Digitalization and the Environment: Not Only Good News

The development of the service industry in a world with increasing disposable income has broken the link between resource consumption and economic growth. Digitalization has played a key role in developing and expanding the service sector, and in driving efficiency. But what are the effects of digitalization on sustainability? Does an increasingly smart world mean a greener world? The answer is yes, most—but not all—of the time.

Although digitalization has the potential to contribute significantly to sustainable development, its hidden side effects on the environment exist, sometimes where we least expect them.

Assessing technology’s impact requires a holistic, long-term view that factors in both the environmental footprint and the economic value created. It also needs to break down the direct and indirect impact of a digital solution compared to its alternative, as well as the possible systemic change it causes on the environment. Ambienta uses this complex approach and integrates it into its proprietary Environmental Impact Analysis (EIA) methodology to drive its choice of investment opportunities and avoid the risk of greenwashing. After more than a decade of making this the core of its work, Ambienta is happy to share its considerations on this issue and conclude with a presentation of Namirial, an Ambienta company and leader in digital trans-action management, where digitalization and sustainability work hand-in-hand.
During the first industrial revolution, sustainable development wasn’t exactly a big topic. Yet, in 1865 British economist William Stanley Jevon was the first to theorize what became a fundamental concept of environmental economics. A witness to the intensive coal-fuelled industrial output in England at the time, he believed that greater resource efficiency would result in an increased demand for resources. The Jevon Paradox introduces the “rebound effect”: greater technological efficiency increases productivity, reduces production costs and prices, and eventually boosts demand.

Economic growth and natural resource use progressed in unison from the first industrial revolution of the 1800’s until the 1950’s, and after the oil price spikes of the 1970’s, supporting Jevon’s paradox. But as technology started to make increasingly important inroads, the two began decoupling, especially with the onset of the third industrial revolution, as shown in Figure 2. The advent of digitalization, more than any other macroeconomic factor, has allowed economic wellbeing to outpace the exploitation of natural resources in the last 50 years (see Ambienta’s 2019 Newsletter Industry 4.0 and Environmental Sustainability: Good or Bad News?)

The rate of decoupling will likely continue to increase as the pervasiveness of technological development and digitalization expand their reach. Big data is becoming the “new oil.” The Internet of Things is driving the fourth industrial revolution and its focus on efficiency. Artificial Intelligence will play a comparable role to that of electricity during the first industrial revolution... and the list goes on.

“Digitalization in the service industry has driven the decoupling of economic growth from resource exploitation.”

Historic Economic Growth and Natural Resource Use: an Inevitable Tandem?

The Jevon Paradox: The Evolution of Chicken Consumption

An example of Jevon’s paradox is provided by the consumption of chicken meat over the last century in the United States.

Figure 1: Lower Prices in Chicken Meat Yield Higher Consumption in the U.S.


Figure 2: Global Material Extraction and GDP 1900-2005

Source: Krausmann et al. “Growth in global material use, GDP and population during the 20th”, 2009
* GDP in 1990 International Geary Khamis Dollars and Population
Decoupling and the Service Economy

Yet, to date, real decoupling has mostly occurred in the service economy rather than in the production of goods. In fact, as shown in Figure 3, the ICT industry, the real enabler of the service sector, only accounts for about 2% of CO₂ emissions while generating approximately 6% of GDP in OECD countries. It also represents 40% of market capitalization in the S&P 500 index, as a reflection of the expected further growth it will generate.

Digitalization’s impact has been especially transformative in driving the information economy, whose services revolve around content and knowledge. Telecommunications, entertainment, media and interactive media provide a plethora of services that include search engines, cable television, social media platforms, streaming services and cellphone provision. Mobile media consumption and video-on-demand have revolutionized expectations and usage habits of consumers, who want to access and stream specific content when and where they want it, using a single device. All sectors of the media industry have been impacted by the disruptive effects of technology.

After a first phase that has witnessed the impact of disruptive technologies in the service industry, the challenge now is to reduce natural resource consumption thanks to digitalization’s transformation of manufacturing processes and of legacy industries that have leveraged less the potential of technology: construction, fashion and heavy industry. Let us now turn to the effects of digitalization on sustainability.

Our Framework to Assess the Impact of Digitalization on the Environment

Although tech companies rarely have a direct negative footprint on the environment, they can create indirect, hidden repercussions that are unexpected, misleading and hard to measure. A positive outcome in one area can generate a negative multiplier effect elsewhere.

