Sustainable Technology:

An Urgent Need

Technology both improves and harms environmental sustainability. It's a double edged sword. While emerging technologies such as Al, loT, AR/VR and others are being used to help achieve sustainability goals, these technologies when put into mainstream adoption will leave a hefty environmental footprint.

The technologies mentioned are creating a rapid rise in Information Technology (IT) infrastructure, such as data centers and edge servers. These data centers consume significant amounts of water and energy leading to large Green House Gas (GHG) emissions. It is imperative for organizations to consider and address these environmental impacts.

The purpose of this paper is to inform the reader of both the history of digital identity and propose its future state. We believe decentralized identity (DID) may be core to this future. We take a balanced view showcasing both the promises and the challenges.

In this primer, we detail the urgency of sustainable technology, provide insights on the sustainable tech stack, explain key metrics and put forth an approach that organizations can implement to measure their tech stack.

What's Inside

Version 1.0

May 2023 | a ***lab45*** Publication

Data Centers will become the Oil Fields of the Future

Data centers will soon be the largest contributors to emissions

12x
the amount of CO2 emitted today*

2030

40x
the amount of CO2 emitted today*

2050

Data centers will be huge consumers of water

3x
the amount of water consumed today

17x
the amount of water consumed today

Data centers will be large contributors to landfills

17%
of E-waste generated is recycled. The remainder resides in landfills in developing nations[1]

It is more economical today to manufacture from scratch than to recycle E-waste[1]

If we continue on our current trajectory data centers will leave a huge footprint on our planet.

1. https://www.statista.com/
2. https://theshiftproject.org/
* Data calculated by Lab45 using power consumption data projections till 2030

The Urgent Need for Sustainable Technology

Beyond Data Centers - The Impact of key ICT components

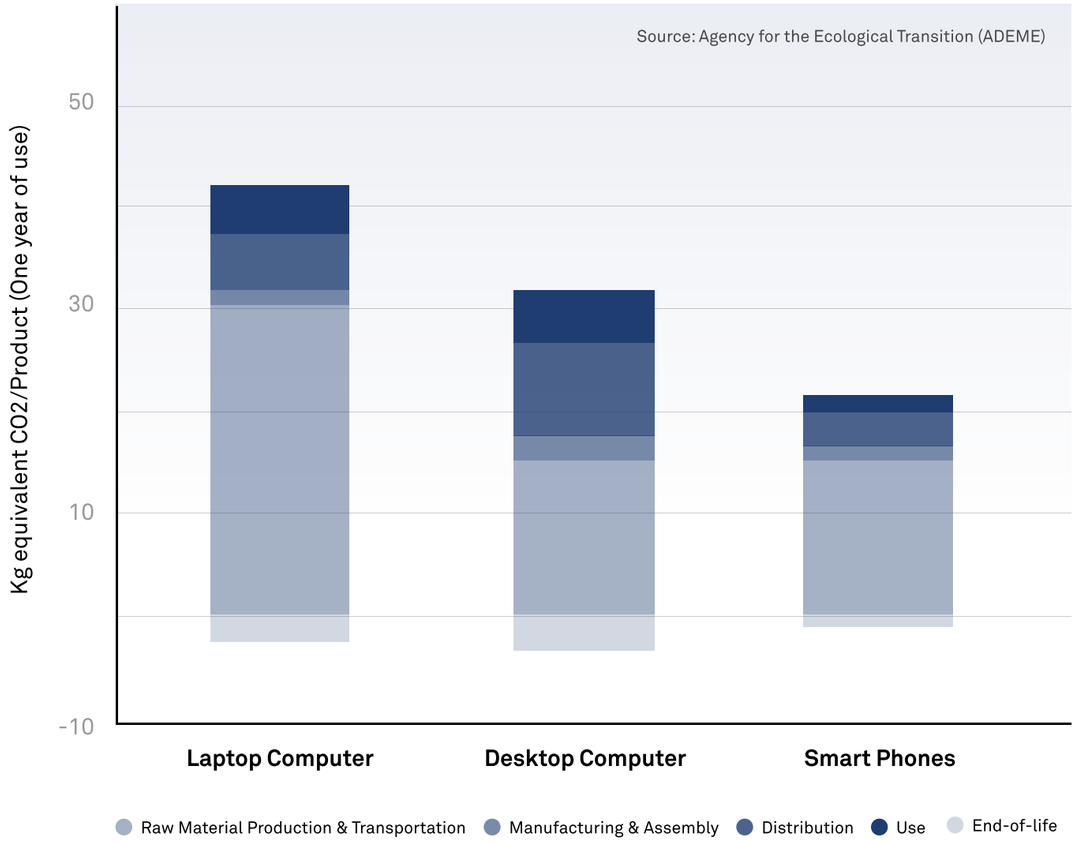
It's projected that Information and Communication Technologies (ICT) components will emit 692x the amount of CO2 as they do today. ICT components are used in IoT devices, smartphones, PCs, and other electronics.

