their products to a higher degree than others. For the fishing industry, blockchain has proven vital due to past incidents of mislabelling and thus, high demands for transparency. Volvo Cars, a leader in sustainable sourcing practices, is likely to have to demonstrate that the cobalt it uses (of which 59% of the global supply originates from the DRC), is responsibly sourced. The application of the technology thus appears to depend on the degree to which the demands for transparency influence the companies' social license to operate. Based on this, the economic costs and difficulties of ensuring the provenance of CMs in IKEA's supply chain do not make the application of blockchain technology currently feasible. Nonetheless, we view it as necessary to observe the technology development and its

potential application to improve the efficiency in supply chain reporting.

Recycling Opportunities

A second option to mitigate the risks connected to CMs is to explore opportunities to recycle or purchase recycled minerals according to our interviewees. Under the current definition of the RMI, recycled 3TG are deemed to be "DRC conflict free". The OECD Guidance defines recycled materials as "reclaimed end-user or post-consumer products, or scrap processed metals". This option is not only crucial for mitigating the risks in the supply chain but also with a view on the finite nature of natural resources and the environmental impacts caused by their extraction. The availability of tin for example is predicted to end by 2033 [9], under current consumption and recycling patterns, which makes it necessary to recycle tin now and in the future.

Our interviewees informed us that recycling practices of 3TG largely depend on the value and quality of the minerals included in the products. For this reason gold, which has a high value on the international market, is commonly reclaimed (30% on a global scale) from components such as circuit boards and reused. Possibilities to recycle tantalum are restricted due to the low material value which results from its recycling. The economic feasibility of recycling the 3Ts is thus dependent on either the economic efficiency of the recycling operations or additional money that purchasing companies are willing to pay. Umicore Hoboken, one of Europe's biggest smelters and refiners, has appeared to have achieved economic efficiency in the recycling of a broad range of materials by the size of its operations. As highlighted by the interviewee the price premium seems to be influenced by the intensity of human labour in e-waste recycling, the lack of information on the materials included in products, and the degree to which a product can be taken apart.

Our recommendations on how IKEA should respond with the recycling of CMs are twofold:

1) they should engage with suppliers through more effective communication, and 2) and redefine product design.

For the communication strategy, the two main messages are that; (1) the suppliers of IKEA should look for alternatives, which include either recycled CMs or start choosing alternatives by purchasing fair-trade certified gold only and (2) the company is willing to pay a little price premium. The rationale for sending out these market signals is based on the belief that as soon as a company, as large as IKEA, publicly announces that its products are to become "conflict-free" a market development could be started. This would be the case, regardless of whether the company has a large electronics branch or not. Suppliers could be motivated to find sources of recycled CMs that are existing.

Image 4: The collection of e-waste ready to

Additionally, in our interview it was discussed how an increase in the demand for recycled CMs could potentially lead to the development of more efficient technologies. This could further lead to recycling infrastructures that lower the price for recycled CMs in the long run, making them financially more attractive.

We found that engaging with suppliers to transform the design of the products is another viable option to meet the challenges described above. To make products more recyclable in the future we found that three main conditions have to be met.

- Products need to contain high enough and purer quantities of minerals to ensure that recycling practices are made feasible.
- Products need to be equipped with tags that contain information on the products' contents. We found that the technology for developing these tags is already available.
- Products need to be designed in ways that make it easy for recyclers to disassemble them.

Image 5: The recycling of mobile phone circuit boards s (Source: Fairphone)

Our Recommendations

Based on the above findings our main recommendations could be summarised as:

- Improving collaborations with both organisations in industry, to improve the traceability of CMs, those on the ground to tackle issues and suppliers
- Integrating inside perspectives between different departments
- Building good relationships with suppliers and cooperating with non-conformities
- Asking for recycled materials/ better options

Conclusion

Tracing CMs in the supply chain remains a complex task for organisations across all industries. However, our research has identified a number of businesses who have made significant progress to address traceability and tackle the detrimental impacts caused as a result of extraction.

For IKEA, opportunities exist for a more robust traceability system to be established. Additionally, technologies within the waste industry have also provided opportunities for recycled CMs to be used in products. The next step would be for IKEA to decide how these can be implemented within their own supply chain. With the increasing demand for electronic equipment, decreasing supply for raw materials and IKEAs own circularity goals, IKEA needs to continue strengthening their sourcing strategy (beyond requirements necessitated by existing regulations) to further their agenda on responsibly sourced conflict minerals.

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Luth Richter, J. Project Manager and Postdoctoral Fellow. International Institute for Industrial Environmental Economics. 22nd October 2020.

Image 6: Gold mining in Uganda (Source: Fairphone)

Energy and Water Efficiency

Oatly

Team Oatly

From left to right: Anna, Michaela and Åke (supervisor).

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Team

Michaela Feiglová is from the Prague, Czech Republic, and holds Bc. in Marketing and PR and Bc. in Liberal Arts. She has experience working in marketing with clients across various industries and is interested in circular economy.

Anna Kracher is from Munich, Germany, and holds a B.A. in Social Sciences. She has experience in climate adaptation and a strong interest in clean technologies as well as urban and energy transitions.

How Efficient is Efficient?

Collecting Cutting-edge Practices to Reduce Water and Energy Consumption in the Liquid Food Processing Industry

By Michaela Feiglová and Anna Kracher

Over the last few years, the global demand for plant-based products has been rapidly increasing. Especially in the dairy field, there has been a shift towards vegan alternatives made of oats, rice, soy, peas, almonds, coconut, etc. Different reasons like health, ethical, environmental considerations as well as societal trends, convince more and more people to opt for plant-based beverages and foods.

The Swedish oat milk manufacturer Oatly is currently facing the challenge to handle the rapidly increasing demand while ensuring sustainable growth. With ambitious sustainability goals, Oatly has been determined to contribute to a transition in the food industry.

In light of production expansion, Oatly is currently looking for solutions to further increase resource efficiency in oat-product manufacturing. The company tasked our team to generate an overview of current and future cutting-edge practices to reduce water and energy consumption. By talking to various companies and industries, we compiled a standardised approach to efficiency and a set of technical and organisational measures to increase efficiency in liquid food processing.

Context

With industrialisation, the usage of natural resources as well as the pollution of the environment drastically increased.

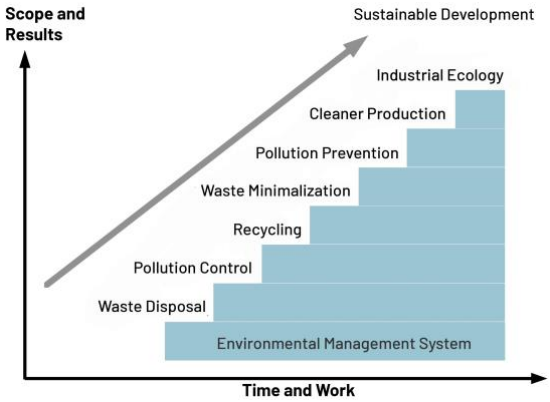

Figure 1: Staircase of concepts of industrial environmental management, adapted [1].

According to the idea "out of sight - out of mind", in the past, waste streams were diluted and dispersed into the environment leading to severe environmental damage. Only later, reactive environmental strategies got into focus. Figure 1 depicts the steps of environmental management in industries. Pollution control through end-of-pipe measures refers to the treatment of e.g. industrial wastewater and flue gases after it has been generated.

With the establishment of the concept of sustainable development in 1987 by the Brundtland Commission, attention towards the limits of environmental tolerance as well as the needs of future generations came into focus. In recent decades, politicians and industries have been increasingly interested in incorporating the "precautionary

principle" into industrial processes to avoid pollution and treatment effort in the first place. The paradigm has shifted from passive environmental strategies based on pollution control towards proactive environmental strategies built on pollution prevention [2].

The concept of *Cleaner Production* is defined as the "continuous application of an integrated preventive environmental strategy to processes, products, and services in order to reduce risks to humans and the environment" [3]. Concerning production, the efficient use of natural resources, like materials, water, and energy, as well as the minimisation of waste and emissions from industries are central issues. The concept of Eco-Efficiency emphasises the economic and competitive advantage of efficiency through efficient usage of resources. Today, resource efficiency is seen in the light of Industrial Ecology. By closing the loop, for example by using the waste from one industry as input for another industry, the demand for virgin resources decreases [2]. Further, the literature has been discussing the concept of a circular economy as a new paradigm shift.

Besides the economic advantages of efficiency, global challenges around resource scarcity as well as the pressure of different stakeholder groups through increased environmental awareness strengthen the debate of preventing pollution through resource efficiency.

A Company with a Mission

One example of seeking for cleaner production and higher efficiency is the Swedish company Oatly. Based on the research of the Swedish professor Rickard Öste at Lund University on turning fibre-rich oats into nutritious liquid food products, Oatly was founded in the 1990s. In 2006, the first production site in Landskrona, Sweden was opened and from then, the expansion of production continued. Today, Oatly produces around 40 products based on oats and is available in more than 20 countries, with the production of 165 million litres of product in 2019 – almost a double compare to previous year [4].

Image 1: Selection of Oatly's products [5].

With the purpose "We exist to make it easy for people to eat better and live healthier lives without recklessly taxing the planet's resources in the process." [6], Oatly wants to be part of a systemic change and sets high sustainability ambitions. Concerning resource efficiency, Oatly has made major achievements to significantly decrease water and energy consumption. To demonstrate, the water consumption declined from 7,5 l/l of product in 2016 to 4,3 l/l of product in 2019 on average at Oatly sites [4].

Image 2: Oatly production site in Landskrona.

While Oatly is globally involved in various projects concerning different aspects of the products' life-cycle, the Oatly site in Landskrona decided to set the scope of this project on the production plant. Although production is only one factor contributing to environmental impacts, Oatly can exercise direct influence as producers over these processes and thus have more opportunities for change.

Approach to Efficiency

Based on our research, we created a set of steps that any company can take in order to become more efficient, no matter how far in the efficiency journey it stands.

Step 1: Understand the Production Process

The task of becoming more efficient starts with having a good overview of all processes involved in the entire production and product's life-cycle. You should have a sufficient level of understanding of what happens in each step of production, including material flows - product, energy, water, and waste. To start, process mapping with material flows and temperatures is useful.

Step 2: Find the Root Causes

Next, the main root causes, meaning the most energy and water-intensive processes in the production should be identified, for example with an Ishikawa diagram. In liquid food processing, these are often processes involving high and low temperatures, such as for heating with steam or cooling with ice water. Concerning water usage, cleaning is commonly most demanding.

Step 3: Identify Opportunities to Intervene

Based on the process flow and the root causes, you can pinpoint the inefficient techniques and sequences and find opportunities to intervene, such as focusing on the appropriate quality of water and energy and identify how to reuse water, energy, and wastewater flows. Another area worth considering might be product loss throughout the process.

Step 4: Measure and Benchmark

In order to identify possibilities for improvement and changes in efficiency, measuring and monitoring are key activities. To begin with, it is fundamental to establish a baseline to which you can compare your developments. You should commence by collecting the most relevant data and gradually add others to avoid overwhelming from the beginning.

From the performance perspective, it is also valuable to determine where your operation stands in comparison to others in the same field. Therefore, it is recommended to collect data both on

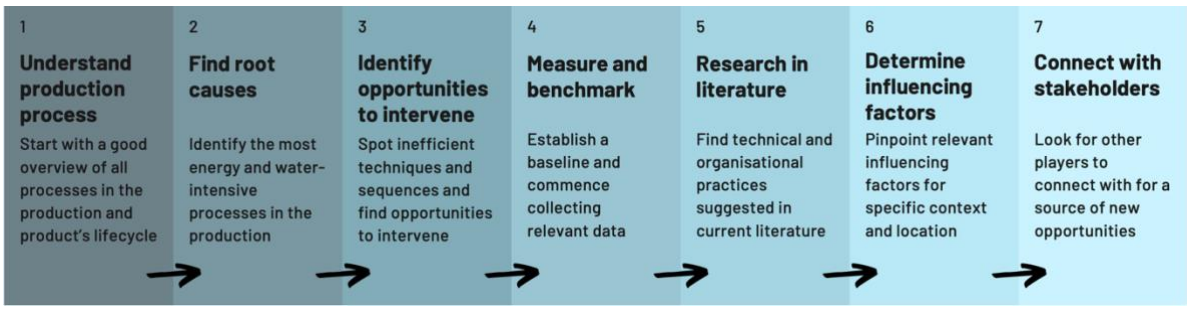

Figure 2: Steps overview.

resource usage and on used techniques, such as monitoring, digitalisation, heat recovery, and recirculation of water and wastewater. In case that there are multiple factories operating under your company, internal benchmarking can also be a driver of increasing efficiency. When comparing such performances, the scope and context of other factories should be considered (see step 6).

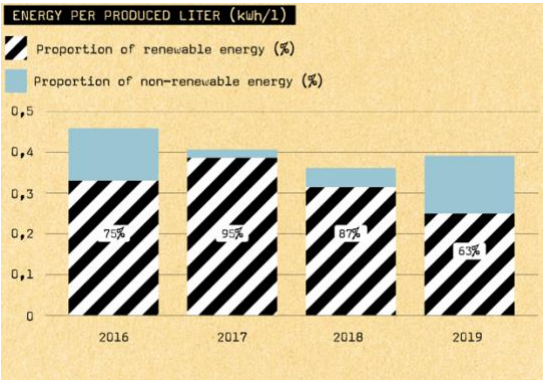

Image 3: Proportion of renewable and non-renewable energy in Oatly's production [4].

Step 5: Research in Literature

Further literature review on what technical and organisational practices are suggested in current literature to increase efficiency is recommended. Among the main sources are BAT (Best available techniques) documents for the liquid food industry, industry-specific magazines, sustainability reports of both competitive companies and other companies within the industry as well as grey literature focusing on technological news and trends. Another source of efficiency measures are academic articles, however, due to long publishing periods, those might not be up to date.

Step 6: Determine Influencing Factors and Trade-offs

When considering the application of selected methods and technologies, the context of the site location should be taken into account. Therefore, the factors that influence such a decision should first be identified. This might for example include overarching factors, like the price and availability of resources in a given location, legislation as well as product-specific factors, like the batch size, the number of products and shelf-life, and plant-specific factors, like the production capacity and plant layout. Decisions might also be different for already existing and new plants.

Other aspects to consider are the trade-offs that are inherent with alternative solutions. For instance, you might decide to clean with higher temperatures to decrease the amount of water. However, the demand for thermal energy increases.

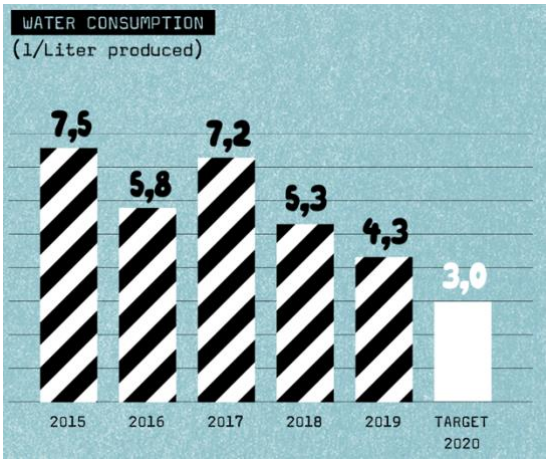

Image 4: Average water consumption used for production at Oatly [4].

