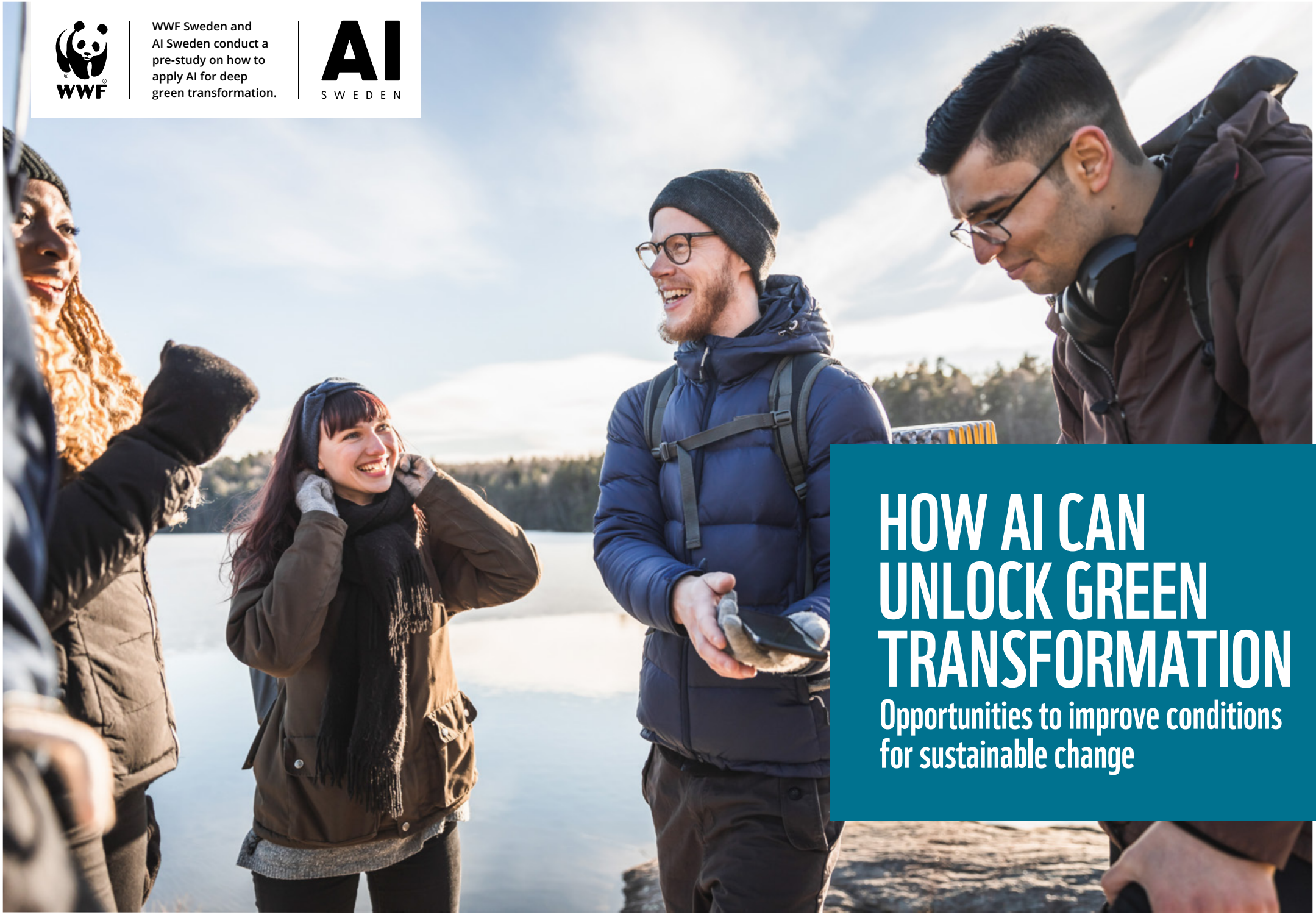
WWF Sweden and AI Sweden conduct a pre-study on how to apply AI for deep green transformation.



HOW AI CAN UNLOCK GREEN TRANSFORMATION

Opportunities to improve conditions for sustainable change

INTRODUCTION

HARNESSING AI FOR SUSTAINABILITY

The world stands at a pivotal moment, confronting a polycrisis: climate change, biodiversity loss, pollution, inequality, wars and more. Artificial Intelligence (AI) is advancing at an extremely high rate, emerging as a potentially powerful ally in our mission for a flourishing sustainable future.

This pre-study shows examples of how AI can be a unique tool that can help us take transformative steps that previously have been locked in. Based on insights from 35 experts across diverse fields, we examine several broad societal AI opportunities and specific impacts within the food retail sector.

The goal of the pre-study is to spark engagement around these AI opportunities and form collaborations that can take leadership in directing and funding AI development towards the applications needed for an accelerated green transformation.

We invite you to join us in this endeavour and wish you an inspiring reading experience.

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Climate Innovations, WWF
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Analyst, AI Sweden
(AI horizon and food retail
section author)