IoT devices: Projections indicate that the number of IoT devices will reach 200 B and electricity consumption and CO2 emissions will rise by 1,200%, both by 2050. More IoT devices also results in greater storage and computing needs, contributing to the increase.

Smartphones & PCs: CO2 emissions and electricity consumption are expected to increase 138% and 120%, respectively, by 2050. It's projected that by 2050 there will be 10.75 billion active smartphones*.

> **Beyond electricity consumption and CO2 emissions, ICT components also generate large amounts of E-waste. The majority of E-waste is stored in landfills.**

Impact assessment of different phases of the ICT life cycle



Numbers that tell a story

45%

Manufacturing and production is responsible for 45% of the total ICT energy footprint[2].

80%

80% of the energy costs of a smartphone occurs during its manufacturing, rather than during its use[2].

1. https://www.statista.com/
2. https://theshiftproject.org/

* Data calculated by Lab45 using power consumption data projections till 2030

A Framework for Sustainable Technology in Datacenters

Our Approach to Sustainable Technology

In order to address the need for technological sustainability, we developed a framework to understand the IT lifecycle. This framework consists of a stack of building blocks. Most organizations structure their IT systems along the lines of this model.

Sustainable Technology framework

The Framework is divided into four high-level functions (shown in blue boxes) and six sub-functions (light-grey boxes).

Our Sustainable Technology Framework is designed to facilitate a comprehensive and structured implementation of a sustainability strategy. Traditional IT stacks are repurposed to achieve sustainability objectives. The Framework is divided into four high-level functions (shown in blue boxes) and six sub-functions (light-grey boxes).

In the drawing, the blocks below the line have a first order effect on sustainability metrics since they represent the physical parts of IT. The blocks above the line have a second order but equally important impact since the decisions made in those blocks flow down to the bottom blocks.

▶
As the graphic to the right shows, using an example initiative of app-portfolio rationalization, the three layers on the top have indirect impact on sustainability and the three below have direct impact.

Our Approach to Sustainable Technology

Implementing our Sustainable Technology Framework

Stack- level insights

As organizations move forward with sustainable strategies, we outline a few high level insights that will drive actions at each level of the stack.

IT Strategy		All IT sustainability initiatives need to incorporated in goals, policies, decision making, and growth and operational strategies.
Sustainable IT Dev & Ops	Sustainable Application	• CTO Org directly controls application architecture modernization • Rationalization of Application portfolio tradeoffs with Business objectives
	Sustainable Coding	• The choice of programming language has more impact than the quality of the code • Increased automation of code development and deployment
	Sustainable Data	• Data policies aligned with industry and regulatory requirements • Data privacy, security and scalability in data lifecycle management
Sustainable IT Infrastructure	Sustainable Data Storage Strategy	• Reliability and availability of data storage highly impacts sustainability • Find an optimal balance between on-premise data centres and cloud data storage
	Sustainable Spaces & Infrastructure Services	• Cloud is more environmentally-friendly than on-premise data centres • Efficient utilization of real estate and infrastructure is more energy-efficient
	Sustainable Networks	• Optimization through infrastructure automation, virtualization and digitalization • Optimal network architectures have greater impacts on sustainability vis-à-vis equipment tweaks
Asset Lifecycle Management		• Green procurement policies will have more impact on energy management than usage policies • Effective E-waste management will have less impact on environment

Measuring progress: key metrics

As organizations proceed with their sustainability initiatives, it is critical to measure the impact of their actions. Metrics may be derived from recommendations from firms like Sustainable IT[3]. They may also aligned with broader GRI and SASB sustainability standards. While some are easy to measure, others will need processes, tools and technology for accurate measurement.