Step 7: Connect with Stakeholders

In many cases, connecting with other players such as suppliers might be a source of new opportunities - when bringing forces together, more can be achieved together than alone. There is a wide scale of formats of what this cooperation could look like, from a very local directly connected network, or knowledge sharing across different key

players via initiatives or associations, to more distant trust-based communication with consumers. Such solutions do not increase the efficiency per se but increase the knowledge among different stakeholders, which further encourages efficiency performance.

Recommendations

When going through the steps of the research approach of efficiency for Oatly, at the beginning of our research, we were looking for cutting-edge innovations, which will increase Oatly's water and energy efficiency dramatically. In practice, after talking to various companies within comparable industries and experts in process optimisation, we quickly realised that these great technical innovations are not (yet) available, especially considering the advanced technical standard that Oatly has already implemented. Thus, we focused on generating a holistic set of several smaller but nonetheless important measures. The following measures to increase water and energy efficiency are an excerpt from our research in the liquid food processing industry. Figures 4 give a summary of the most important issues.

Energy Efficiency

The industrial energy system can be divided into two main parts. While energy-rich fuel, like natural gas, is mainly used for heating purposes and to generate steam, electrical energy is required to run machines, like compressors, pumps, and refrigerators.

To *save thermal energy*, on top of efficient combustion and efficient usage of primary energy, some companies use cogeneration units. It functions as a small combined heat and power plant and thus produces heat and electricity at the same time. However, the advantages of this application depend highly on the influencing factors, such as the local price of electricity and fuel.

To *save electric power* and avoid electricity peaks, frequency converters are installed to convert the alternating current of one frequency to the alternating current of another frequency. For the production of ice water, it is common to use ammonia chillers. Alternatively, absorption chillers are able to recover heat from the production process and convert it into cold. This reduces the electricity need as

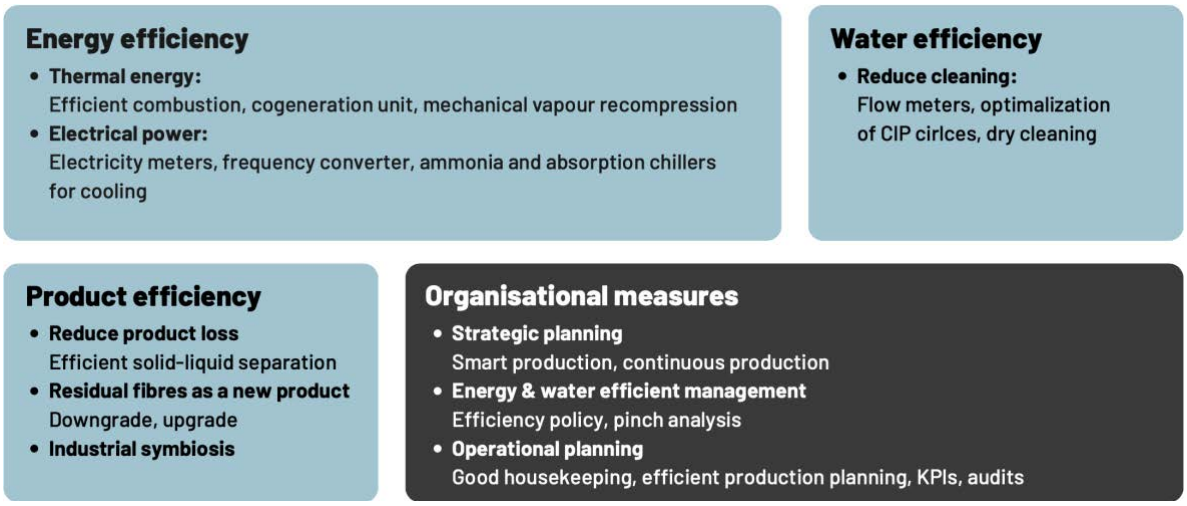

Figure 3: Summary of recommendations.

no compressor is required. However, heating and cooling have to be executed at the same time, or storage is needed.

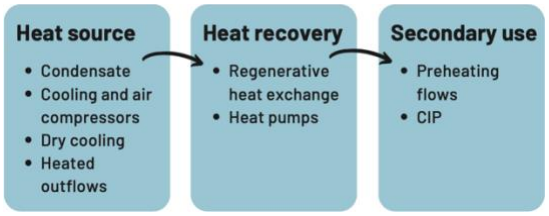

Figure 4: Recirculation of heating & cooling flows.

The *recirculation of heat and cooling flows* (Figure 4) was emphasised often as one of the most important measures. Heat can be recovered from various sources, like condensate, cooling, and air compressors, as well as heated outflows. Depending on the quality of the heat, some streams can be used directly in a regenerative heat exchange to preheat incoming flows. For other streams, the quality can be "re-boosted" by using heat pumps.

Water Efficiency

As discussed earlier with identifying the root causes, cleaning often requires a vast amount of water. In liquid food processing, *Cleaning-In-Place* (CIP), meaning cleaning without dismantling of pipes, vessels, etc., is commonly used. Although the duration of CIP circles is still often determined by experience, it is recommended to automate the continuous optimisation of CIP circles to further reduce water consumption. Hence, turbidity and conductivity sensors can be helpful. Moreover, a pigging system can be used as a *dry cleaning* method, when a cleaning plug (so-called "pig") is pressed through a pipe under pressure by which it scraps down leftovers and pushes them out. Even though it increases resource efficiency, pigging systems remain rather uncommon due to limiting factors, like the high complexity of the design and high costs.

Again, the *recirculation of water and wastewater flows* (Figure 5) depicts an important measure to increase water efficiency. Water can be recovered from different sources, including different cleaning steps, cooling and sealing water, and condensate. Depending on the necessary quality of water, impurities can be removed through pre-treatments, like filtration or an internal purification with *reverse osmosis*. The water can be used in various internal applications like the product itself, CIP pre-rinse and to dilute residual products for transportation.

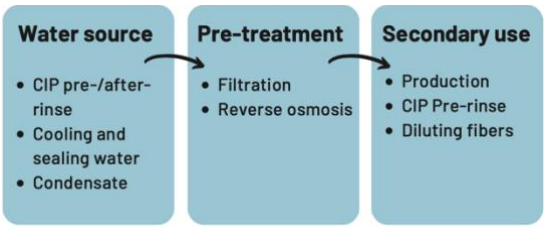

Figure 5: Recirculation of water flows.

Product Efficiency

When talking about energy and water efficiency it is also important to include waste from the perspective of product loss and the further use of by-products. In liquid food processing, a reduction of product loss can be achieved by using a water flow to *push the leftover product* out of the pipes as well as a*n efficient solid-liquid separation*. Concerning the internal reuse of the residual output, the residual fibres can be either upgraded and sold as a new product or downgraded to be used as fuel in form of pellets and biogas.

Industrial symbiosis is about connecting different companies from different industries. While residuals might be seen as waste in one industry, it can be used as raw material for another. Neighbours

within short distance can provide or receive residual materials, heating, and cooling as well as water flows. Although industrial symbiosis does not lead to direct energy and water efficiency, it results in regional efficiency as it prevents the usage of virgin resources within a region. As scarcity of resources like water is and will become a pressing issue in some parts of the world, industrial symbiosis will become more and more important.

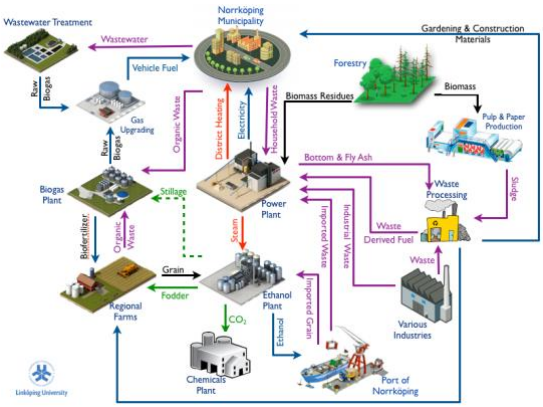

Image 5: Industrial symbiosis [7].

Organisational Measures

From our research, it was clear that organisational measures can highly increase the energy and water performance of a company. However, it was also apparent that this opportunity is often neglected compared to technical measures.

Regarding the long-term perspective, one opportunity to improve water, energy and product efficiency is through *strategic planning*. A smart plant design can for example be achieved by an efficient layout and a design for cleaning. By way of example, using straight pipes and rounded corners reduces the need for cleaning water. Moreover, linear and continuous production lines make efficient production planning easier. Digital applications, such as a digital version of the plant as digital twins, can assist in enhancing strategic planning. Further, *pinch analyses* can be a helpful tool to systematically optimise water and energy use by calculating possible targets for water and heat recovery.

Implementing *energy and water efficiency management* can additionally improve efficiency in the long-term. Defining goals and measures in an efficiency policy, top management involvement in management reviews, assigning responsibilities are part of an effective management system. Information from ISO 14001, 50001, 9001, or EMAS can help in setting up an individual or certified management system. To stay on track regarding future developments, *back casting* and *scenario planning* are valuable tools to spot upcoming trends and technological developments.

Long-term planning and efficiency management should then be complemented by a short-term perspective. *Operational planning* includes good housekeeping, like maintenance and insulation to avoid losses. By identifying appropriate quality (e.g. for water or temperature) for appropriate use, unnecessary waste of water and energy is avoided. With an efficient production plan, you can time the different products to avoid cleaning (e.g. organic before non-organic product).

Continuous improvement from a long-term perspective can be achieved by *ongoing water and energy efficiency management*. Among others, measuring and monitoring water and energy flows are indispensable. Hence, it is important to set, measure and monitor specific Key

Performance Indicators, (KPIs) in regular time intervals. This allows you to be aware of the water and energy flows, react to irregularities, find opportunities to intervene, and benchmark internally and externally. Digitalisation through flow and electricity meters and software for automated evaluation make the process easier. However, as digitalisation also has its flaws, manual checks and understanding should not be neglected. In addition, regular internal audits (e.g. across different departments or production plants) and external audits can act as a reminder of the importance and contribute from an outsider-perspective.

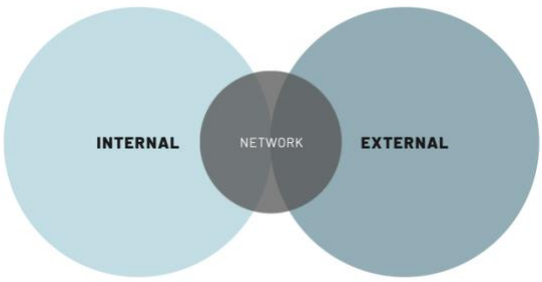

Figure 6: Communication overview.

Furthermore, *communication* is an important organisational measure, which combines the long- and short-term perspectives (Figure 6). On the internal level, knowledge and innovative insights can be shared among different factories. Setting up a knowledge platform keeps everyone updated on current achievements and challenges. On a network level, ideas and experiences can be exchanged with other companies from the same industry. External and transparent communication of efficiency, e.g. as part of a sustainability report, increases the obligation for continuous improvement.

Challenges

Throughout our research, we encountered great interest from the companies we interviewed in efficiency - in both economic and environmental terms. However, companies are also facing several current and future challenges.

It was surprising to learn that a certain level of efficiency can be achieved by small, uncostly measures. The recirculation of heat, cooling as well as water flows, for example, is in the first place rather about efficient planning than about highly, cost-intensive technologies. Nevertheless, it is often due to a lack of time, that easy measures are not implemented. In order to pre-empt this challenge, from the start of planning a new factory, we advise to include current and future efficiency issues iteratively. Assigning the responsibility for efficient production planning, measuring, monitoring, benchmarking, etc. avoids forgetting about these issues and helps to solve the issue of time constraints. This is especially important for rapid expansions if you want to cover increasing demand.

Although we learned that continuous linear production lines with only a few products are water efficient, in practice, various products are often produced at the same line for flexibility in shifting demands and unplanned events. Thus, it is important to be prepared with a strategy on how to properly cope with these situations. The aforementioned technical and organisational measures can help to detect and manage irregularities. On a global scale, another challenge of efficiency comes with the availability of resources. Depending on the country of production there might be a limited

possibility to get water of appropriate quality. The problem of scarcity might even become more pressing and widely spread in the upcoming future due to changes in climate. Further, the possibilities to discharge wastewater and acquire renewable energy are different depending on the region. According to the context of demand and supply, the price or high-quality water might increase the price correspondingly.

Image 6: The team trying Oatly's products.

Conclusions

This project is a great example that despite the search for innovations with cutting-edge results, smaller changes can have significant efficiency results.

To meet the rapid demand, from the very start, it is necessary to include organisational considerations, such as long-term, short-term, and communication measures. An effective organisational setup then assures continuous learning, development, and implementation of technical measures. In light of resource scarcity, efficiency should attain even more attention and importance - with respect to social, environmental, and economic sustainability.

However, there are also limits to efficiency within the production phase. When a certain efficiency standard is reached, it might be time to look outside the factory's gate and influence other, more inefficient life stages of the product. The question "How efficient is efficient?" points toward the question of whether the effort is worthwhile compared to the price to save the last drop. In other words, one should balance environmental impacts and financial expenses when further efforts cost more than they bring in gains.

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List of people interviewed

Andréa Raivander. Environmental Coordinator. Absolut. 23rd Oct 2020.

Anna Lidström. Head of Sustainability. Spendrups. 21st Oct 2020.

Anna Wendler. Project Manager. Spendrups. 7th Oct 2020.

Bert Jan Grootes. Director Global Sustainable Production. Heineken. 22nd Oct 2020.

Caroline Ranelycke. Head of Environment. Oatly. 28th Sep - 3rd Nov 2020

Fredrik Johansson. Consultant. AFRY. 15th Oct 2020

Jonas Lindhe. Business engineer. E.ON. 20th Oct 2020.

Moritz Albus. Environmental Management Officer. Allgäu Milch Käse. 20th Oct 2020.

Marcus Hansson. Performance Driver. Tetra Pak. 14th Oct 2020.

Murat Mirata. Senior Lecturer. Linköping University. 21st Oct 2020.

Peder Roslying. Purchasing and Production Manager. Sia. 14th Oct 2020.

Rudi Van der Arend. Manager Sustainability. FrieslandCampina Ingredients. 15th oct 2020

Sofia Wiktorsson. Systems engineer. Oatly. 28th Sep - 3rd Nov 2020

Tom Lindberg. Project engineer. Oatly. 28th Sep - 3rd Nov 2020

Tobias Lindén. Process engineer. Oatly. 28th Sep - 3rd Nov 2020

Thomas Parker. Co-Founder. WA3RM. 23rd Oct 2020.

Youth Employment and Empowerment

Stockholm+50

Team Stockholm+50

Left to right: Jing, Megan, Dushyant, Rumbidzai and Madeleine.