USGS / Pexels (CC0) – Algae outside Gotland, Sweden

CONTENTS

Cover photo: © Diego Martin / Stocksy

INTRODUCTION

THE CURRENT AI HORIZON

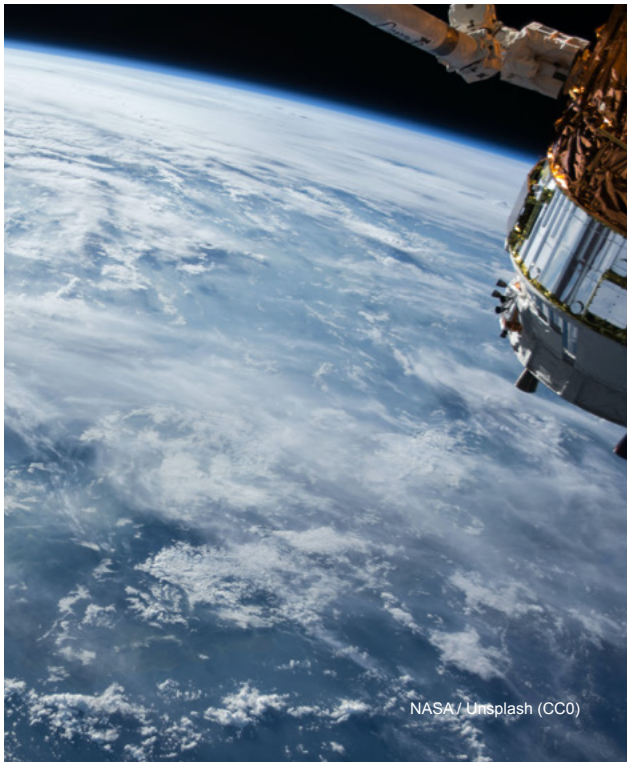
For most of its 70-year history, AI has developed at a glacial pace, but today the speed of development is such that any statements about the nature, impact, or limitations of AI are sure to be dated within months, if not weeks.

Previously confined to academic research, today AI technologies have escaped the lab. They are applied broadly—from cereal crop farming to urban planning and pharmaceutical research—as well as deeply—from low-level industrial systems all the way up to chatbots and digital assistants.

We are currently in an AI wave which bears all the hallmarks of previous technology-driven paradigm shifts. From recent examples such as the mobile revolution or the internet boom, to older ones like the first age of electrification, these shifts have some common characteristics. They disrupt existing systems, trigger rapid changes in the economy, and alter human behaviour and wider societal norms. They are not evenly distributed, but their impact is always global and felt on a timescale of decades.

We do not know how AI will be applied even a single decade from now. Broadly we can say that AI is likely to grow as an interface between users and complexity. Some AI will continue to passively analyse, recognise, and predict, delivering results to

"We do not know how AI will be applied even a single decade from now. Broadly we can say that AI is likely to grow as an interface between users and complexity."


NASA / Unsplash (CC0)

users for action. In other applications AI will likely have agency, managing and controlling systems of varying complexity. AI may soon help you buy a train ticket as well as run the traffic control systems of the train network.

The overall impact is even harder to predict, but AI can become a net positive for the planet. Whether this happens depends on how and where we apply the technology. A sustainable future of applied AI requires the active participation of people who are focused on sustainability. People who develop and showcase applications for sustainability, highlight the positive impact of others, drive change and advocate for effective regulation where that is needed.

In the midst of a rapidly developing present we are certain of this: the future of AI will be determined by those who engage in its development and use.

> "...the future of AI will be determined by those who engage in its development and use."

INTRODUCTION

BUILDING ON EXPERT INPUT

With the support of AI Sweden, we conducted hour-long interviews with 25 highly knowledgeable professionals to understand the most serious barriers to green transformation.

The interviewees were selected to ensure a diverse range of perspectives. We focused on two scopes: a general scope not limited to any sector, and a specific focus on the food retail sector to achieve more concrete and specific results.

Next, we consulted 10 AI experts to explore AI opportunities that could address some of the identified barriers.

The authors then chose, synthesised, made hypotheses and simplifications based on this input. Consequently, a lot of great input was omitted for the sake of creating an introductory pre-study with the primary aim of sparking further conversation.

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About WWF

The world's leading independent conservation body with the purpose to build a future in which humans live in harmony with nature.

This pre-study is developed by the WWF Climate Innovations Programme in Sweden.

About AI Sweden

AI Sweden is the Swedish national centre for applied artificial intelligence.

The mission is to accelerate the use of AI for the benefit of our society, our competitiveness, and for everyone living in Sweden.

AI Sweden is broadly funded and not-for-profit, and collaborate with speed and boldness with over 130 partners from the private and public sectors as well as academia.

Damir / Pexels (CC0)

INTRODUCTION

THE EXPERTS WE INTERVIEWED

Anders Axelsson — Senior Manager CR Strategy & Development, ICA Gruppen

Anders Wijkman — Honorary President Club of Rome, former Member of the Swedish Parliament and EU parliamentarian for Christian Democrats and the Moderate Party

Andrew Merrie — Research Liaison Officer at the Stockholm Resilience Center and Science, Futures and Partnerships Lead at Planethon

Anna Richert — Senior Food Expert at WWF-Sweden

Astrid Sjögren — Project Manager and AI Business Advisor at AI Sweden

Aurore Belfrage — Tech Diplomat, Economist, Investor, Digitalization Strategist in a Green Transition and Political Advisor

Birgit Brinkmann — Co-editor of the book "Regenerative futures and AI"

Christian Landgren — Founder of Iteam, a high-tech and digital innovation agency and AI-lead Klimatkollen

Christina Snöbohm — Senior Program Manager for Sustainable Food Supply Chain at WWF-Sweden

Daniel Gillblad — Chief of AI, Recorded Future

David Mjureke — Senior Expert Climate and Policy at WWF-Sweden

David Rolnick — Assistant Professor and Canada CIFAR AI Chair in the School of Computer Science at McGill University and at Mila — Quebec AI Institute

David Thau — Lead Scientist Global Data and Technology at WWF-US

Elina Eriksson — Associate Professor at the Department of Media Technology and Interaction Design (MID) at the school of Electrical Engineering and Computer Science at KTH Royal Institute of Technology

Fredrik Viksten — Applied AI Lead at Santa Anna IT Research Institute

Gustaf Lind — CEO at WWF-Sweden, Doctor of International Law from Stockholm University and former State Secretary for Minister for Migration and Swedish Prime Minister

Isabelle McAllister — Transformational Activist, Strategic Communicator & Thought Weaver

Jakop Dalunde — EU Parliamentarian and former Member of the Swedish Parliament, Swedish Green Party

Joakim Eriksson — AI Developer at AI Sweden

Joanna Franzén — Programme Manager and Strategic Area Lead in Sustainable Food Systems at Vinnova, Sweden's Innovation Agency