Metric achievement can be benchmarked against peer firms while new goals and milestones are established to guide a firm's sustainability journey.

Key metrics may include:

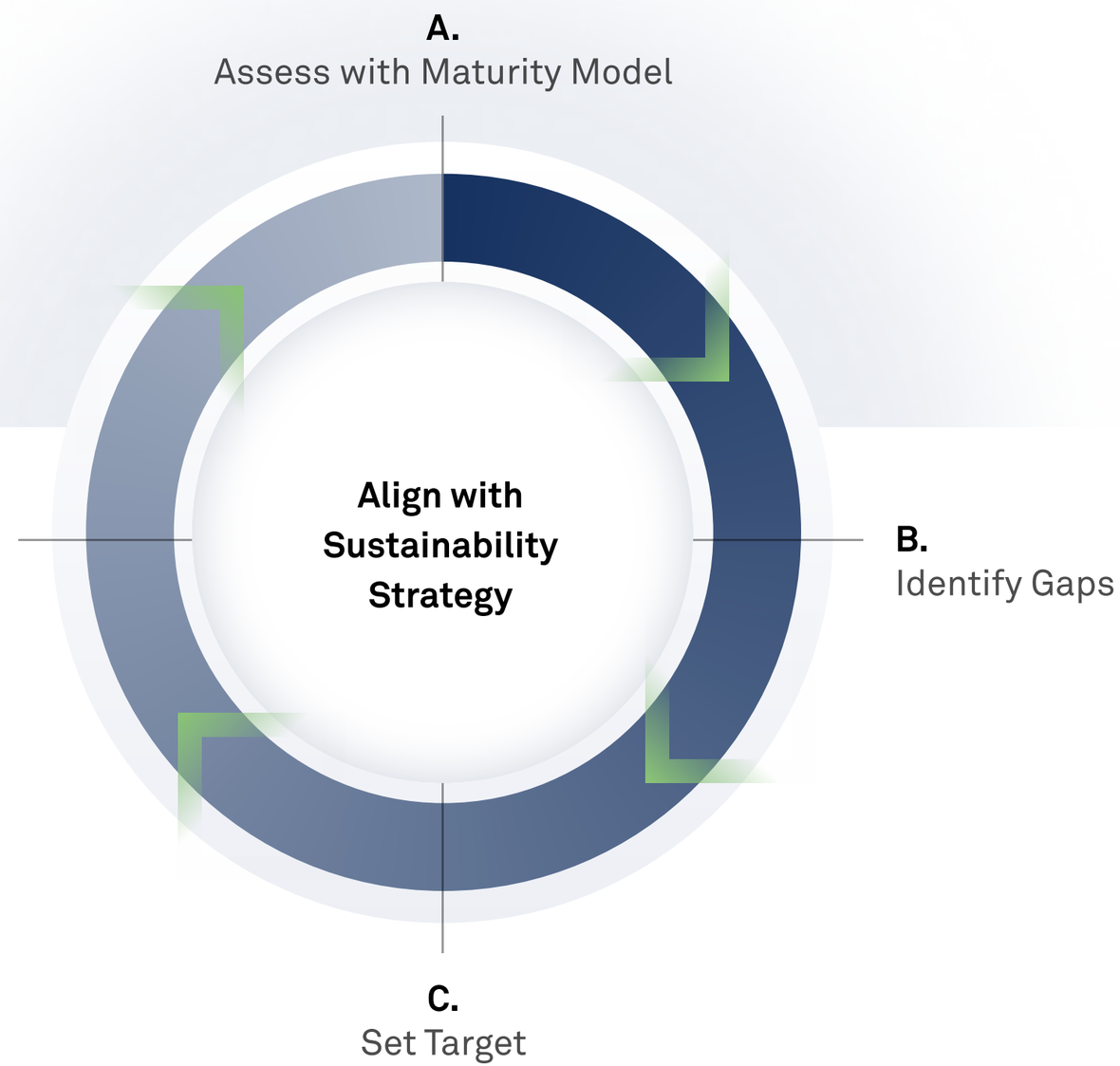
- % of electricity used
- % portfolio on renewable
- Total volume of E-waste
- % of data compressed
- Number of IT sustainability measures reported in annual reports