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The Team

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Madeleine Helms is from Germany and Australia, with a B.A. of Arts in Media and Communication Management. She has gained professional experience in business management, media and communications and is currently an associate in content and communications for a company helping multinational business leaders transform into purpose-driven companies. She's also currently the yoga teacher for Batch 26.

A Future Worth Believing In

Stockholm+50 Conference in 2022

By Rumbidzai Chikowero, Dushyant Manchandia, Megan Kalsman, Jing Lu, & Madeleine Helms

Background

The Stockholm Conference of 1972 was a landmark global conference organised by the Swedish Ministry of the Environment. The conference invited leaders from around the world to participate in a first of its kind international meeting, focusing explicitly on issues related to environment and sustainability. It also kick-started the global movement for environmental cooperation and led to the formation of the United Nations Environment Programme [1]. As we enter the final decade of the Sustainable Development Goals (SDGs), there is a need for revitalisation of a global movement for cooperation between countries within the realm of environment and sustainability to counter the threat of nationalism, climate change, social inequalities and so forth. The need for choosing global cooperation over extinction has never been higher.

Client and Task

The client is the Stockholm+50 Secretariat from within the Swedish Ministry of the Environment. Fifty years following the conference in 1972, an international meeting will be held in Stockholm in 2022 to contribute to the Decade of Action and deliver on achieving the UN SDGs.

The project task was to contribute to the preparations of the Stockholm+50 event through research. The exact scope of this research contribution was kept open by the client. The topic areas of this research contribution were prescribed as SDG #8 (summarized as "employment"), SDG #12 (translated as "sustainable consumption and production") and Youth. A global perspective was imperative to provide input suited to the global ambitions of the future event. As such, it was necessary to give views from a worldwide variety of actors. It is at the intersect of these three topics, as shown in Figure 1 (below), that we began refining our task. The research question we developed is **"What needs to happen to facilitate youth's access to green jobs around the world?"**.

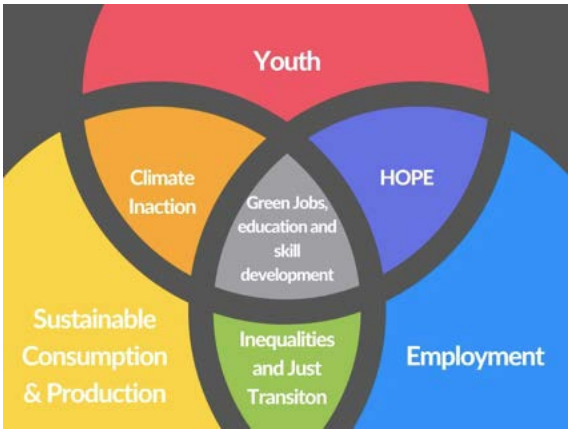

Figure 1: The three focus areas.

Research Approach

Scope and Methods

The time frame for this project is a total of five weeks. The global scope of the project is redirected into a regional one, as we apply the client's previously defined

research structure. These regions are; Europe, North America, Asia, Africa, Central America and the Caribbean, South America, the Middle East, and the Nordics.

Figure 2: Systems mapping exercise.

Recognising that challenges and opportunities are highly contextual for each region, we split regional research among the five group members. With assistance from project supervisor Karolina, each researcher chose three to four countries within the region to conduct desk research on. Our team analysed the research results in a synthesis matrix, which helped to formulate the research question and the following findings. After that, we conducted a system mapping session to further narrow our scope to one significant aspect in each region. Figure 2 (above) shows one of the output images from the systems mapping. Following this, we had two brainstorming sessions to decide what was our intended outcome, with the focus both on the primary issue and the connection of other fundamental problems. From this preliminary research, we narrowed down our focus to the relationship between youth and green jobs.

With our research question defined as *"What needs to happen to facilitate youth's access to green jobs around the world?"*, we conducted an expert roundtable panel, as well as peer-to-peer feedback and progress sessions.

For the purpose of this project, the group uses the following definitions:

Green Jobs: "Work in agricultural, manufacturing, research and development, administrative, and service activities that contribute substantially to preserving or restoring environmental quality"[2].

Youth: "Persons aged 15 to 24 years"[3]

Youth cannot be categorised as a homogenous group, as with any other societal group. Nonetheless, to ensure a manageable scope, it was helpful to organise youth into two extreme and one average group.

The Activists: This group is vocal and highly aware of global problems. They have high expectations from those in places of power, but distrust of those currently in charge. They believe in the acceptance of all groups, regardless of their gender or sexual preference and strive for justice and decent work. Many of them would consider themselves as activists.

The Forgotten: This group lacks freedom of expression and the privilege to choose the type of work they want to do. Education and healthcare are not accessible to all. Many come from regions with conflicts, and hence they demand peace.

The Middle: This group of youth does not fall in the two prior mentioned extreme categories. They may see specific issues as problems (wellbeing, health and safety, climate), but they may not choose to act on them. This group also needs to be included leading up to the event.

Unfortunately, one thing they all have in common is a bleak outlook to the future.

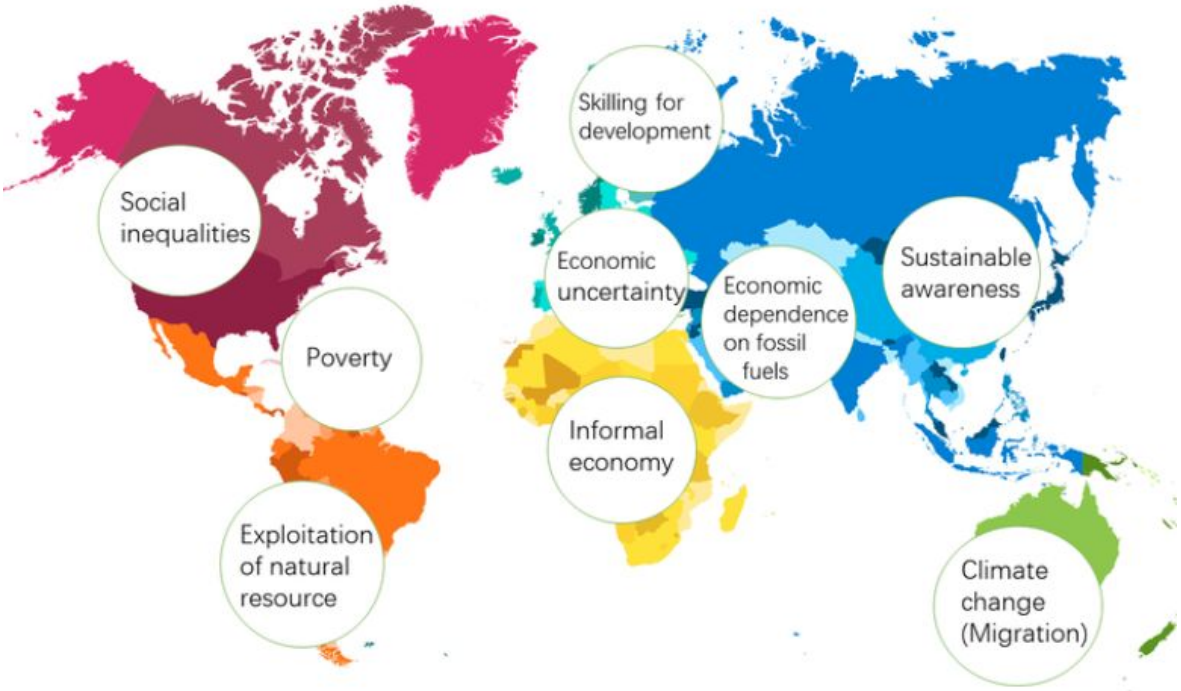

Figure 3: Regional issues around the world.

In tandem with the second round of desk research on the connection between youth and green jobs, we conducted 30+ interviews with experts and youth from various organisations (middle school, high school, and early career young adults) to gain outside and deeper insights.

Findings

In order for us to understand what is inhibiting youth access to green jobs we did extensive research and had interviews with experts from each region to understand the issues and opportunities. These will be presented below.

Nordics

Even with the presence of the welfare state and other complimentary social support schemes, rising unemployment and mental health issues have been growing challenges for the youth in Nordic countries, which have been exacerbated by the COVID-19 pandemic. The issues concerning mental health are further elevated in the youth due to climate inaction, which is a big issue on the minds of the Nordic youth [4]. The pandemic, much like other regions, has worsened the employment conditions in the area.

More youth in the Nordic countries feel that *improper skill development* is inhibiting their prospects into the labour market [5]. Thus the value of vocational training focusing on specific skills for employment has an extremely prominent role to play as a solution to this crisis in the Nordics. Strategic vocational skilling in green sectors can further the goals of the green transition in the Nordics while empowering youth with the means to be a part of the solution to the environmental challenges. This may also alleviate some of

the anxiety that they face with regards to the climate crisis.

Finally, migration has been a major driving force behind the population growth in the Nordic countries in recent years. Of particular notice is the current inflow of asylum seekers during the refugee crisis of 2015. These issues have led to new challenges arising in the region concerning social integration of the accepted people, their integration into labour markets and so forth and require policy interventions for integration to ensure a just green transition [6].

Europe

In the European Union, because of COVID-19, the economy experienced a massive shock. The region is battling a resurgence of COVID-19 infections, border closures, curfews, the tourism and hospitality industry closures are rattling the economy. Nonetheless, the EU may be one of the best equipped places to deal with current *economic uncertainty* status.

Luckily, already before the pandemic, youth in the European Union mostly welcomed the adoption of SDGs and were putting more pressure on businesses and governments to do better. This trend does not seem to be going away. In fact, the majority of young people in the EU see a greener transition, climate protection and economic policy as chances for access to better jobs rather than posing a threat to their current working lives [7]. Below are three suggestions outlining what can be done to support and facilitate a greener transition to give youth more access to green jobs.

Firstly, governments need to use the existing financing schemes to invest in companies that are already doing better and where youth will want to work in future. Secondly, higher levels of education and training needs to be made available so that young people have the skills they need to work in the sustainability sector. Lastly, the renewal of the European economy must provide meaningful youth participation and foster young people's creativity and translate these ideas into concrete policies [8].

Until now, the vision and focus of young people and their quality of life has not been included enough in the European green recovery scheme to combat the economic uncertainty. More work needs to be done to improve the access of green jobs for young people in the European member states.

North America

Across North America (Canada, U.S. and Mexico), *social inequalities* persist throughout society. As the region recovers from the global pandemic, policies and programmes to address systemic inequalities are crucial. Social injustices have been highlighted in 2020, especially in the U.S., with the Black Lives Matter movement and protests against police brutality. Youth in these regions are calling for direct action to improve the current uncertain employment and economic conditions.

In efforts to empower young people in finding green and decent jobs, access to education is key. Income inequality is a major challenge in this region. According to OECD's 2019 global Income Inequality index, North American countries are on the higher end of the spectrum [9]. In particular Mexico and the U.S. are in the top seven countries with the highest income inequality. The huge income disparity directly relates to years of schooling completed as well as quality of education. Lack of quality education then impacts future job prospects, especially in a highly competitive market. The COVID-19

pandemic has brought systemic social inequalities to the spotlight and young people are calling for change. Governments, businesses, and NGOs need to collaborate on policies and programmes to increase access to green and decent jobs in North America.

Asia

Asia is a continent where the countries have distinctive development levels, but in general, there is a *lack of sustainability awareness* among various sectors. However, the Asia-Pacific region is home to more than 60% of the world's youth [10], so the development of this area becomes determinant for the youth.

Most corporations only take passive actions to meet the requirements of regulations, resulting in a very slow green transition. Regarding sustainable production and consumption, many countries (like China, India) are still highly dependent on fossil fuels and their recovery strategies after the pandemic remain carbon and energy intensive [11]. Moreover, with the economic development of Asia, society now consumes much more than basic needs and has little awareness of how their consumption pattern and preference will affect the environment [11].

Furthermore, the education issue and poverty are still pronounced in Asia [12], being sustainable or not is not their primary concern. To tackle these issues, there should be more concrete directions for industries, more incorporation of sustainability in early education and further publicity for the sustainable concept.

South America

South America is a region rich in natural resources, however *the unsustainable exploitation of those natural resources* is an issue for youth access to green jobs. A troubling concern is that in resource-rich developing nations, the illusion of easy access to wealth disincentivizes societies from exploring other, more sustainable sources of income [13].

Despite the region's natural wealth, youth remain vulnerable and in poverty; with lowered social support and a pressure to migrate for opportunities [14]. 107 million South American youth (17% of the population) live in the rural areas and are directly affected by the disruption caused by resource extraction at these societal fringes [15]. Natural resources provide a positive boost to the regional economy, but a persistent challenge is harnessing that positive economic effect in a sustainable and efficient way [16]. Unsustainable resource-use today denies future generations access to those resources, and drives youth today to find any other means of livelihood. Without sustainable businesses, there are no green jobs; meaning companies must be encouraged to be sustainable by governments and consumers [17]. We can also be hopeful that more push towards a greener economy will come from the youth, because they care about climate change, culture and politics [18], incentivising institutions to create greener jobs.

Central America and the Caribbean

Poverty limits development and access to education in Central America and the Caribbean. Chronic poverty, meaning people who are born into poverty and may never escape this status, is a challenge for youth to gain upward mobility in this region [19]. Compounding this issue is that high levels of poverty, corruption and violence deter investors [20], thus inhibiting economic opportunities on a

systemic level. For youth access to green and decent work opportunities, poverty challenges need to be addressed first and foremost.

Employment opportunities which lead to upward mobility in Central America and the Caribbean are scarce. "Global economic shocks coupled with natural disasters left most Caribbean countries with zero to negative growth and high unemployment rates" [21]. Without stable or sufficient economic support, there is little chance for youth to develop the skill set needed for formal employment, which in turn means no access to green jobs. What we see is that "a large share of the labour force is engaged in low-return agricultural activities and many [...] poorly educated rural youth with few skills and poor job prospects cannot thrive due to lack of support in terms of policies, infrastructure, inputs and investment" [22]. Thus, in an environment where standard employment is already a challenge, green jobs that require systemic overhaul, new investments, human capital and revised systemic capacity present a higher challenge for these impoverished regions.

Africa

Africa is the fastest growing continent, with 226 million youth aged 15-24 years old representing 20% of Africa's population and one fifth of the world's youth population [23,24]. The *informal sector* makes up the largest share of African economies, comprising two-thirds of non-agricultural employment in Sub-Saharan Africa [25].

Young people in Africa cannot afford not to work, pushing them to under-employment and a lack of decent working conditions [26]. No real pathways exist, in the form of schooling or opportunities, for youth to access green jobs [27]. Where opportunities do exist for youth regarding green work, barriers to entry such as access to capital, lack of skills, no access to information, and no enabling environments make it difficult for Africa's youth to access the green job opportunities available [28]. The majority of jobs are informal, at the fringes and beyond institutionalised support; whilst national economies rely heavily on the formal sector for economic power [27]. This all presents a challenge for youth. Strategic and fundamental changes are needed for the successful implementation of green jobs in Africa [29]. Enabling African youth's access to green jobs will therefore mean dismantling systemic barriers.