Jochem Bossenbroek — Co-founder and CEO of Verdify

Johan Jörgensen — Founder of Sweden Foodtech, a leading international think tank on the future of food

Johan Östman — Scientist at AI Sweden

Kim Henriksson — Edge Lab Wizard at AI Sweden

Koen Thewissen — Sustainable Behaviour Consultant and Founder at weareDaniel

Mariell Juhlin — CEO of Policy Impact, Economist and Policy Expert

Mark Bünger — Co-founder and CTO of Futurity Systems

Mattias Frumerie — Climate Ambassador and Head of Delegation to UNFCCC at the Swedish Ministry of Climate and Enterprise

Pierre Monget — Programme Director with Sustainable AI and AI for Green focus at Hub France IA

Simon Wakter — Strategic Adviser at the market liberal think tank Timbro

Stefan Wendin — Principal AI Engineer AI Sweden

Tor Blomqvist — Food Scientist at EDEN Laboratory

Tove Blomgren — Creative Director at SALLY, a future manifestation lab at EY Doberman

Victor Galaz — Associate Professor in Political Science at the Stockholm Resilience Centre and Programme Director of the Beijer Institute's Governance, Technology and Complexity Programme

Åsa Domeij — Head of Environment and Social Responsibility at Axfood

INTRODUCTION

WHAT WE LEAVE OUT

AI, like any powerful tool, comes with significant risks and potential downsides.

The most concerning include its misuse for harmful purposes or losing control over it. AI also has limitations that can make it unreliable, biased, unethical and basically could make many things worse. None of these aspects are covered in this pre-study.

There are two main concepts: ”Green AI” and ”AI for Green”. This pre-study focuses on the latter—using AI to support green transformation. ”Green AI” refers to making AI itself sustainable and resource-efficient, which is crucial as some AI applications significantly increase energy, mineral, and water consumption. However, some AI applications, like edge computing, are very resource-efficient.

The authors acknowledge the cultural biases of the interview group and of us, which limit the universality of the views in this pre-study. It is primarily based on experiences from the Global North. Therefore, when we refer to “us,” our perspective is limited in many ways. We invite readers to enrich the discussion with insights from diverse identities and experiences.

> ”We invite readers to enrich the discussion with insights from diverse identities and experiences.”

Milad S / Pexels (CC0)

INTRODUCTION

AI'S UNIQUE POTENTIAL

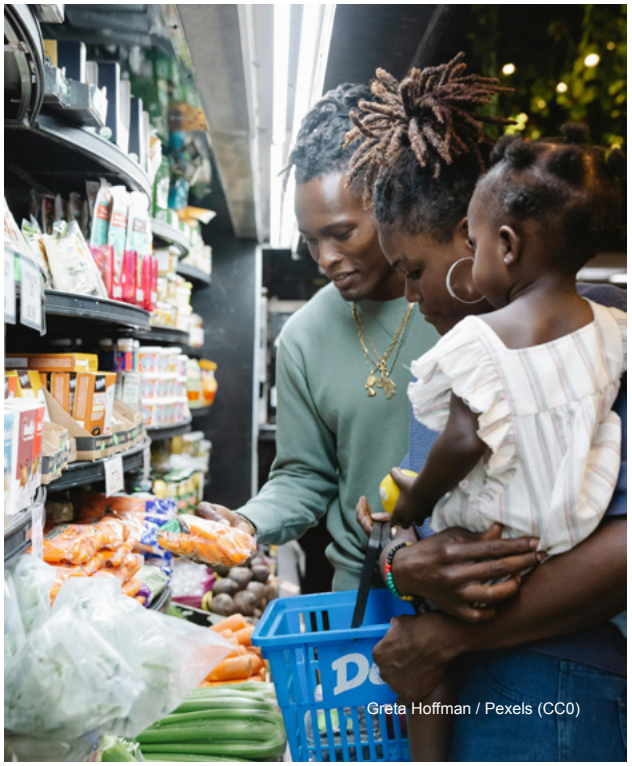
The following sections delve into some of the challenges where we are "stuck" today. We want to show that AI can play a unique role in providing opportunities for progress that previously have been locked in.

We've organised our discussion around pairs of challenges and actionable opportunities, providing a straightforward approach.

We begin with a wider perspective on the individual and societal benefits that AI brings to the table in situations where the information reaching us is of unnecessarily low quality.

We then narrow our focus to food retail where data often is abundant and of good quality—a sector ripe for transformation through AI intervention.

Ahmed / Pexels (CC0)



Greta Hoffman / Pexels (CC0)

BIG TRANSFORMATIONAL LEVERAGE

How can we achieve maximum leverage for transformation? The Iceberg Model[1] offers some guidance.

The illustration to the right shows a version freely adapted for this pre-study's purpose. The rationale is that the deeper in the iceberg a change can be made, the more fundamental and impactful it can be.

Currently, most AI applications for green transformation are found in the upper levels of the iceberg. For example, monitoring, measuring, and optimisation of existing events and processes.

In this section, we have identified both barriers (exemplified in the illustration) and AI opportunities at the two deepest levels of the Iceberg Model.

Our aim with this approach is to achieve greater transformational leverage.