3. https://www.sustainableit.org/

The Five-Level Enterprise Roadmap

For organizations building sustainable technology systems, we recommend they follow the Sustainable Technology Maturity model as a roadmap. They are encouraged to continually work to iterate their processes along its guidelines.

The 5-level Sustainability Maturity model is a high-level guide for organizations evaluate their current level of sustainability maturity. A more detailed study can be conducted to identify specific actions, goals and metrics that can be implemented at different levels of the model or the IT stack.



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The graphic on the right details how to implement the 5-Level Sustainability Maturity model, while another graphic on the next page comprehensively details the 5-level model.

Sustainable Technology Maturity Model

Technology Strategy	No Strategy.	Understanding, documentation of requirements and standards.	Defining guidelines, policies, governance structure.	Implementation of defined strategies.	Continuous improvement of the defined strategies and reiteration of the same.
Application	Ad hoc development without synergy with sustainability.	Understanding areas of application development for sustainability.	Driving development of low code, no code apps.	Management of a Sustainable Application Portfolio.	Rationalizing the portfolio post performance analysis.
Coding	No KPIs for Sustainable IT goals and objectives.	Understanding developer KPIs for Sustainable IT goals and objectives.	Aligning developer KPIs for Sustainable IT goals and objectives.	Implementation of Sustainable IT goals and objectives.	Focus on addressing balance among accuracy, speed and cost.
Data	No processes, workflows lifecycle management of data.	Identification of data certifications, lifecycle management model and intelligent workflows for data handling.	Alignment of data certifications, lifecycle management model and intelligent workflows for data handling with company's sustainable strategy.	Implementation of data certifications, lifecycle management model and intelligent workflows for data handling.	Optimization of storage devices, locations and data transmissions.
Data Centres	No strategy for less data centre impact.	Defining efficient strategy and design for data centres.	Implementing efficient strategy and design for data centres.	Implementing cloud-native applications.	Optimization of data centre resources, wastage from cooling and production.
Infrastructure	Lack of energy efficient systems for infrastructure.	Monitoring asset lifecycle efficiency.	Defining smart asset management.	Implementation of smart asset management.	Adopting circulating for infrastructure managements.

Strategic Value ↑

Maturity →

Level 1

The organization has no sustainability objectives, goals, or strategies in place. The organization is taking sustainability action on an ad-hoc and as-needed basis.

Level 2

The organization has begun to understand the various requirements and standards. Basic documentation is in-place and teams for application or infrastructure optimization have been formed.

Level 3

Organizations begin to follow a more-integrated approach. They begin to manage improvement opportunities, individually and as part of a portfolio. The sustainability goals of the organization align with those of the employees.

Level 4

Sustainability strategy is integrated into the overall firm strategy as a transformation program. It's included in firm culture, operations, comms, and more. The firm begins to identify opportunities for greater impact.

Level 5

The organization is continuously evolving and acting strategically, solving for gaps and further implementing sustainability. It becomes an industry thought leader. It invests and establishes partnerships to create a greater collective impact through forums, R&D, and innovation.

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At Lab45, engineers, research analysts, and scientists come together to infuse creative ways of incubating solutions for customers that will transform the future. It is a space filled with ambition at the vanguard of far-reaching research across cutting-edge technologies.

Established with the Silicon Valley culture of free-flowing creativity, Lab45's goal is to make bold ideas a reality and to invent the future of enterprise. So come, collaborate, and see what happens when ideas are left unbound.

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