Middle-East

As of 2018, 79.4% of the proven oil reserves of the world were located in the Organization of the Petroleum Exporting Countries (OPEC), with 64.5% of the total being in the Middle-East [30]. Two of the four focus countries for the region (other being Syria and Yemen), Saudi Arabia and Iran, are the second and third respectively in the OPEC group of countries with the highest proven oil reserves [30]. Due to this, *economic dependence on fossil fuels* in the region is extremely high [31]. Thus, a transition away from fossil fuels and economic dependence on them has the potential to create wide-scale employment opportunities in the region both by replacing fossil-fuel jobs with green jobs and creating additional green jobs to facilitate demand. However, prior policy objectives would have to bear in mind the reskilling of existing workers to ensure a just green transition.

Political and social conflicts have also been a defining characteristic of the Middle-East. More than 11 Million people have been displaced from their homes in

Syria alone since 2011, while countless have been injured [32]. The cost of conflict and violence in the region is enormous and has contributed immensely to the region achieving the lowest level of youth engagement [33]. The Conflict has also dented the positive aspirations of the affected countries in achieving the SDGs and has in fact reversed the progress made by many countries such as Yemen [34]. Thus, peace and disarmament in the region would be paramount for the achievement of Agenda 2030 and the SDG's in the Middle-East.

Oceania

Although the Pacific- and Cook Islands are only contributing to about 0.03% of the world's total greenhouse gas emissions, they are experiencing the most damaging *impacts of climate change* such as coastal erosion, coastal flooding and sea-level rise [35].

On the other hand, Australia is one of the most resource and carbon-intensive OECD countries in the world [36]; Australia is also profoundly affected by global warming. In this region, youth is aware of the environmental problems and are unsatisfied with the lack of environmental and climate policies. They do not see their needs and values reflected in the current government or policies.

Now, due to COVID-19 and the global travel restrictions, the largest sector of the most vulnerable states, the tourism industry, has plummeted considerably [37]. Young people and women are most affected by the loss of jobs and income. With fewer resources, to begin with, they are dangerously exposed to tightening financial conditions resulting in a potentially unsustainable debt environment.

The global economic crisis and uncertainty will continue to influence the policy landscape for the foreseeable future. The poor and vulnerable groups have to be considered in rebuilding the economy and there needs to be authentic inclusion of

youth and remote communities into policy making so that more inclusive and green jobs are created.

Recommendations

A Future Worth Believing in

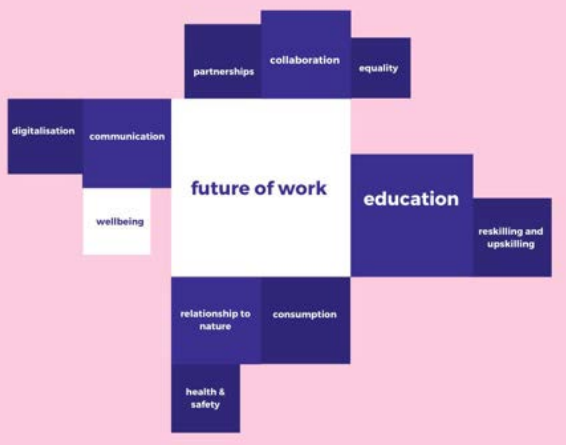

Figure 4: A Future Worth Believing In.

In this section, our focus is to shift from a bleak outlook of the future to a better future for everyone highlighting hope and empathy. Using our research question, and the predefined focus areas of sustainable consumption and production, youth and employment, we suggest an alternative future for education and work from a host of other focus areas. We also put a special spotlight on Youth Empowerment and Engagement as we believe that the power of youth can be harnessed to catapult us into this future worth believing in. Figure 4 illustrates our vision of the future.

Image 1: Children in a classroom.

Education

For education, three forms are vital. First, formal education: the education we get from school is the primary way for youth to gain knowledge and build up a basic understanding of the world. It is crucial to guarantee equal access, to incorporate creativity building and also adapt it to this digital world.

But beyond school, non-formal education like community programmes and informal education like the learning process in daily lives are also indispensable [12]. They empower youth with skills like problem-solving, self-management, working with people, and technology use and development, which are of great importance to prepare youth for their future work [38].

Moreover, education that inspires people from different disciplines to create a better future is also important. Equipping people from different backgrounds with sustainable knowledge and skills can remove the fear that the green transition will take away jobs, since the 21st century would be marked by a sustainable economy, so all the jobs in future will be green jobs.

Future of Work

There is a growing movement and demand for business to start tackling global challenges and meet new needs. Especially youth want to have access to jobs that have a greater focus on people and the planet. The pandemic has been a catalyst for change in sustainability and highlighted the enormous impact businesses with purpose can have on society when they look beyond short-term profits [39].

There is also a movement on the rise called the rise of the "fourth sector" or the "purpose-driven sector" [40]. It is a sector that helps companies act with purpose-over profit-first. These organisations measure themselves by the purpose they deliver to society and the planet whilst maintaining economic viability. It puts purpose at the core of its business strategy, aiming to distribute value to all stakeholders. They show more trust, transparency and accountability towards their business activities.

Especially the younger generations want more access to businesses that do good things for society, while treating their employees well and empowering them to be part of the solution towards the green transition. It is up to governments and civil society to help consumers and people understand which business to support that are authentically doing the work to support a future we want. There needs to be more tools and communication strategies to help cut through the noise and give society the tools they need to make better decisions and judgements.

These are some example purpose driven companies with their special initiatives.

- Ikea, People and the Planet Positive Strategy & Ikea Foundation, Sweden

- Danone, Enterprise à mission, France
- DT Group of Companies (DTGC), DTGC Foundation, Thailand
- Mahindra Group, Rise for Good, India

Youth Empowerment and Engagement

Youth's participation is important in all aspects of society, for example, they can be a creative force and a dynamic source of innovations, but their role in decision making and policy making is very limited, which is especially true in countries where their politics are less democratic and in low income areas where the youth's voices are not easily being heard. Youth should be encouraged and supported to have both formal and informal engagement in political participation [10].

Firstly, it is important to foster an enabling environment in the legal framework, policies and plans that youth can participate in a broader sense, for example, the electoral and parliamentary processes, public administration and local governance. In that way, policies that respond to the specific needs of younger generations can be developed. Furthermore, the youth should also be fed with necessary skills, capacity and knowledge to participate in a meaningful way at all levels [41]: express their voices more effectively, build relationships with political leaders, and break down sociocultural and institutional barriers to participation. There are many existing programmes doing this, like Youth Political Participation Programming Guide; Youth Leading Debate; Youth Empowerment.

More importantly, there are the youth who have less willingness to participate, or their voices are hard to reach, then there should be more proactive methods to engage their opinions. One example could be the Youth listening tour in Australia: the organisation leads a nationwide consultation tour every year to discover issues that are most critical to youth. Their findings are presented at the United Nations General Assembly and to Australian policymakers.

Suggestions for Youth Engagement at the Stockholm+50 Conference, 2022

Youth participation needs to be much more visible from the beginning of the planning of the Stockholm+50 event. Below are some suggestions the Swedish Ministry of the Environment could follow to foster more meaningful and authentic youth engagement. The following suggestions are accumulated from discussions with the interviewees, current IIIEE students and our team's own ideas.

Before Stockholm+50:

- Engage with multiple stakeholders who deal with youth: schools, civil society, business foundations, municipalities.
- Collaborating and communicating with youth: challenges and hackathons, social media engagement, workshops, listening tours.
- Listening to youth: recording videos, audio, surveys on what youth cares about.

During Stockholm+50:

- Strategy sessions where youth participates in idea creation and milestone setting towards a better, more inclusive and sustainable future.
- Ensure youth is represented at the event and has opportunities to engage with governments, business and civil society.

- Case studies of youth initiatives around the world. Examples of organisations which help young people gain access to green and decent work.

After Stockholm+50:

- Institutionalise youth participation in all future communication and meetings.
- Foster actionable outcomes, long as well as short term goals and milestone setting for youth.
- Communicate milestones around the world to all youth stakeholders and adapt them to local challenges and opportunities so each member of society can participate in building a better future.
- Celebrate the small victories.

Conclusions

With the rise of knowledge and discourse around climate change and other key sustainability challenges, there is a call for a stronger push for global cooperation to deal with the challenges we face in the achievement of the UN SDGs by 2030. While we focus on achieving the goals, the focus on the idea of a just transition is more prominent and relevant than ever as was also shown in our research. Most regions in the world are still too far off from achieving the SDGs not merely due to lack of political inaction, but due to existing social challenges such as social inequalities, racism, gender inequalities and so forth. Thus, there is a need for stronger global cooperation to make this just transition happen, which also requires us to be imaginative and think beyond the conventional. Such has been our vision for the Stockholm+50 conference, to go beyond the existing norms to start a new movement of internationalism much like its predecessor was able to do 50 years ago. Through the purposes of this report, we have tried to incorporate the ideals of cooperation by first identifying the systemic barriers for green jobs which can be used for agenda-setting of the conference and secondly, by envisioning the vision of a hopeful future to shift the narrative away from doom and gloom. We have also identified specific areas where youth can be further integrated into the Stockholm+50 conference to create meaningful collaborative outcomes.

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Ana Carolina Avzaradel Szklo, Sustainability Manager, Humanize Institute, 22 October 2020. R. Chikowero, Interviewer.

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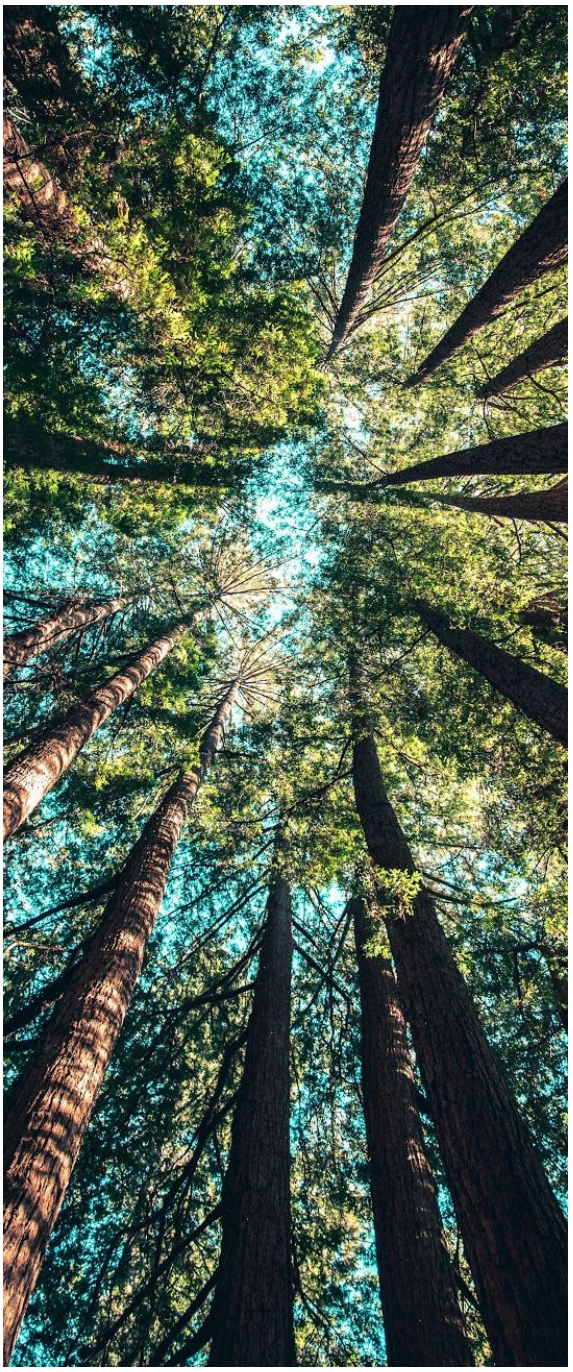

Image 2: Tree canopy.

Driven by Sustainability

Volvo Penta

Volvo Penta: One Client, Two Projects

From left to right: Linh, Cynthia, László, Niklas (Volvo Penta), Philip (supervisor), Tobias, Lisa (supervisor), Rowan and Johan.

Volvo Penta, a subsidiary of the Volvo Group, give us two substantial, and quite different tasks. Two groups took up the challenge, one *benchmarking best practices for CO_2 targeting* (Team Volvo Penta CO_2) and the other proposing *a framework for assessing new projects and business investments in terms of sustainability* (Team Volvo Penta SDGs). The individual reports are presented on the following pages.

The Client

Volvo Penta is a Swedish based business supplier of industrial and marine applications to several industries across the globe. In the marine segment they offer engines, propulsion systems and drive systems for professional and recreational users. The industrial on-land segment covers off-road engines (including drive systems for construction, forestry and agriculture) and power generation (both prime and back-up). Following current global trends, both Volvo Group and Volvo Penta have focused their new business opportunities on three focus areas: electromobility, automation and connectivity.

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Team Volvo Penta SDG

From top to bottom: Johan, Rowan and Cynthia in a typical group meeting.

The Team

Cynthia Coulombe is from Québec, Canada and holds a bachelor's degree in Industrial Relations from the University of Montréal. After graduating, she worked as a Human Resource Administrator at IKEA in Québec. Cynthia is especially interested in bridging both social and environmental fields which is highly relevant when working with the SDGs.

Rowan Drury is originally from England but has lived in Sweden for the past 11 years. In 2016 she founded Sweden's first "package-free" grocery store in Malmö, which aims to provide a more sustainable, resource efficient way of buying food. Rowan has a background in copywriting and marketing. She is interested in bringing together the fields of communication and environmental management.

Johan Jacobsson is from Sweden and holds a bachelor's degree in Political Science from the University of Gothenburg. Apart from his bachelors he has also undertaken courses in business administration, environmental law and Geographical Information Systems. Johan is particularly interested in how incumbent firms can incorporate sustainability into their business model and value proposition.

Operationalising the SDGs

A Framework for Including Sustainability in the Prioritisation of New Business Projects

By Cynthia Coulombe, Rowan Drury and Johan Jacobsson

The Task

Today Volvo Penta's business decisions are based on three main criteria: legal compliance, profitability and brand image. However, due to stakeholder sustainability demands to go beyond legal compliance, they want to explore how the company can go beyond these aspects by incorporating sustainability as a decision criterion. The given task was therefore formulated as follows:

1. Investigate best practices in describing and assessing societal value;
2. Propose a pragmatic framework rooted in the United Nations Sustainable Development Goals (SDGs) [1], for how to assess new projects and other investments from a societal value perspective.

In recognition of this twofold assignment, these tasks have been translated into an exploration of how companies like Volvo Penta can use the concept of sustainability, operationalised by the SDGs, to make concrete business decisions.

The first part of the task involved looking at different companies from various industries and articles citing best practice organisations when it comes to applying the SDGs. More will be discussed in the approach section.

While early discussions with Volvo Penta were based on the term *societal value*, a wider term was formulated to direct attention to both positive and negative impacts. Therefore, we chose the term *sustainable impact* which we defined as "the additional positive or negative impacts of the operations in terms of economic, social and environmental aspects" (see Box 1). As requested by Volvo Penta, this term would be rooted in the framework of the UN SDGs to help them understand how it relates to broader project value and sustainability.

Additionality: A measure of the benefits generated by the projects compared to the status quo scenario.