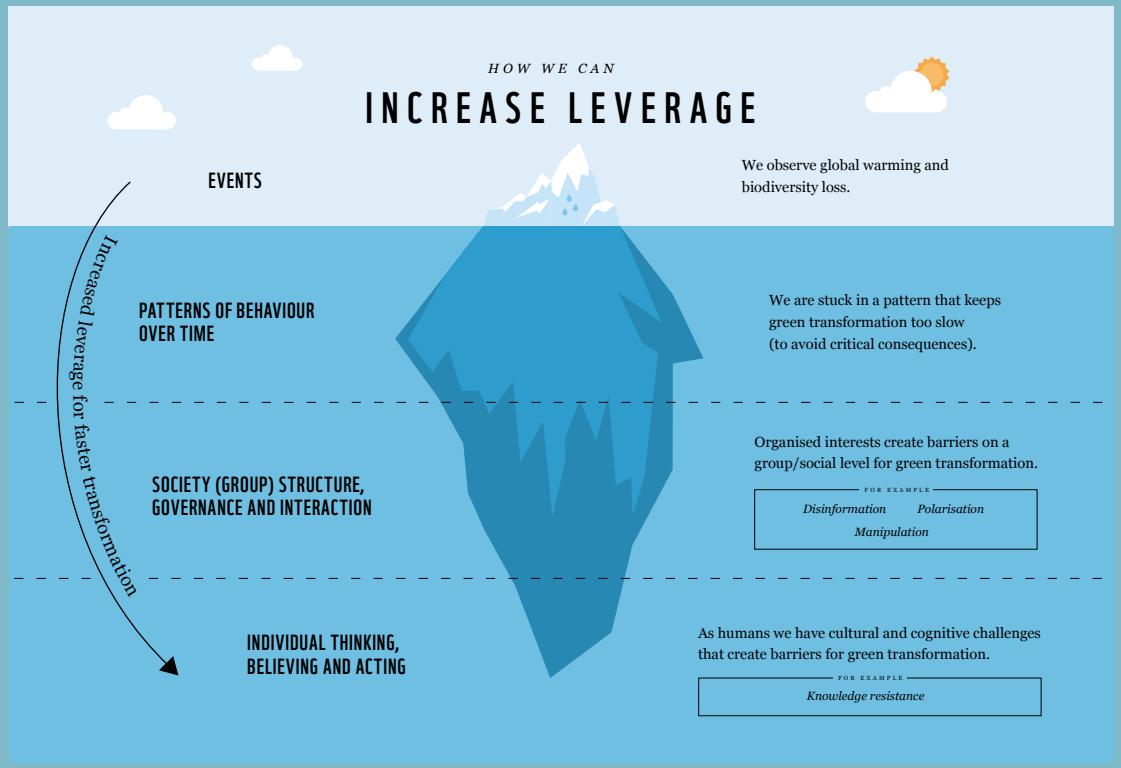


Illustration: Erik Rosin / WWF (CC BY-NC-SA 4.0)

1 Originally developed by anthropologist Edward T. Hall in the 1970s.

IMPROVE INFORMATION QUALITY

Challenge: Poor information quality works too well

Disinformation, misinformation, and biased or inconclusive information undermine our ability to make necessary and beneficial choices and decisions.

As a very concrete example, think of a political debate you have listened to. Often both sides make good cases, supported by logic, data and storytelling. As a listener and voter, you have difficulty to really getting the information you need to decide which side you want to support.

This can be all right; both cases may be well worked out, and just differ due to various ideological views and approaches—as it should be.

But far too often, the fundamentals and facts are poorly supported, and the debater uses many rhetorical tricks, like leaving out certain information, to build a seemingly stronger case. In short, prioritises winning the debate at any cost, rather than providing the best solutions and arguments for the people and society.

The effect is that the listeners will not be any wiser, and as voters, they cannot make use of the democratic function to support the representative that they believe is best. Instead, they end up choosing based on other less relevant and rational factors, such as rhetorical skills and charisma.

Jonatan Svensson Glad / Wikimedia Commons (CC-BY-SA 2.0)
– Party leader debate on Swedish television during the election 2018

Opportunity: The AI-assisted moderator

By equipping a moderator of a political debate with real-time fact-checks, relevant suggestions of questions and other functions, the value of the political debate can increase manyfold.

Let us imagine that the moderator has an AI tool at hand that listens to the statements of a debater, and in (near) real-time can fact-check it. As it has become challenging to agree on what constitutes facts and how they should be interpreted, AI can help check large amounts of data and thereby increase trust in the facts.

The AI tool can suggest three relevant, challenging questions to the moderator. These questions would help clarify whether a statement is well-supported by evidence and highlight any conflicting information. Additionally, the AI can provide vital missing information, sources, and valuable context to the statements made.

The effect is that it becomes much harder for debaters to provide poor information and get away with it, especially if it's intentional. Listeners and voters would receive richer, higher-quality information, enabling society to make more informed and beneficial decisions, which certainly would accelerate the green transformation.

This tool could also be used in other situations where there is public discourse, e.g. in interviews or at speeches.

Henri Mathieu / Pexels (CC0)

OPEN UP TO MORE PERSPECTIVES

Challenge: Changing opinions is hard

We are overwhelmed with information, and it is hard to know what to trust. It is even more difficult to open up to views in which we do not already believe. This keeps us stuck in opinions or even pushes us to be more polarised.

For transformation to accelerate, we need to think, assess, and act differently. This often starts with changing our beliefs, which means embracing new or different information than we did before.

In many ways it means listening to and accepting information from sources that we currently consider not to be in our ingroup[2]. This is demanding for us, but it would probably reduce polarisation and help us reach a broader agreement on transformative issues.

Several factors contribute to this challenge, such as mistrust in the source, the messenger, and the information channel. We might lack firsthand experience to support the new information, and it can be uncomfortable to admit we were wrong or to change our views when those close to us have not.

The effect of this challenge is that green transformation is partly slowed by those that have not yet accepted the severity of the environmental issues.

Artwork by Banksy, London (2009)

2 A theory about how people's self-image is partly defined by the groups they belong to, and how this affects their behaviours and attitudes towards others, made popular by Henri Tajfel in the 1970s.

Opportunity: The nuanced AI-companion

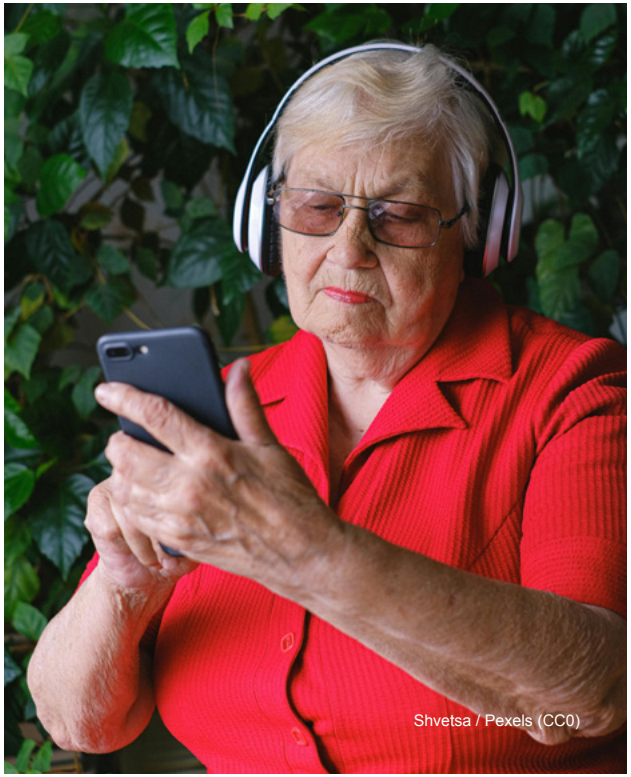
Imagine having an AI chatbot tailored to your preferences, dedicated to providing nuanced and reality-based information. This could make you wiser.

An AI companion could serve as a personal information provider, offering benefits that a human might not be able to. It can learn your preferences—trusted sources, preferred channels, beliefs, and how you like your information presented (text, speech, visuals, video, humour, etc.). This personalisation optimises your information absorption to higher levels than today (this also raises the risk of more effective manipulation).

However, it's crucial to ensure the AI companion delivers reality-based information, clearly making you aware of the sources, potential biases (as done in the news site Ground News[3]), and any blind spots, including those in its programming. Although, excessive transparency can have drawbacks, known as the "transparency paradox"[4].

When "reality" conflicts with your beliefs, the AI companion should present information in a balanced, nuanced and complementary way, helping you learn something new—much like a wise, critical-thinking, diplomatic and well-meaning coach. It should help with challenging norms, misconceptions, and highlighting commonalities with other groups.

Recent research seems to support this to a large extent: interacting with an AI chatbot could reduce conspiracy beliefs by 20%[5].



Shvetsa / Pexels (CC0)

AI's unprecedented potential help comes from its ability to process vast amounts of information, generate personalised messages, and, perhaps most importantly, never tire of you.

The effect is hopefully that we can become less knowledge resistant and less polarised.

3 Breaking News Headlines and Media Bias | Ground News.

4 The AI Transparency Paradox | Harvard Business Review.

5 Durably reducing conspiracy beliefs through dialogues with AI | Science.

SEE A CLEARER NEXT STEP

Challenge: Changing to something else is hard

Making a change is challenging, especially when you can't clearly envision what you're changing to. It's even tougher if you have to give up something you currently have, even if it promises a better future.

There are several conditions and barriers that prevent a person from moving from their current situation to forming a new intention and taking action. Bridging the "intention-action gap" is crucial for green transformation. One major barrier is when the case for making a decision isn't clear or complete enough, leading to inaction. Often, the necessary information and conditions exist but don't reach us sufficiently.

It's important to note that more information alone is seldom enough, as our decision-making isn't purely rational[6].

Another barrier is the reluctance to give up something you have today for something that isn't immediately better. Even if the future benefits are likely.

These barriers result in a society slow to transform.

The Castlebar / Pexels (CC0)

6 Nobel Memorial Prize in Economic Sciences winner Daniel Kahneman's book "Thinking, Fast and Slow" (2002) describes this in a good way.

Opportunity: Build richer cases for the next steps

AI can help meet our brain's requirements for deciding to replace something we have today, which is a key step in transformation. This involves describing the transformed state in a way that is relevant, information-rich, and personal.

For instance, if you're considering eating less meat and replacing it with more plant-based food, AI could help build a well-described case for this change, tailored to your decision-making needs. For most people, this would likely show it's a good change, but for a few, it might not be. We want AI to create unbiased cases based on the best sources and science to help you make the best-informed decisions.

Here is how cases could be more richly described:

- AI is becoming good at multi-modal communication, so you can get descriptions in writing, detailed visualisations, through voice - perhaps in a podcast format, or as a video with all the relevant information in it.
- If you allow, the AI can automatically learn about your learning preferences and adapt the case accordingly. Perhaps a humorous movie is what gets you through and processing the information.
- Many scenarios can be described, so that you can compare and "try out" what motivates you the most. AI can also simplify choices to avoid the "paradox of choice" where too many options become overwhelming.
- A wealth of data can be included beyond basic pros and cons, risks, and numbers: inspiring future visions, trends, and concrete positive real-world examples.
- The case can be highly personalised, showing changes in modified photos or videos of yourself or your home - how it will look like when you succeed with the change.
- You can get information on connecting with others working on the same change, becoming part of something larger yet locally relevant, such as activities in your community.

This is a challenging area to make breakthroughs in, likely requiring too large resources to do without AI.

BECOME LESS MANIPULATED

Challenge: We are too easily manipulated

There are so many interests that want our attention and money. It partly robs us of the ability to make conscious choices. One of several negative effects is that we consume more than we may want and should.

Consider two types of influencing sources: advertising and political agendas. Both aim to influence you to act according to their goals.

The influence can be seen as informing you to get a better understanding of your options. For example, what a product can do or what policy proposal a political party has. But when applying social science and psychology to intentionally and extensively take advantage of our human possibilities to being influenced unconsciously, then it somewhere becomes manipulation.

Many interests have taken this too far, leading you to consume more than intended, distracting you from your focus, and keeping you stuck with an oversimplified view of reality.