Sustainable: Includes all the triple bottom line aspects (environmental, societal and economic).

Impact: Implies that a company and project can have both negative and positive effects.

Box 1: Three important terms in sustainable impact.

For the second part of the task, Volvo Penta requested that the proposed tool should be pragmatic, easy to use and adaptable to different product segments. Besides this, the task was open since this project represents one of the first steps for Volvo Penta to incorporate sustainability and the SDGs into their business decisions. In order to provide illustrative examples that can

yield comparable and quantifiable results, creation of an Excel prioritisation tool was chosen as the most suitable path. In addition to the tool, we were asked to motivate why it makes sense from a business perspective to incorporate sustainability in a company's business model.

The Project Portfolio Management

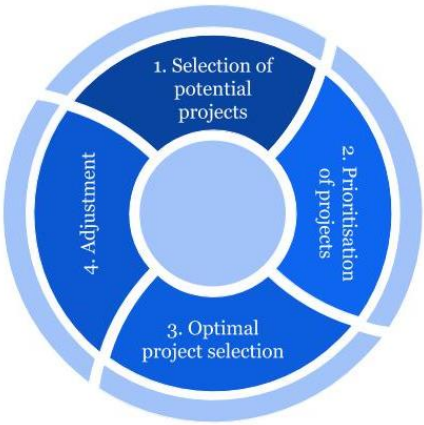


Figure 1: Typical four step process for project portfolio management [2].

The current project management process at Volvo Penta is done on a yearly cycle (called the *strategy clock*) and conducted by three product strategy managers, as seen in Figure 1. During the first phase, they carry out four workshops (future trends, feature strategy, competitor review and profitability and volume analysis workshops) with other departments, which is followed by a gross list of potential projects. Then, they spend a few months creating a priority listing of the potential projects. To conduct this prioritisation, they would typically look at the level of profitability, the impact on their brand image and if they are meeting emission legislation. This is where this task comes in – adding another layer by having sustainable impact integrated in this process. After the optimal selection of the projects is done, the final budget is decided on, and projects are adjusted according each of their allocated resources. Then they start preparing for the implementation of the projects for the following year.

What is the Value for Volvo Penta?

Incorporating sustainability into business is imperative since the two biggest barriers companies need to overcome to achieve change are the lack of a business case for SDG impact and a missing link between the SDGs, the business strategy and product portfolio management [3]. There is a growing pressure on all industries from various stakeholders such as customers, government, investors and their supply chain for them to integrate sustainability into their core business. Companies that proactively respond to this pressure can reap several benefits, which can be seen in the four dimensions of Figure 2.

By integrating sustainable impact and adopting a strong sustainability strategy, Volvo Penta could benefit from:

1. *Increased revenue*: Identifying underserved social/environmental needs can strengthen work towards new business models and technologies, thus opening up to new markets and sales [4].

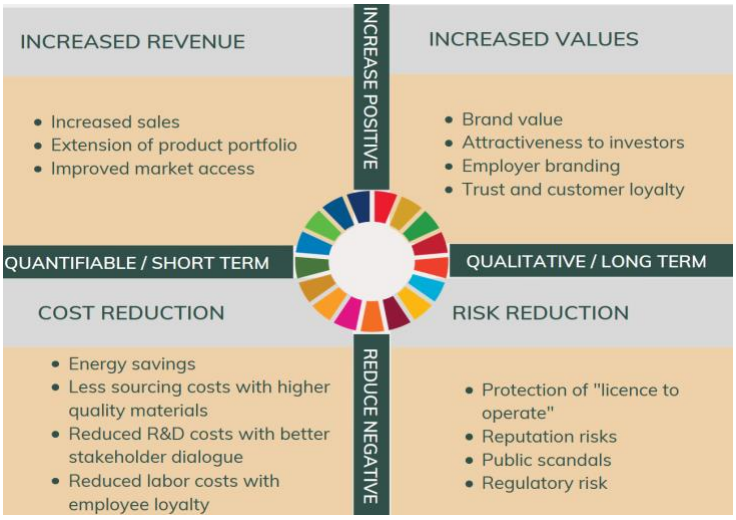


Figure 2: Four dimensions of how businesses can generate value by integrating sustainability [3].

2. *Cost reduction*: Stronger company ability to attract, engage and retain talent, thus decreasing labour associated costs [4]. This is especially relevant when it comes to Millennials.
3. *Increased value*: Aligning practices with Environmental, Social and Governance (ESG) criteria leads to an increased access to financing, especially when it comes to investors that consider ESG as significant criteria in their investment decisions (e.g. BlackRock) [3].
4. *Risk reduction*: By engaging with the SDGs and assessing sustainable impact, the company is likely to profit from anticipating upcoming policies and protect their social licence to operate [3].

In summary, operational sustainability strategies linked to business opportunities strengthens company's capacity to remain profitable and relevant for the coming decades.

The Approach

A suite of tools and approaches guided the materialisation of our solution.

The research phase was two-fold. The first stage was desktop research of existing tools and studies on mapping sustainability and the SDGs from private organisations, academia and tools in the public realm. The findings were compiled in a synthesis matrix. The second phase involved a series of interviews and discussions with both internal experts from Volvo Penta and external consultants to test and validate the tool.

Industry

A review of different companies from various sectors showed that most companies work with the SDGs at a strategic level and as a communication tool rather than using non-financial values to guide specific investment decisions for product development. However, one standout example of using sustainable impact to assess projects was the German chemical company, BASF. They categorise projects, after financial and legal

requirements are met, by their sustainability contribution level and then invest a predetermined percentage of resources to projects categorised as "accelerating" their sustainability agenda [5].

Tools in the Public Realm

There are a number of tools and methodologies available in the public realm. These are published by both non-profit and private organisations and offer a way of incorporating and measuring sustainable impact and the SDGs. The level of complexity of these tools varies from simple two-by-two matrices to in-depth analyses of value chains and production processes. A

suite of tools was found to be of particular relevance to the context of this project which includes the SDG Compass [6], the SDG Impact Assessment Tool [7] and the Impact Management Project [8].

Academia

There is growing literature on the topic of how businesses can incorporate non-financial values in their decision-making and project progress management. In short, it suggests that companies should apply systematic and transparent approaches to choose which sustainability topics/SDGs are relevant for them and establish tracking metrics along with a methodology for evaluation. A paper found to be particularly applicable since it had a very similar objective to this project was the 'SDG-Check' tool. It evaluates the potential effects an innovation could have with regards to the 17 SDGs and targets [9].

Interviews & Dialogue

A roundtable session was held with two industry experts (investment and polymer engineering sectors) convened during our project provided a more in-depth view of industry practices. To get more insight on how to approach the task, expertise was sought from a sustainability consultant. Additionally, semi-structured interviews with the potential internal users of the tool at Volvo Penta were held to seek feedback on the task.

The Proposed Prioritisation Tool

The criteria-based matrix prioritisation method was chosen due to its main purpose of helping to sort projects in order of importance through scoring based on agreed criteria [10]. It also corresponds to the usability criteria of the tool as discussed with the Volvo Penta team. The following paragraphs present the six step process of developing the tool, as shown in Figure 3.

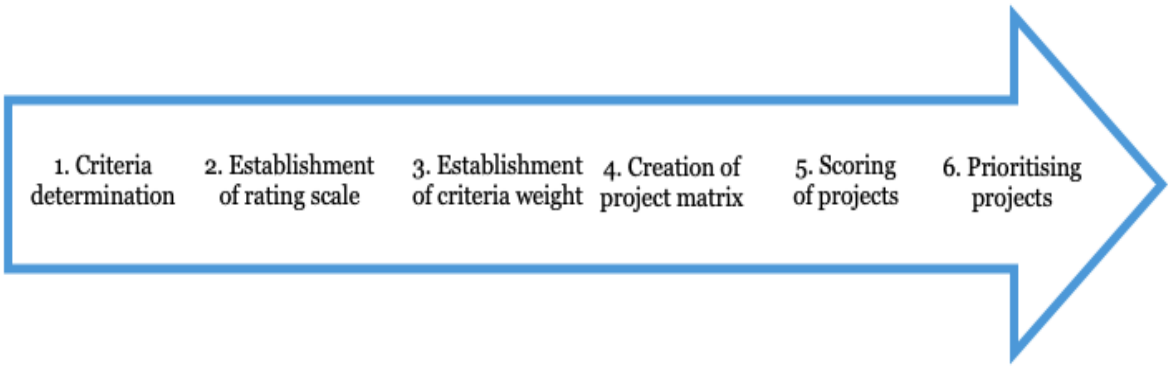


Figure 3: Steps in criteria-based matrix prioritisation [10].

1. Criteria Determination

This step involves determining the key factors/criteria to be used in the assessment of the importance of each project [10]. The conceptual foundation for the criteria is the Triple Bottom Line and the SDG framework. The former is an accounting framework that incorporates sustainability by measuring the impact of an organisation's activities on the three dimensions social, environmental and economic capital [11]. This framework was used to better understand the SDGs by separating them into these three categories of impact. The latter is deemed considerably applicable for this project context because it is a social value charter for the planet, and it is a widely known framework that provides a universal language when talking about sustainability making it easier to communicate with. During our interview with a sustainability consultant, it was proposed that the SDG analysis should be done at the target-level rather than the goal level. To make it less burdensome for the users of the tool, a preselection of targets was carried out by classifying all 169 SDG targets in three categories according to a traffic light categorisation:

- *Green*: Applicable; very relevant for Volvo Penta since they have a high potential to impact the SDG target (direct impact);
- *Yellow*: Potentially applicable; Volvo Penta could potentially impact this SDG target in an indirect way (e.g. through their customers' customers);
- *Red*: Not applicable; the target does not appear to be relevant for Volvo Penta's activities.

Only the 'green' and 'yellow' targets were incorporated into the tool, which represents 63 targets.

2. Establishment of a Rating Scale

The rating scale is based on two main dimensions, inspired by the lead researcher of the methodology of the Project Drawdown [12].

- Direction of impact, which includes whether the project has a positive impact on achieving the target identified by the SDG framework or a negative impact; and
- Magnitude of impact (major, moderate and minor) of the project on SDG target achievement.

Thus, the final rating scale is a seven-point ordinal scale ranging from +3 to -3, as seen in Figure 4. A zero would mean the project has no impact, that more knowledge is needed or that it is simply not applicable.

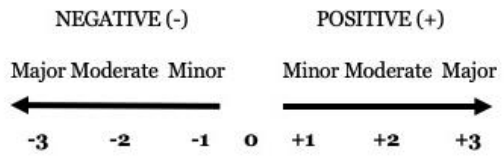


Figure 4: Seven-point rating scale.

3. Establishment of Criteria Weight

Since not all SDGs are equally important for Volvo Penta and some are more relevant than others, they were attributed different weights. To conduct this step, the SDGs were prioritised into three categories: high, medium or low impact depending on the degree of potential impact on each goal Volvo Penta is deemed to have, based on our own judgement (Figure 5). In addition, the SDGs identified relevant by the Volvo Group [13] and other external sources for the transportation industry [14] or specifically for OEMs in transportation sector [15] were used in the categorisation.

Figure 5: Prioritisation of the SDGs for Volvo Penta presented in the context of the Triple Bottom Line.

4. Creation of Project Matrix

The fourth step involved creating the project matrix to clearly show which projects have the highest scores and which should be chosen as a top priority. This matrix was done in Excel, as seen in Figure 6.

		Projects			
			Project 1:	Project 2:	Project 3:
	Criteria	*Description of the projects:*			
		Baseline scenario:			
ENVIRONMENTAL SUSTAINABILITY	6	Total target rating	0	0	0
		SDG weight (medium)	2	2	2
		Total score	0	0	0
	14	Total target rating	0	0	0
		SDG weight (high)	3	3	3
		Total score	0	0	0
	15	Total target rating	0	0	0
		SDG weight (low)	1	1	1
		Total score	0	0	0

Figure 6: Snapshot of the prioritisation tool in Excel.

5. Scoring of Projects

Due to the normative nature of comparing the importance of different SDGs, so-called panel methods applied by lifecycle assessment practitioners can be used for the scoring process of each project. By using a panel of experts from different fields, different perspectives on the potential impacts can be captured. Ideally, this expert panel group should be odd numbered in case there is difficulty in reaching consensus. This is especially relevant for the following step where there should be a vote to determine the final priority project.

The scoring for each SDG is done by multiplying the individual rating criterion by its weight to get a weighted score:

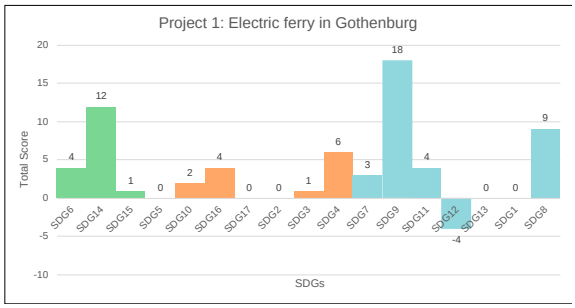
- SDG rating x weight.

After the evaluation of the project against all SDGs is done, the sum of the weighted score will determine each project's total cumulative sustainable impact score:

- ∑ (SDG rating x weight).

6. Prioritising Projects

The final step involves comparing each project's total scores in order to select the ones that will be included in the final portfolio. A waterfall type diagram is generated for each project for the purpose of communicating an overall view of the rating as seen in Graph 1. It is important to note that the prioritisation matrix is just a tool and that the expert panel group involved use their best judgement and may decide that a project is less or more of a priority despite the tool's final score. These adjustments are expected to help fine-tune the priority list.



Graph 1: Final graph of scoring results in the tool.

Once there was a working prototype of the tool, it was tested ex-post using information from three existing Volvo Penta projects derived from publicly available information. Several assumptions were

made due to the absence of detailed information on supply chains, materiality, and so forth. However, it was a valuable exercise to see where improvements needed to be made and how the tool would work when comparing several projects.

Lessons Learnt

When developing the prioritisation tool, it became evident from the start the challenges associated with trying to operationalise a complex framework such as the SDGs. Many of the difficulties we encountered are not specific to Volvo Penta but are, as discovered during the research phase and the roundtable, difficulties that multiple organisations have come across.

As seen in the steps to develop the tool, the identification of criteria is an important part. In Ghana's climate change prioritisation tool, the criteria identified was based on clear priority investment areas for projects (e.g. impact potential, sustainable development potential, etc.) [10]. In Volvo Penta's case, these priority investment areas for projects with regards to sustainability have not yet been identified. By not having this, it made the SDG selection less representative and strategic for Volvo Penta.

On a practical level, there can be trade-offs between comprehensiveness and simplicity. It is a challenge to ensure the prioritisation tool uses all SDGs to gain an overall view of the potential positive and negative impacts while balancing it with making the tool less burdensome for users. This is especially relevant for a company like Volvo Penta that has activities in very different sectors with diverging customer segments for which the relevant SDGs might differ significantly. For example, SDG 2 Zero Hunger might be relevant for a project involving an engine in an agricultural machine but may not be relevant for a leisure yacht engine.

On the same note, in order to allow a clear comparison and ranking of different projects, it is better to have a quantifiable result which makes it easier for the user, but it risks reducing granularity particularly when trying to quantify sustainable impact.