The effect of manipulation slows progress and diminishes your ability to act in line with your values and plans. Additionally, manipulation through disinformation or fake news imposes excessive costs on society in various areas[7].

Jose Francisco Fernandez Saura / Pexels (CC0)

7 The Economic Cost of Bad Actors on the Internet | University of Baltimore (2019).

Opportunity: The manipulation watchdog

We can partially neutralise manipulation by using AI to make us aware of unwanted influences, helping us regain more control over our decision-making.

AI could learn the social science and psychology behind unconscious influence, detecting, and alerting us when we're exposed. One challenge is that we are exposed quite extensively, so the watchdog should be possible to activate or deactivate as it suits you, possibly integrated into an AI assistant for use in various interactive situations.

For instance, while scrolling through your social media feed, the AI could identify patterns in the content that subtly shape your opinions or emotions. It might notice that certain posts consistently make you feel anxious about your health or finances, nudging you towards specific products or services.

When the influence is more sophisticated, it becomes even more crucial to recognise what biases may be triggered and what "manipulation tricks" the sender may use. These methods are not commonly known by the average person, but being coached in this way would foster automatic awareness and enhance critical thinking in all communication situations. This would help you make more informed decisions, ultimately benefiting green transformation.

Karolina Grabowska / Pexels (CC0)

USE THE LEGAL SYSTEM'S POWER

Challenge: Avoided responsibility for our planet and health

Human activities are causing severe damage to our ecosystems and health, often without accountability. This happens because it's possible to degrade the environment without facing legal consequences.

Pollution, degradation, and loss of resilience[8] will inevitably affect us all, sooner or later. For example, pollution in one part of the world can lead to more expensive and less healthy food in another, due to our interconnected global society, economy, and shared atmosphere and oceans.

> "...we should lift the bar to at least get all actors to comply with societal laws and regulations."

To reduce this, we should lift the bar to at least get all actors to comply with societal laws and regulations. This is not happening today because it is very tedious and resource-intensive to identify where environmental laws are violated, and to build legal cases that are solid enough to be successful.

The effect is that it is less costly and has limited risk to continue with illegal activities, at everyone's expense.

Vitaly Vlasov / Pexels (CC0)

8 What is resilience? - Stockholm Resilience Centre.

Opportunity: The green legal AI-investigator

By using AI to search pertinent data, understand laws, creatively build cases, and articulate them effectively, we can enhance the justice system's performance.

There have been some interesting legal cases in recent times where harm due to greenhouse gas emissions have been claimed and won in significant courts[9]. Also, UNEP highlights that climate litigation is a key tool in delivering climate justice[10].

An even stronger possibility arises if "ecocide"—the destruction of the environment by humans—is included in the Rome Statute, making it a crime under international law. This could enforce personal responsibility on individuals such as CEOs or politicians.

Due to its access to many data sources, tireless processing and arguing abilities, AI could build legal cases very effectively and bridge the gap where people, and especially less resourceful groups, could get support from the law on more equal terms. However, human review and decision-making remain essential for critical outcomes.

The effect is that bypassing laws becomes riskier and more challenging. Maybe this possibility itself is enough to deter a lot of illegal environmentally damaging activities.

Other related opportunities:

- Strengthening environmental regulations could be accelerated by AI proposing new legislation optimised for effectiveness and acceptability.

Vincent M.A. Janssen / Pexels (CC0) – Climate march in Maastrich, NL

- Detecting and preventing criminal environmental activities through AI-supported geospatial intelligence, remote sensing[11], scanning, online monitoring, analysis, correlation, risk assessment, and predictive analytics technologies[12].

9 "States have legal duty to cut greenhouse emissions, says top maritime court" | The Guardian (2024-05-21).

10 "Climate litigation more than doubles in five years, now a key tool in delivering climate justice" | Unep.org (2023-07-27).

11 E.g. Climate TRACE.

12 E.g. PERIVALLON—an EU-funded project against environmental crimes.

FOOD RETAIL OPPORTUNITIES

The unsustainable system we have built around food is complex.

It is governed by national policies, international agreements, market mechanisms, and ultimately by consumers making everyday choices. It is also rich in data, and uniquely suited for the application of AI for green transformation.

Our food system is a vast machine that links producers, retailers, and consumers through intricate logistics. This machine emits nearly one-third of global greenhouse gas every year and is the biggest driver of biodiversity loss. Nowhere else do the daily choices of consumers have a greater direct impact on the future of our planet.

Adopting healthier diets is estimated to lead to a significant reduction in emissions, while addressing two other facets of our current polycrisis: the rise of diseases of affluence and the long-term sustainability of our healthcare systems.

Wasted food represents roughly 10% of global greenhouse gas emissions and is a main driver of the loss of forests, grasslands, and other critical wildlife habitats. Cutting down on food waste will reduce greenhouse gas emissions and increase the profits of both producers and retailers, while simultaneously reducing costs for the consumer.

The changes that have the potential to drive emissions reduction in our food system are often technologically simple, but behaviourally complex.

Such changes require a transformation in how food is grown, processed, transported, and sold. However, any effort will fall short of its potential without a shift in consumer behaviour.

From the decisions of sourcing and marketing departments to the choices of hungry supermarket visitors, food retail is a central arena for decision-making in our food system. It is a 12 trillion USD industry employing an estimated 150 million people worldwide. It spends considerably on

”The changes that have the potential to drive emissions reduction in our food system are often technologically simple, but behaviourally complex.”

communication and marketing, influencing both production and consumption. Crucially, it collects, processes, and uses vast amounts of data, on which AI technologies depend.

It is difficult to imagine a better area than our food system in which to apply AI technologies for green transformation.

In the next four sections, we will highlight four opportunities for AI-mediated change in food retail. These opportunities do not pit producers or consumers against food retail. There are ample opportunities for changes that align sustainable farms, more profitable supermarkets, and healthier consumers.

TRAIN THE GREEN MACHINE

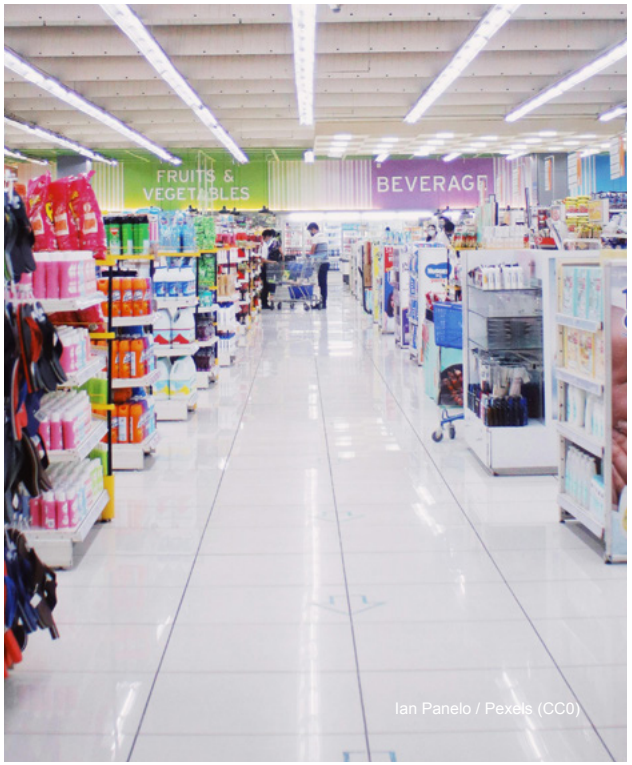
Challenge: We're stuck with old ways of thinking

Food retail is incredibly rich in data, and large retail companies are already seizing the opportunity of AI and machine learning to improve operations and drive higher profits. However, we need to set new and better goals to meet the challenge of green transformation.

Large retailers track every item sold in every store. They measure the impact of marketing and communication, both in and out of their stores. They have a wealth of data on their products and are often able to demand more from producers. They also know a lot about consumers, both individually and as a group. In short, retailers possess a vast amount of high-quality data.

AI runs on data, and the success or failure of a machine learning task is almost entirely determined by the quantity and quality of data. But success means little if we do not set the right objectives.

In the current economic system, the environmental impact of a product is not reflected in its price. This results in maximised profits with little consideration of environmental impact. The same logic is reflected in the application of AI technologies in food retail. Sustainability is not sufficiently reflected in the objectives set by AI teams, and those teams are not sufficiently connected to the sustainability teams.



Ian Panelo / Pexels (CC0)

Opportunity: Set new objectives for AI teams

Connect the teams working on AI with those responsible for sustainability and begin setting new green objectives for machine learning.

AI efforts and machine learning have potential that extends beyond improving operational efficiency and driving profits. Retail can use AI to align profit and sustainability goals.

A first and crucial step is to connect the teams working on AI with those responsible for sustainability, with the goal of setting new green objectives for AI tools.

A joint team could address questions such as:

- How can green objectives in AI teams help drive progress on sustainability goals?
- Can retailers better understand what drives customers to make more sustainable purchasing decisions?
- Can retailers incorporate environmental impact into profit objectives?
- How can we increase sales of high-margin greens and minimise the sale of low-margin meat products?

By working together in novel ways, retailers have a chance to harness this new technology to achieve meaningful change.

Markus Spiske / Pexels (CC0) – Tomato farming in Bavaria, Germany

LEARN TOGETHER

Challenge: Solving common problems while locked in competition

The green transformation aims to solve problems that are common to all, but competition, and laws prohibiting sharing of data, can hinder effective joint action.

It is not enough that one or two actors make progress on green transformation while other retailers backstep. Food retail is a competitive sector where campaigns and lower prices are common tools to attract customers. Often these tools do not take green objectives into account, and taking bold action on sustainability is sometimes seen to risk giving an advantage to competitors.

At a time when rapid progress is crucial, competition rules and anti-trust laws make actors more cautious. In some cases, these regulations prevent the collaborative action necessary for significant impact.

The sector may be good at setting joint goals, but progress on those goals remains more elusive. As rich as food retail is in data, the sector is often prohibited from sharing by law.

> "As rich as food retail is in data, the sector is often prohibited from sharing by law."

Rollz / Pexels (CC0) – Supermarket in Rotterdam, Netherlands

Opportunity: Collaborative technologies

Federated learning is a method that allows separate organisations to collaborate on improving their artificial intelligence models without sharing their sensitive data.

Training an AI requires a vast amount of data to be processed. This data is often proprietary and subject to privacy or competition rules. With federated learning, instead of sending data to a central location, each organisation trains the model using its own data and then shares only the improvements with a central system. This way, everyone can benefit from a more accurate and robust AI model while keeping their data private and secure.

> "This way, everyone can benefit from a more accurate and robust AI model while keeping their data private and secure."

This can be a component in a collaborative effort to make progress on jointly set goals. Federated learning can also facilitate collaboration with third-party actors such as service providers and academia, while helping address regulatory compliance and data sovereignty issues.

In pooling improvements from a variety of actors, federated learning can help establish best practices that elevate the entire sector. Greener supply chains, demand forecasting that reduces food waste, and customer experiences that drive sustainable purchasing patterns.


Greta Hoffman / Pexels (CC0)

EXPERIMENT IN THE DIGITAL WORLD

Challenge: Margins are too small to risk experimentation

Pressure on margins and customers opting for low-cost alternatives are top of mind for leaders in food retail. This creates an environment where experimentation is difficult.

Supermarkets compete on price and consumers have come to expect low prices. The current model for pricing in environmental impact charges customers a premium for desired change (sustainable or organic production) while deferring the environmental cost of less sustainable production to the future through lower prices.

While the food retail sector reports customers downgrading and choosing less sustainable options, surveys report consumers overall being willing to pay a premium for more sustainably produced goods.