Explicitly defining and understanding these challenges and their meaning led to the creation of a more comprehensive prioritisation tool. Understanding them will serve as the foundation for the future improvements brought to the prioritisation tool.

Recommendations

Several recommendations for the short- and long-term were made to Volvo Penta next steps in the process of integrating sustainability in their business and the tool into their project prioritisation process. These suggestions were structured along the SDG Compass five step process for companies to integrate the SDGs into their business practices, as seen in Figure 6. The main task of the assigned project aligns more with the fourth step of this process. Therefore, in order to truly maximise the company's contribution to the SDGs and the value they get out of the tool, a recommendation is to focus on the previous steps of this process as well, described fully in the following paragraphs.

Figure 6: Five step recommendations for Volvo Penta to maximise their contribution to the SDGs [16].

Understanding the SDGs

A first step in moving forward in working with the SDGs and the tool is for the team to become familiar with the overlap of Volvo Penta's projects with the SDGs and how a tool can capture the relevance and areas of applicability. The ex-post evaluation of a number of Volvo Penta's projects along with richer data sets of materiality assessments will provide the personnel with a common understanding of the processes and will ensure a clear comprehension of the criteria and their meaning [10].

Getting a deeper understanding of the SDG framework and what it means for Volvo Penta is crucial to be able to move on to the next steps. An external sustainability consultant could run an SDG workshop for the relevant people to provide them with valuable knowledge and a holistic picture of the impacts the company has, which will maximise the value of engaging in such activities.

Define Priorities

In the medium-term, in order for Volvo Penta to define priorities based on an assessment of their positive, negative, current and potential impacts on sustainability [16], a materiality analysis specific to the subsidiary company should be conducted. By considering what is important for the organisation and the relevant stakeholders, it will enable the company to align with their stakeholders' views and get a broad understanding of their sustainability challenges.

If Volvo Penta is serious about apprehending how their products influence the surrounding environment, then investigating the social and environmental impacts of each product is a logical way of achieving this general overview.

Setting Goals

Building off the identified priorities, setting specific, measurable and time-bound sustainability goals is critical to give a direction of where the firm wants to be and help foster shared priorities across the organisation [16]. The advice given to companies is to set goals that cover all the defined priorities across the economic, social and environmental aspects of sustainable development [16]. This alignment will help Volvo Penta set more meaningful goals and will help

communicate more effectively their commitment to the global agenda. The company should also define the level of ambition regarding goals depending on the position they want to adopt compared to others in the industry.

Integrating Sustainability

In the long-term, when Volvo Penta becomes more confident with the previous steps, the next milestone could be adopting an approach coined as 'Designing for Sustainability' meaning that the company takes a social and/or environmental lens in the innovation process with the objective of increasing the positive SDG impact of the company while at the same time capturing new business opportunities [3]. This practice was adopted by the Deutsche Post DHL who designed for cleaner cities and improved working conditions leading to the innovation of StreetScooter [3]. The associated business value for the postal company was a reduced risk of losing access to cities due to stricter environmental regulations; reduced costs due to tax savings and lower maintenance costs; and an increased intangible value through improved working conditions and positive perception by customers and the public [16].

For Volvo Penta, this approach can be done by using the identified challenges and defined goals as a starting point for developing projects rather than taking a developed project proposal and assessing how it fits into the goals.

Communicating

When Volvo Penta is ready to go public on their sustainability efforts, it is strongly suggested to be transparent which will have the effect of enhancing the company's brand value and reputation.

Final Remarks

Through our interviews with the potential tool users at Volvo Penta, there was a considerable willingness and openness to adopt an approach such as the delineated by this analysis and the tool. The recommendations have also been well received and, if followed through, will bring added value to the way they prioritise projects in the future.

As Volvo Penta is currently at a stage where they are just at the start of incorporating sustainability above and beyond legislation, there is huge potential for them to develop this area and to take it to the next level. Even if there is less pressure at the moment on manufacturers higher in the value chain than those directly interacting with customers, there will however be an increasing pressure on them since sustainability sits higher and higher on the global agenda and they are part of a bigger value chain. By acting proactively to this arising trend, Volvo Penta can still react in time and come out as a forerunner.

Perhaps the most significant contribution to Volvo Penta from this project and its outputs has been to show how sustainability can be considered wider than only focusing on climate change and emission legislation. Throughout the project, it has been demonstrated that there are ways of mapping both positive and negative impacts on society, and that projects and pathways can be adjusted to maximise the positive sustainable impact. Overall, this project has shown that this not only makes sense from a moral perspective, but also from a strictly business perspective.

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List of people interviewed:

Cecilia Rosenqvist-Witte, Strategy Manager for Marine Commercial at Volvo Penta, 22nd October 2020.

Cecilia Johansson, Environmental Director at Volvo Penta, 22nd October 2020.

Hanna Bremander - Sustainability Consultant at TomorrowToday, 19th October 2020.

Ibrahim Sánchez Gomez, ESG Corporate Rating Analyst at International Shareholder Services, 21st October 2020.

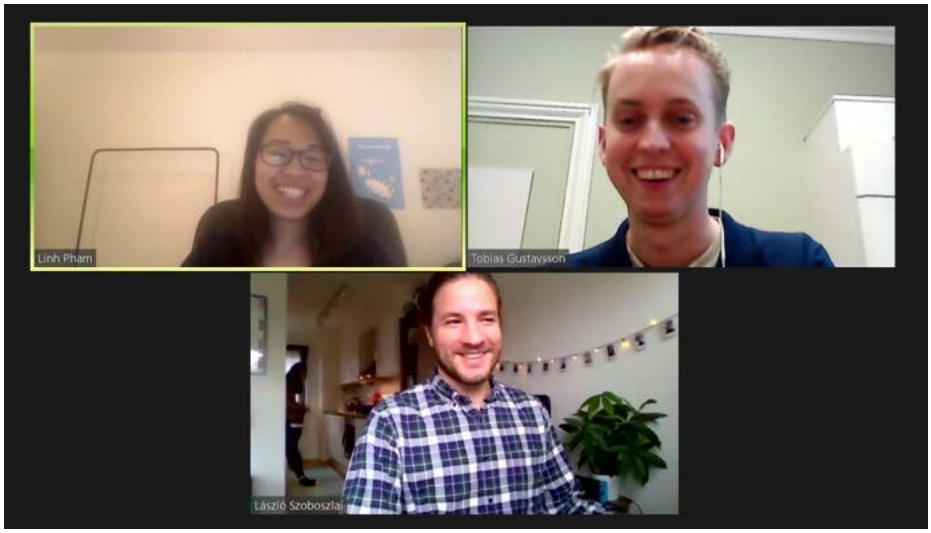
Ida Sparrefors, Business Models & Strategy, Sustainability at Volvo Penta, 22nd October 2020.

Irina Lioufko, Strategy Manager for Industrial at Volvo Penta, 22nd October 2020.

Linda Bergö, Strategy Manager for Marine Leisure at Volvo Penta, 22nd October 2020.

Rosman Jahja, Vice President Corporate Responsibility at Trelleborg AB, 21st October 2020.

Team Volvo Penta CO_2



From top to bottom: Linh, Tobias and László in a typical group meeting.

The Team

Tobias Gustavsson is from Sweden and holds a Bachelor's degree in History and Human Geography. He has a background as Political Advisor to the Swedish Minister of the Environment and he is particularly interested in environmental issues related to traffic and transportation, and how it can be solved from both the perspectives of policy, infrastructure and businesses.

Linh Pham is from Vietnam and holds a Bachelor's degree in International Business from Haaga-Helia University of Applied Sciences. She has a background as a business consultancy for Foreign Direct Investment companies in the Vietnam market, and took part in several projects in the sustainability area during her bachelor study. Linh is interested in material, water and energy efficiency and circular economy business models.

László Szoboszlai is a Canadian, Hungarian and Romanian and holds a Bachelor's degree in Geography and Environmental Management as well as an Advanced Diploma in Sustainable Energy and Building Technology. He has a background as an energy efficiency and environmental management consultant. László is interested in how industries can find more circular means of production, decoupling growth from environmental degradation.

Power Up to Lower Climate Impact

Best Practices for Targeting and Reducing Use-Phase Emissions for Tier 1 Companies in an Energy Intensive Sector

By Tobias Gustavsson, Linh Pham, and László Szoboszlai

The Paris Agreement demands businesses as well as governments to step up their climate ambitions. If we are to keep the global temperature increase below 2 °C, the importance of actions by companies cannot be overstated. As a measure to support this, the Science-Based Target Initiative (SBTi) was jointly developed by WWF, UN Global Compact, World Resources Institute and Carbon Disclosure Project (CDP) after the adoption of the Paris Agreement in 2015. SBTi offers companies a framework for challenging themselves to set and fulfil climate targets in line with the Paris Agreement.

The Task at Hand

This project was requested by Volvo Penta who sought guidance on how they can use Science-Based Targets or similar to target Greenhouse Gas (GHG) emissions in their value chain. Given the business nature of Volvo Penta, such a targeting procedure contains a few specific challenges:

First, the vast majority of the GHG emissions in Volvo Penta's value chain are found downstream as so-called Scope 3 emissions. Scope 3 means all indirect emissions within the value chain which occur from activities that the company does not own or control, in contrast to Scope 1 and 2 which a company can influence easier (see Figure 1) [1].

More specifically, a substantial amount of the emissions are found in the Scope 3 category *Use of Sold Products* (e.g., emissions occurring when their products are in use). This is because they produce products, mainly engines and power systems, that when in use emit large quantities of GHG emissions. In order for Volvo Penta to set targets that cover most of their value-chain emissions, they have to address the use-phase emissions.

Second, Volvo Penta is a tier 1 supplying company operating in a business-to-business setting, meaning they supply Original Equipment Manufacturers

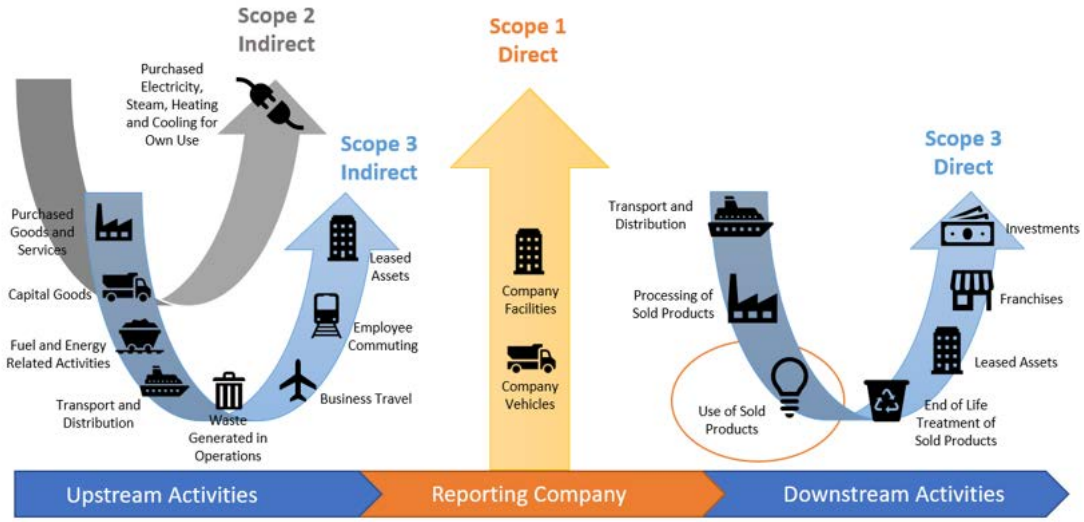


Figure 1: Scope 3 Diagram [1].

(OEM) with products that are installed in an end-product. The end-product is then sold to an end-user who will later use the product. An implication of this is that Volvo Penta has limited influence on the downstream Scope 3 emissions (not least the Use of Sold Products-emissions), as it is the OEM who designs the final products and their customers who use them. Thus, it is difficult for Volvo Penta to influence the energy efficiency and usage-pattern of the end-product.

Third, Volvo Penta sells products that are used in a wide range of applications that can have very different characteristics, from leisure boats to large forest harvesters. This poses challenges regarding how to report and measure the use-phase emissions in a standardised manner.

Fourth, there are no regulations on CO_2 emissions for the type of product Volvo Penta produces that we have encountered in Sweden, EU or anywhere else. This means that there is no regulated standardised approach on if and how to work with the emissions. However, as noted by the client, there are expectations that such regulations could come, and it is thus sound risk management to prepare for this.

The task is therefore to find best practice principles and measurements that a company within this specific context can use in order to set Science-Based Targets and lay out a roadmap on how the targets can be achieved.

Research Approach

Three main activities were conducted to carry out the objective task:

- Reviewing academic papers and grey literature, especially guidelines provided by SBTi and the GHG Protocol (defined in *Framework section)* to get an overall understanding of carbon targeting measurement and report;
- Benchmarking 29 companies through their CDP reports, Global Reporting Initiative (GRI) reports, sustainability reports, press releases etc. in order to gain insights on how and what companies have been doing in response to climate change and Scope 3 emissions;

- Interviewing with practitioners to obtain internal knowledge as well as their perspectives on the topic.

Benchmarking

In this section, we present relevant findings on frameworks for reporting and then we will present our findings on how tier 1 companies, in the energy-intensive industry, set and address targets on Scope 3 emissions.

Reporting Frameworks

In order for Volvo Penta to report on Scope 3 emissions, standards and frameworks are available to ensure it is done accurately. For this task, we used the guidance of the SBTi to set out the roadmap for Volvo Penta's Scope 3 reductions. Throughout this report, developing Volvo Penta's roadmap will be done in the context of meeting the requirements and standards as set by the SBTi in order to keep the roadmap directed towards science-based targets in line with the Paris Agreement.

The SBTi through its collaboration of partner institutions, relies on the guidance of the GHG Protocol which is a global standard and framework for measuring and managing greenhouse gas emissions. More specifically, the guidance of the *Corporate Value Chain (Scope 3) Standard* offered by the GHG Protocol was used to scope our work [1].

When Volvo Penta pursues the reporting and quantification of its Scope 3 emissions it should include relevant activity data and emission factors data for its product offerings. Important to consider when collecting that data is to use the GHG Protocol guidelines to ensure there is no double counting occurring.

As will be described in the next section, the majority of companies use the CDP reporting method and rely upon the GHG Protocol and its guidelines and standards to quantify and report their emissions. Based on the research done on the frameworks and standards seen in the benchmarking and how relevant they are to Volvo Penta, we believe using the GHG Protocol for measuring emissions and CDP for reporting emissions is the most appropriate fit for Volvo Penta.

Company Benchmarking Overview

We benchmarked 29 companies in total - with some of them suggested by the client. The majority of the benchmarked companies were in a similar business sector as Volvo Penta, mainly offering power solutions for industrial and vehicle settings, and a few were also active in the oil and gas industries. The Figure 1 presents companies' current situation of reporting and setting targets for Scope 3 emission reductions.

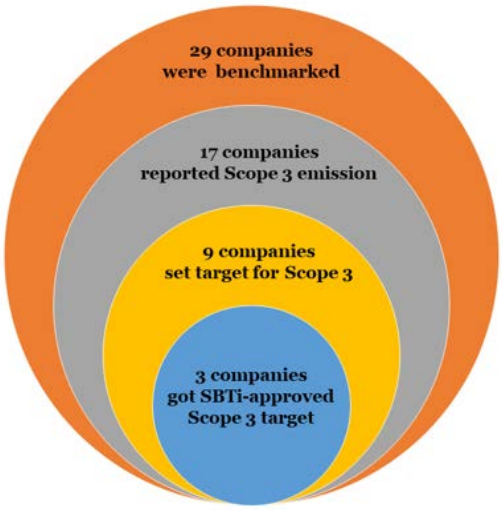


Figure 2: Benchmarking companies.

Even though only nine companies under the benchmarking set the target for Scope 3 emission reduction, there were

considerable numbers of companies, 17 out of 29, which disclosed some parts of their Scope 3 emissions. This gives positive expectations on companies' actions and responsibility toward climate change.

Data Collection, Calculation Tool and Methods

Primary data in Scope 3 emissions in general and in the Use of Sold Products-category in specific were claimed to be difficult to collect. All the benchmarked companies that reported Scope 3 emissions either used industry average emission factors, or proxy input data, or their own assumptions with limited primary data input.

Various tools, for example, industrial databases, conversion factors, calculation tools, risk analysis, etc. are provided by international organisations as well as governments to support companies. Conversion factors, introduced by The Department for Environment, Food and Rural Affairs of United Kingdom (UK DEFRA), are used to calculate GHG emissions from energy use, water consumption, waste disposal, recycling and transport activities [2]; GABI, a Life Cycle Assessment modelling and reporting software [3]; and different GHG Protocol calculation tools are widely used by benchmarked companies.

A key lesson from the benchmarking and interviews is that it is essentially up to the company to decide calculation methods, which can be done in different ways as long as it is transparent with a reasonable justification of how and why it was done.

Identified Challenges

All benchmarked companies which reported their Scope 3 emissions in general and also the specific Use of Sold Products-category, found significant challenges in defining scope boundaries and attributing emission reduction credits among value chain actors. Even though these companies took actions on customer and supplier engagement, there has not been sufficient cooperation and responsibility sharing in emission reduction target allocation in the industrial or global level.

Besides, the risk of double-counting was also raised by BHP company due to the overlap in calculation boundaries. Since Volvo Penta has a refurbishment business sector, this issue could possibly occur if applying the same calculation methodology for new products on refurbished products, a part of the emission may be double counted.

A Roadmap for Targeting and Reducing Emissions from Use of Sold Products

This section introduces concepts, requirements, and best practices that Volvo Penta can use to chart a roadmap for targeting and reducing emissions from use of sold products. Not all detailed steps required either by CDP, GHG Protocol or SBTi will be included, instead focus will be on complex issues that needed further investigation.

Setting a Target

The overall logic of Science-Based Targets is that the targets should be in line with the Paris agreement. But the questions remain what this means in practice. The following subsection provides examples of requirements by SBTi of the targets, examples from other companies and lastly introduces a few alternatives that Volvo Penta can choose between.

Scope 3 - Overall	
Danfoss	-25% by 2030 comp. to 2007
Mitsubishi	-15% by 2030 comp. to 2018
Scope 3 – Use of Sold Products	
Bosch	-15% by 2030 (no baseline year mentioned)
Volvo Cars	-52% per vehicle-km by 2030 comp. to 2019
Cummins	-25% by 2030 comp. to 2018
Wärtsilä	-15% by 2020 comp. to 2015
Michelin	-8% by 2020 comp. to 2013
Scania	-20% by 2025 comp. to 2015

Table 1: Benchmarked companies' Scope 3 emission reduction targets.

Table 1 below provides examples of targets that have been set by other manufacturers for overall Scope 3 targets and also specifically Use of Sold Products. To set such a target Volvo Penta must conduct an emission screening of all categories and target all categories that fill the criteria for being significant. The combination of all targets for Scope 1, 2 and significant Scope 3 categories must then meet the SBTi-criteria for being in line with the Paris Agreement.

When setting the target, a company can choose between having an absolute or a relative target. Since the client expressed that the intention is to go for an absolute target, this is what the group has investigated. Such absolute targets can in fact be formulated either as an absolute emission reduction target (e.g. as Cummins, Bosch etc in Table 1) or as an *intensity target* (e.g. emission per unit, as Volvo Cars in Table 1). For Use of Sold Products, SBTi recommends to set both types of targets if possible, so that these can complement each other and avoid misrepresentation of the data.

We also discovered through our interviews that the earlier Volvo Penta works together with the SBTi, the more support and flexibility they will get as they themselves are in a growing and adapting phase.

Defining Measuring Units

The next step to set the target is to define measuring units for absolute and intensity targets. The questions here are *which emissions are to be measured*? and *which emissions should be targeted?* and *how can these be formulated as one or more units?*

For an OEM, these questions are often simple to answer. A manufacturer of trucks can measure CO_2/tonne-km and report on all emissions from the truck. This comes from the fact that the truck manufacturer is responsible for the full energy efficiency of the vehicle, and thus could directly influence this. However, for tier 1 companies such as Volvo Penta, it is more complex. They only produce parts of the end-product, and thus cannot directly influence the overall energy-efficiency of the product. We have also found that there is no standardised approach to which emissions to include by tier 1-suppliers. A second factor that complicates the defining of units is that Volvo Penta's products are used in a broad range of end-products that produce different types of work, e.g. in boats, harvesters, static power generation, etc. This makes it difficult to decide what an intensity target could be based on.

Limited examples were found due to the emerging nature of this field, but these have been used to outline the following approaches for Volvo Penta regarding which emissions to measure and base units on:

The *first approach* is to estimate the percentage that each part of the end-product/system consumes of the total fuel/energy usage. Three examples of this were found:

- Jet engine manufacturer: estimation by the engines share of the airplanes total weight
- ABB: measures energy losses in their electronic motors used in industrial settings
- Michelin: looks at the tyres' contribution to the vehicle's fuel consumption

These are examples of the same approach in the sense that they all look at where the fuel/energy consumption occurs and thus who can influence it and allocate the responsibility for the emissions between the suppliers accordingly.

As this approach provides a principal framework of which emission to include, the group believes this approach could be relevant for Volvo Penta. One major benefit to it is that Volvo Penta only takes responsibility for the emissions that they can impact. However, a downside is that it would be complicated for Volvo Penta to estimate this for all the end-products their products are used in. Indeed, a representative of Cummins, an engine manufacturer with a number of similarities to Volvo Penta, highlighted that there is "no realistic way" to separate either the responsibility of the emissions or the efficiency measures between the OEM and the supplier. All three companies that have used this approach have also been able to operationalise it in simple standardised units (weight/energy, losses/tyre's contribution to fuel consumption), for Volvo Penta that would be more difficult.

The *second approach* is to measure the emission from all fuel/energy consumed in the engine. This is the approach used by Cummins, who explained that SBTi accepts double counting within Scope 3 emissions in this sense. As this is an easily applied and consistent approach, the group believes also this is relevant for Volvo Penta. The downside is that it creates an impression that Volvo Penta is responsible for emissions that in fact are outside their influence, however, as this does not impact the actual emissions, it can be questioned how much of a problem this would be.

If Volvo Penta chooses to define measuring units for *absolute* targets, they should choose which of these two approaches would be most suitable. We have found that it is more complicated with *intensity* targets. We have in fact not found any fully relevant example that Volvo Penta could find inspiration from in defining such a unit. However, the combined analysis indicates three possible principal approaches that could be used for intensity targets. First, a single intensity unit could be used for all products and all segments. Second, different units could be used for different products and segments. Both could potentially be described in Co_2/kWh or Co_2/hour of operation. The third approach would be to skip intensity targets since this is not required by SBTi, which is the approach used by Cummins.

Activities to Focus On

Next step in the roadmap is to identify activities that Volvo Penta can use to fulfil the targets. The purpose is both to identify best practice emission reduction activities relevant to Volvo Penta, and also to clarify which types of emission reduction activities SBTi allows a company to take credit for when reporting on the target.

For this, SBTi provides recommendations for each Scope 3 category. Regarding *Use of Sold Products*, they recommend three main *emission reduction levers* that companies

can focus on. These are *Product and Service Design*, *Customer Engagement* and *Business Model Innovation* [4]. For each of these levers, potential activities and focus points for Volvo Penta will be discussed.

1) Product and Service Design

To design better products that emit less is a key activity for Volvo Penta to reach a potential climate target. Volvo Penta currently focuses on electrification, fuel cells and efficiency measures for Internal Combustion Engines (ICE). Given that these strategies are apparently being pursued, we did not focus our research on this further. However, it should be noted that this will continue to be a main activity in the roadmap toward fulfilling their target.

2) Customer Engagement

The second lever recommended by SBTi is customer engagement activities, i.e. activities that aim at positively impacting use patterns of the products to lower emissions. According to SBTi, the main challenge with managing downstream emissions is that a company has limited influence on its product's use once it has left the factory. However, SBTi suggests that collaborative customer engagement activities can be a cost-effective complement to product development for fulfilling the company targets. Furthermore, as mentioned by Lee & Park, 2020 [5], working with the value chain and specifically supporting those downstream from a company has shown to be the most successful in driving emissions reductions.

Two concrete examples of customer engagement activities adopted by OEMs that are relevant for Volvo Penta were encountered. The first involves educating their customers in optimal usage of their products. The second involves the signing of collaboration agreements with their customers about biofuel usage. SBTi allows both of these activities to be accounted for in fulfilling the company's target, and it appears that Volvo Penta could use similar approaches.

Image 1: Our team brainstorming ideas with others during Wanås forest retreat.

There are two different ways for taking credit for customer engagement. One is that a company adopts a "customer engagement target", which means that it commits to influence a certain percentage of its customers to sign up for SBTi. This is labelled as non-ambitious by SBTi and not something Volvo Penta prioritised for this study. The other is that customer engagement activities are used on top of product development in fulfilling absolute targets, such measures are used by Cummins and could thus also be applied to Volvo Penta.

3) Business Model Innovation

The third lever recommended by SBTi is business model innovation. The literature suggests various methods for a tier 1 company to go beyond the traditional sale of a product. The specific task was to find examples or principles of how innovations in business models can have a clear link to emission reductions in the use-phase of a product. Additional research needs to be conducted to specifically tie these activities to their corresponding quantifiable emissions reductions. However, from our research and benchmarking, it is possible to highlight three key principles found which are improving fuel/energy efficiency, changing fuels, and prolonging lifespans of the products.

Improving fuel/energy efficiency. Volvo Penta could expand its use of telematic systems for helping end-users to use the products more energy efficiently. This would require significant collaboration with OEMs as well as finding ways to incentivise data sharing, which requires further research. One inspiring example is Bosch's *Battery in the Cloud*-service, in which Bosch collects data on usage of electric vehicles to give feedback on how to use them to increase range and lifetime [6]. For this, Volvo Penta needs to develop synergistic data collection between OEMs and the end-users on usage patterns and energy usage, which would allow Volvo Penta to then interpret and give advice towards improvements. In this, Volvo Penta could align environmental benefits with profit generation since this service could make up a new revenue segment.

Changing fuels. Volvo Penta could find incentive structures to push their end-users to use sustainable biofuels instead of fossil fuels. One such example could be to lease the products with clauses on sources of energy used. This is something Volvo Penta could put research in how to operationalise.

Prolonging lifespans. The final principle involves extending each unit sold lifespan. An example found was the Power-by-Hour concept launched by Rolls-Royce, where aviation companies pay for jet engines based on time in operation. This model gave Rolls Royce the incentive to prolong their engines' lifespans by making them more durable and improving the repair and maintenance infrastructure, translating to less environmental impacts [7]. Refurbishment of engines is something Volvo Penta is already doing, and results in increasing each sold unit's lifespan. More research needs to go into whether these should be counted as a new unit sold or not, and if the latter, then when calculating emissions, they should not contribute to an additional emissions stream in the value chain.

Reaching the Target

A key conclusion from this analysis is that Volvo Penta can develop a detailed roadmap for how the targets are to be met to better focus their sustainability efforts to be in line with their science-based targets. Such a roadmap would also enable transparent, substantiated communication with stakeholders.

This roadmap could include different product development activities (such as electric engines, fuel cells, efficiency measures in ICE's), customer engagement activities, and new business models. To effectively fulfil a target, Volvo Penta could put research into quantifying each activity's potential for emissions reduction, which would help make sure that the targets are within reach. A conceptual example of this sort of visual quantification is demonstrated in Figure 3 below:

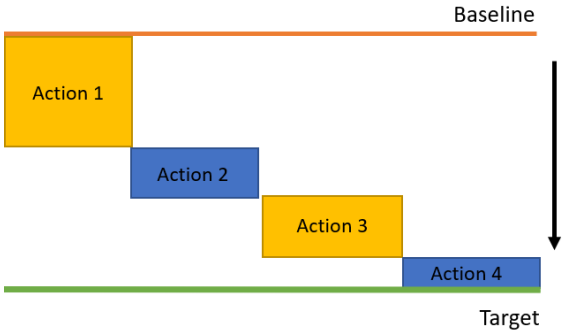


Figure 3: Visual concept of quantification to meeting targets.

Limitations

A few limitations affected the conduct and outcome of this project. The first one was the need to address topics related to sensitive and sometimes competitive information. This made it more challenging to access companies' specific data and include all our findings in the report, as some details had to be redacted to maintain confidentiality.

A second was that the task was also an industry leading initiative and therefore there was limited information about tier 1 companies targeting use-phase emissions. Furthermore, the fact that Volvo Penta offers a wide range of applications to its customers and does not neatly fit into existing sectoral pathways within the SBTi or GHG Protocol frameworks, making it a challenging exercise to benchmark it against other relevant companies and organisations.

Third, it was a steep learning curve to get to know all standards, and understand the complexities of scope 3 reporting, especially for such a challenging situation as Volvo Penta. This learning curve has translated into important skill and knowledge development for the team and valuable and actionable information for Volvo Penta.

Reflections and Conclusions

The path to reducing scope 3 use-phase emissions is an inherently complex task involving many stakeholders. In our report we have presented examples where this challenge serves not as a deterrent for action, but rather as a unique opportunity to make impactful changes in the value chain. We have seen that many companies are shifting towards setting Science-Based Targets for their businesses and feel this emerging trend will make a positive impact towards having the private sector doing their part for fulfilling the Paris Agreement.

Image 2: Student consultants reflecting on their progress during retreat.

The efforts cannot be overcome alone. Volvo Penta as a tier 1 company is in a strong position to influence its downstream customers, and as our benchmarking and roadmap shows, collaboration is key to implementing these findings and synergies must be found between the relevant businesses and organisations.

Volvo Penta has the opportunity to become a leader in the industry. With this said, we hope the research we have conducted and the roadmap we presented may serve as inspiration for Volvo Penta (or other relevant companies) to start setting climate targets in line with the Paris Agreement.