The overall picture does not invite bold experimentation, but bold change is needed to meet climate change challenges.

> "The overall picture does not invite bold experimentation, but bold change is needed to meet climate change challenges."

Erik Mclean / Pexels (CC0)

Opportunity: Experiment with digital twin technologies

Digital twin technology builds digital replicas of the real world and allows for experimentation with minimal risk to margins.

Digital twin technology creates virtual versions of real-world objects, such as supermarkets and warehouses along with the people moving through these spaces. It can also model processes such as a shopping experience. These digital replicas are built for experimentation. Retailers can simulate the effect of changes in store layout, product placement or customer interaction. They can iterate to find optimal solutions. Crucially, experiments in the digital twin carry little financial impact.

There are already examples of digital twin technology being used in food retail. Large retail chains have used digital twins to manage stock and to test out new designs for checkout areas. But digital twins could also be used to test changes that aim to maximise green profits, lead consumers to make more sustainable choices, and reduce food waste.

Connecting digital twins with real-world data such as stock or sales figures opens up opportunities for continuous improvement and employing AI to generate new simulation scenarios might offer new paths for innovation.

Polina Tankilevitch / Pexels (CC0) – Refill system in food store

MAKE THE RIGHT CHOICE EASY

Challenge: It is too hard to make the right decisions

It is relatively easy to make the right, or most sustainable, decision. It is almost impossible to do it 30 times in a row, even in the best of circumstances, and supermarkets aren't the best of circumstances.

Supermarket shoppers are not perfectly rational agents processing the latest research on environmental impact and translating it into purchasing decisions. They are ordinary people, perhaps hungry, on their way home after a stressful day at work, or tired parents with their kids in tow. Most other purchasing decisions would be deferred in such circumstances, but not groceries.

> "The supermarket's design is intended to facilitate decisions that benefit the supermarket, not the shopper."

Supermarkets themselves have become fantastic landscapes of colourful packaging and a wealth of choice that would have been unimaginable just 40 years ago. Products are not selected or laid out to minimise impact or enhance human health. The supermarket's design is intended to facilitate decisions that benefit the supermarket, not the shopper.

In short, it is too hard to make the right decisions.

Gustavo Fring / Pexels (CC0)

Opportunity: Make good choices easier

The technology that could make it easier to consume more sustainable food already exists, but the potential products lack the same incentive structure that underpins other food retail technology.

Most technological solutions to the problem of helping shoppers consistently make more sustainable purchasing decisions suffer from the same fatal flaw: they rely on manual input from their users. As such they merely shift the work of decision-making from the supermarket aisle to the home, often while significantly worsening the user experience.

New AI technologies[13] can provide user experiences that mimic talking to an assistant or a knowledgeable friend. It is easy to imagine applications that generate personalised shopping lists based on your preferences, nutrition and sustainability data, your shopping patterns, and what it infers you have left in your fridge, as well as by prompts:

- The tomatoes are about to expire. Here is a quick recipe for a delicious pasta sauce, but I think you need to pick up garlic on the way home.
- It's time to do the shopping, right? I have prepared a shopping list for you.
- Do we have milk? (asked in the morning)

As exemplified, well-designed AI can have the impact of personal interaction and the reach of mass-communication, opening new doors for creating change on a large scale.

Wild Little Things Photo / Pexels (CC0)

13 Notably large language models (LLMs) combined with retrieval-augmented generation (RAG) which provides voice-interfaces to pre-selected data sources such as nutritional or sustainability data, and information that the user provides actively (e.g. specifying at setup "I want to eat more beans") or passively (e.g. the app registering what was purchased, where, and when).

NEXT STEPS

LET'S SEIZE THE OPPORTUNITIES

As we stand at this pivotal moment in humanity's future, AI can be a powerful ally. We hope this pre-study has inspired you to see how AI can unlock transformative steps, previously out of reach, for a brighter, greener and more equitable world—which requires action and leadership from many of us.

Lastly, thank you for reading! I'd love to hear your thoughts and what you believe is important. Please reach out to share your feedback, and explore potential collaborations.

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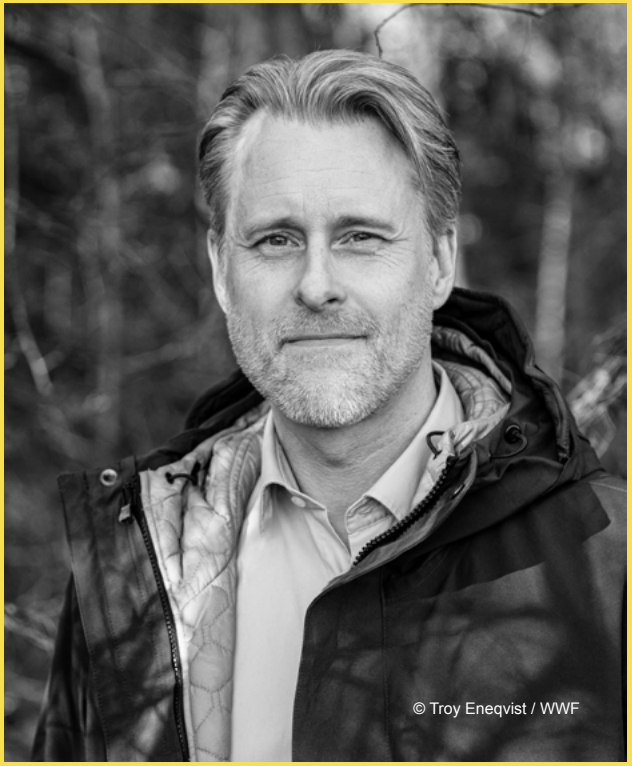
HOW YOU CAN TAKE ACTION:

1 SHARE THE OPPORTUNITIES

Help spread understanding by sharing the opportunities in this pre-study and your views.

2 START COLLABORATING

Reach out to explore collaborations or contribute to advancing AI for an accelerated green transformation.

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