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List of People Interviewed

Anders Nordström, Global Sustainability Professional at ABB, October 21

Cecilia Johansson, Supply Chain Development at Volvo Penta, October 20

Cecilia Näsman, Consultancy at U&We, October 21

Henrik Dahlsson, Senior Advisor on Sustainable Transport at Scania, October 7

Sparrefors, Director Autonomous Solutions and Tailored Business Models at Volvo Penta, October 20

Lars Mårtensson, Director Environment and Innovation at Volvo Trucks, October 20

Oliver Edberg, Environment specialist at TetraPak, October 20

Petter Dahlin, Department Secretary at the Swedish Ministry of the Environment, October 19

Email Correspondence with Laurie Counsel, Environmental Strategy & Compliance Professional at Cummins, October 15 - October 26

Digitalisation and Sustainability

By B26

Living in a Digital World:

Lessons Learnt on Digitalisation and Sustainability

Even though the pandemic forced us to work from Lund, it did not hinder the projects from engaging with sustainability issues in the real world. Not only have we acted locally and thought globally, but also engaged virtually across the globe. This is thanks to digitalisation – the adoption and use of digital technologies across the spectrum of societal and human activities. The digital transformation already impacts all facets of life – an obvious one being how we work and interact with each other. However, over these few weeks, the different ways digitalisation affects and influences society and the sustainability agenda going forward has been encountered: from operationalising the Sustainable Development Goals (SDGs) to increased data transparency and production efficiency. Below are some of the lessons learnt on digitalisation and sustainability - both the opportunities and the challenges.

Galvanising the Sustainable Development Goals

This year a number of our projects touched upon the SDGs, from a governmental perspective (Stockholm +50) and a business perspective (Volvo Penta). Set in 2015 by the United Nations (UN), the SDGs offer a shared language and understanding about where we need to get to by 2030 in terms of social, economic and environmental sustainability. Achieving these goals is not a simple task, particularly for businesses since many of the goals and their sub-targets are aimed at a government level. However, digitalisation has become a leading light in achieving the SDGs, positively impacting not only our global transition, but also influencing performance on a business level. The UN Declaration for the SDGs also specifically mentions how information and communications technology can help operationalise the goals, “The spread of information and communications technology and global interconnectedness has great potential to accelerate human progress, to bridge the digital divide and to develop knowledge societies" [1].

Some clear examples of how digitalisation can enable the SDGs are:

> SDG 4 Quality Education – E-learning solutions can transform education delivery, as proven by classrooms around the world transitioning online.
>
> SDG 6 Clean Water and Sanitation – Smart water management, using predictive analytics can reduce global water consumption.
>
> SDG 7 Affordable and Clean Energy – Smart energy management, e.g., smart grids with predictive analytics.
>
> SDG 12 Responsible Consumption and Production – Digital sharing platforms for everything from clothes to cars, tools and homes.

Production and Transportation in a Digitalised World

Efficiency in Production

Inspired by SDG 12 and utilising new technology there is a major opportunity for cleaner and more efficient production. For food production companies, like Oatly, processes are increasingly automated and the use of sensors, telematic systems, the Internet of Things (IoT) and Artificial Intelligence (AI) allow for real-time data collection and more precise production planning. Through the creation of digital simulators, producers can better understand the environmental impact of their products as well as how to improve their design, incorporate recycled materials and for easier disassembly and end-of-life.

The PRO, Elkretsen, predicted that digitalisation in the future can play an important role extending the life of electronic and electrical equipment (EEE). Digital platforms can be used by both consumers and businesses to create market places for used EEE. Social media platforms and other information platforms can furthermore be used to raise awareness among consumers. Digital platforms can also be used to coordinate collection of waste electronic and electrical equipment (WEEE) to mitigate the need to transport waste.

Lastly, there is great potential with AI, which could improve sorting practices. Sorting equipment with AI can interact in real time with the quality and quantity of incoming WEEE and thereby minimise material downcycling. Small-scale research projects are already being used, testing the potential of such a sorting system for more general use.

Efficiency in the Transport Sector

Next to production, the transport sector is often mentioned in relation to digitalisation. A wide range of digital applications is described as a solution to various problems. Connected “smart” cars and trucks could help increase traffic safety, and transport efficiency, saving lives and reducing congestion. Furthermore, telematic data collection systems could contribute to limiting fuel and energy usage in running vehicles.

An even more digitised scenario is fully automated vehicles. An imagined future scenario is that we will not own our own cars. Instead, we will use an app to order a driver-less car. This would require fewer cars since each car would be used more effectively.

The effects on our transport systems of digitalisation is so far mostly theoretical. It is correct that automated cars could result in fewer cars in total, but our traffic behavior is largely decided by the cost and convenience of different traffic alternatives. Automated cars will likely make it cheaper and more convenient to travel by car. Thus we could face a new mass-expansion of a motor-society, where car commuting expands on the cost of public transit, cycling and even walking. That could jeopardise our efforts to transform urban transportation in a sustainable way. We still don’t know what a digitised transport sector would mean for society.

Data Transparency & Accessibility

The strong growth of telematic systems in combination with IoT and AI in transportation vehicles, industrial engine, and machinery sectors, have accelerated the data collection and analysis process. This not only prolongs the appliance and equipment lifetime, as stated in the

above section, but also robustly supports products' use-phase emissions with accurate primary data. This has not been possible to access before, for example in the case of Volvo. Data availability and accessibility is one of the key points for stakeholder communication as well as cooperation improvement among actors in the value chain.

The Axis team explored how digital surveillance technology can improve water management and infrastructure. It remains to be seen to what extent digital solutions will be adopted in this sector, but the potential benefits are many: better climate change adaptation, more resilience to extreme weather events, and better water efficiency and pollution control. The saying goes that what cannot be measured cannot be managed. The vast potential in using digital surveillance for better environmental monitoring is apparent.

The Diab team dived into the dynamic world of sustainable finance, where digitalisation will also play an increasing role. The use of distributed ledger technology (such as blockchain) can unlock several benefits. New finance platforms can allow for increased liquidity, transparency, and expanded access to finance. This enables investment directly in sustainability projects, increasing the financial flows for sustainable development. Further, increased digitisation opens the opportunity for business to track the materials they are using through the whole value chain. The use of blockchain technology has been increasing in manufacturing industries and companies faced with higher demands on transparency and traceability, like IKEA. Blockchain technology stores information on transactions but separates them into blocks, which makes it possible to see where a certain material entered the value chain.

By contributing to the improvement of data transparency and accessibility, digitalisation positively influences the sustainability agenda. However, it also comes together with the significant risk of data security as data breaches have dramatically increased worldwide. Cyber-attacks got the highest rank in 2020 risk management from 79% of 1,500 executives surveyed by Marsh & McLennan Company [2]. Hence, in this age of digital transformation, companies must take advance steps in security solutions for collecting, storing and sharing data in order to achieve freedom and flexibility for further development and success.

Digital Communication

The COVID-19 pandemic has dramatically shifted work and communication to the digital space, with the pace of technology adoption making a five-year jump within just two months. This unprecedented digitalisation development is expected to remain and can accelerate economic growth and provide incredible opportunities. According to the World Economic Forum (2020), it is estimated that AI will increase global GDP by 15% and 5G technology will create an economic value of 13 trillion USD by 2035. As digitalisation and remote work look like they are here to stay, required skills across the world are changing rapidly. More employers are providing opportunities of online learning for their workers and individuals are also seeking these opportunities through their own initiatives. At the same time, 84% of employers are set to rapidly digitalise working processes, including a significant expansion of remote work [3].

Digitalisation in the context of communication means more virtual meetings and events, and less travel - something we have experienced first-hand in this course. The benefits are many: increased productivity, time efficiency, and accessibility. Digitalisation has allowed us to

communicate with professionals across the globe - gaining insight and information in an unprecedented manner. The Stockholm +50 team conducted 29 interviews in the span of two weeks with people from every region of the globe. Evidently, digitalisation unlocks a huge potential for knowledge sharing and collaboration on social and environmental issues.

Digitalisation also comes with drawbacks. The digital transformation means more jobs will be replaced by computers, with an increasing dependence on data and digital tools, requiring high energy and material use. The rate of transition to renewables will determine the sustainability of this shift, along with our travel patterns post the pandemic. Further, employees whose jobs can be replaced, need the opportunity to be reskilled or up-skilled because if there is a continued absence of proactive policy efforts to protect workers, the digital transformation may actually increase inequality. Proactive efforts to decrease inequality and ensuring youth has the skills to tackle the digital work life, will be essential when imagining a better future, as explored by the Stockholm +50 team.

Lastly, the changes in daily lives, like the popularisation of social media, has a substantial impact on mental health, especially among youth. As the world goes digital, in-person interaction, social skills, and well-being have the potential to be damaged. Productivity and efficiency must be balanced with what is more rewarding from a social perspective.

Reflections on Digitalisation and Sustainability

Digitalisation offers a myriad of opportunities to propel sustainable development. Digital technologies have the potential to support the transition to zero-carbon, circular and resilient societies. When tracking performance on the SDGs, digital solutions act as indicators as they can play an essential role in enabling technologies to harness efficiency gains and inducing lifestyle changes. This can have implications on environmental quality and health, as well, for example on water or air pollution monitoring [4].

Although new and smart digital techniques can be used for accelerating the transition to a low-carbon and resource-efficient society, it can also help cause the opposite. New autonomous cars could potentially pack our streets and replace public transit. Oil and gas companies can use new smart systems to reach findings that have previously not been accessible. With the expansion of new technologies there is always a risk of a rebound effect i.e. that the resource and energy demand will grow faster than what is possible to deliver sustainably. The extraction of scarce minerals, for example, used for phones, computers and solar panels is increasing.

As society we should thus remember not to be naive about new technology. Innovation and development are needed to tackle the challenges facing society, but it is increasingly important to keep a critical and reflective mindset. While digitalisation is a tool, it must be paired with knowledge and commitment. The sustainability professionals of tomorrow will need to balance the benefits and trade-offs inherent within digitalisation. Practical experience in solving real world issues has been the focus throughout both this project and the entire master's program. This combined with a reflective and critical mindset, puts EMP Batch 26 in the ideal position to contribute to a better world in a digital world.

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Concluding Thoughts and Pictures

By Batch 26

Reflections

This year, out of difficulty has come the opportunity for change and for a new "normal". Batch 26 has embraced this, demonstrating our resilience and exploiting the opportunity to create a number of valuable recommendations to pave the way forward for our clients. The process was intense, challenging and fun; here we share our reflections.

Team Axis learnt that the applicability of existing technology is not enough to digitalise urban water management. Businesses should engage with stakeholders and build on relevant policies and investments in order to integrate digital technology into a mix of solutions that provide social, environmental and economic value to cities.

Team Diab realised that as investors are increasingly scrutinising companies against ESG criteria, there is also a shift in the role of companies needing to create value for their stakeholders and ultimately society instead of shareholders. Sustainable finance is playing a massive role in the global transition towards a low carbon economy, rewarding front-runners in their industry and enabling sustainability improvements.

Team El-Kretsen was inspired by the company's vision to redefine the role of a producer responsibility organisation in the transition to a circular economy. This vision guided our recommendations to prioritise repair, restructure collection practices and encourage collaborative industry change. The reaffirmation that something is changing in the WEEE industry filled us with positivity about the future of this field.

Team IKEA found that tracing material flows in supply chains can be incredibly complex, especially for conflict minerals. This complexity calls for new ideas, collaborations and technologies that can be adopted to both mitigate risk and tackle impacts on-ground. IKEA is one organisation that could drive this change, through continuing on its ambitious pathway.

Team Oatly realised during our journey that water and energy efficiency is rather the result of a combination of several smaller, technical and organisational measures than the outcome of one major innovation. With knowledge sharing and cooperation across departments, plant sites and industries we can advance together.

Team Stockholm+50 worked on our communication and collaboration skills through defining a broad scope into a tangible product. We were inspired by the 30+ interviewees and youth to work towards creating a hopeful future worth believing in.

Team Volvo Penta SDGs established that there is no tick-box answer to assessing a project's sustainability impact, it's a complex process involving multiple stakeholders and interlinked methods. We also found that it's essential to get key internal people onboard with the project early on to ensure its success.

Team Volvo Penta CO_2 experienced firsthand how a company's position and influence in the supply chain can result in complexities when targeting climate commitments. Through the guidance of professionals in the field we were offered fresh perspectives and innovative ideas. This continued collaboration and innovation in the value chain can translate challenges into impactful opportunities.


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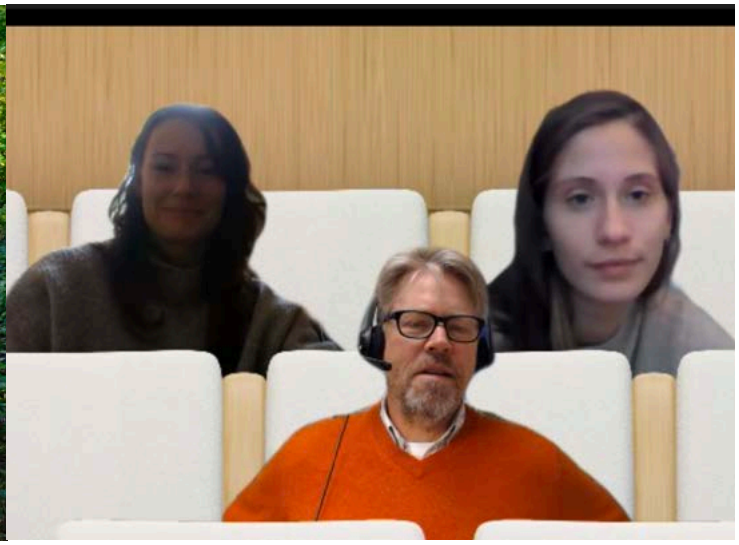

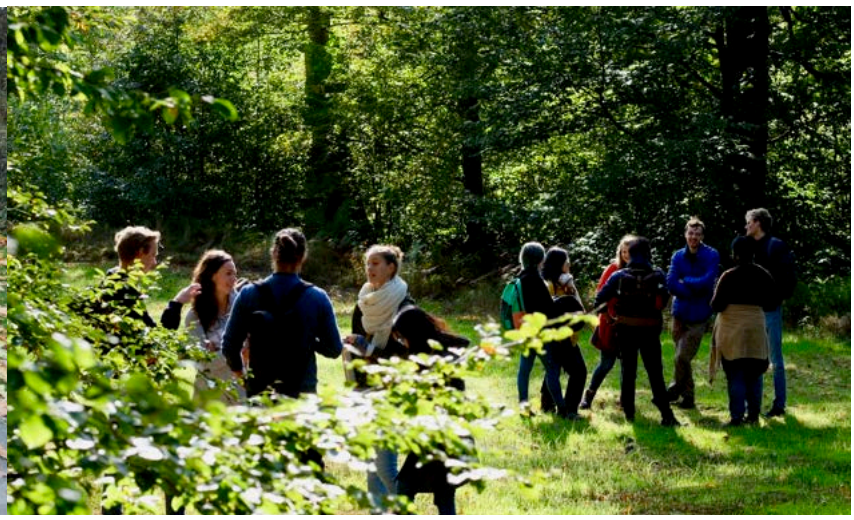


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