Merely looking at their direct energy intensity is too simplistic because, as shown in Figure 4, this can be a misleading indicator. Cement and steel manufacturers are still huge energy users in spite of big efficiency improvements over the years. Auto manufacturers, which use up less energy, in fact generate a much bigger overall footprint due to the pollution caused by vehicles. Telecom and tech companies, which consume relatively little energy, might generate additional services that create spill-over energy consumption into other industries. Similarly, software and social network companies, apparent energy-intensity champions, are quite the opposite, due to the vast amounts of energy required to manage their data storage and their small employee base.

Because of this inherent complexity, Ambienta’s proprietary EIA methodology is important. We will use it below to analyze two examples of technology plays and their impact on sustainability.

- Digital Marketing: especially in online advertising and marketing, lower costs from the replacement of paper have generated such an enormous rebound effect that the energy required to supply push notifications and emails has far outpaced the positive impact from paper consumption in traditional media.
- Digital Concepts in Fashion: Dress X, a new digital fashion concept, sells digital clothes that are worn virtually and shared on social media, but have actually never been manufactured. This idea is a win-win in the fight against the unsustainable pace of fast fashion (see Ambienta’s 2018 Newsletter Sustainable Innovation in the Textile Industry: the Answer to an Ever Growing Polluting Value Chain). But the complexity of this model and the lack of data make it difficult to evaluate the real size of its impact against its immediate and intuitive appeal.

Understanding digitalization’s impact on the environment is not simple. It requires a comprehensive approach that takes into account both short-term and long-term impacts.

Figure 3: ICT CO₂ Emissions, GDP and Share of Global Market Cap

![Figure 3: ICT CO₂ Emissions, GDP and Share of Global Market Cap](source: Bloomberg)
Figure 5: A Framework for ICT Environmental Impact

Ambienta’s Environmental Impact Analysis (EIA)

- **Is there an absolute positive balance?**
- **Is the impact material?**
- **Is sustainability a growth driver?**
- **Is it measurable?**

<table>
<thead>
<tr>
<th>DIRECT IMPACT</th>
<th>INDIRECT IMPACT</th>
<th>SYSTEMIC CHANGE</th>
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<tbody>
<tr>
<td>POSITIVE</td>
<td>DEMATERIALIZATION OF THE PROCESS/PRODUCT</td>
<td>GREENER LIFESTYLE SHIFT (E.G. AVOID UNNECESSARY ACTIONS)</td>
</tr>
<tr>
<td>NEGATIVE</td>
<td>INDIRECT EFFECTS OR SUBSTITUTION (E.G. PARCEL DELIVERY INSTEAD OF DEDICATED TRIP TO STORES)</td>
<td>REBOUND EFFECT (E.G. GROWTH OF LONG-DISTANCE TRAVEL)</td>
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**Figure 4: Energy Intensity of Different Industries by Employee**

Source: Bloomberg: 2019 data on representative company samples

micro and long-term macro effects, in line with the OECD’s framework for ICT environmental impact.

Ambienta applies this framework and integrates it into its own methodology to evaluate investment opportunities in its private equity and listed equities divisions, and to single out greenwashing. The OECD’s framework provides a systemic approach to the impact analysis of an ICT solution; the EIA establishes how a solution unlocks a positive differential impact vs. the status quo. This systemic approach highlights different types of impacts that technology can have on the environment, and their positive and negative effects:

- **Direct Impacts:** impacts generated by products, services and operations. For instance, impacts can be the energy consumption or emissions from operations, or the disposal and end-of-life management of ICT equipment used for a specific company.

- **Indirect Impacts:** positive examples include the real dematerialization impacts unlocked by a digital business, such as optimization (smart electricity distribution networks) and dematerialization (the replacement of paper with digital processes). Negative examples include increased electronic waste production and its complicated handling.

- **Systemic Changes:** impacts that extend beyond the business model itself or that drastically alter demand of a certain service, potentially creating new sets of businesses. Think of the changes introduced by social media in marketing or in people interaction, once limited to phones or sms’s. Many digital businesses indeed modify other industries, as when personal computers eliminated typewriters and their value chains over the years. Measuring systemic change is more complex and remains largely unexplored.

On the basis of the methodology we have developed, let’s take a closer look at some highly digitalized businesses, like e-commerce, and see how they are aligned with environmental sustainability, which is the core investment strategy for Ambienta and its investors.

**E-Commerce: A Case Study**

E-commerce has transformed customer expectations about the breadth of product assortment and
speed of delivery. While the new range of choices is a definite plus for shoppers, meeting their rising expectations often increases the overall carbon footprint, and heightens the challenge of measuring it. Below is a breakdown of the different impacts and systemic changes generated by e-commerce.

- **Direct Impacts**: these include the energy consumed by data centers managing the purchase and all the logistic infrastructure required for distribution. When compared to retail purchases, the data center impact is incremental. For example, Ebay’s data center energy usage in 2020 was equivalent to the electricity requirements of a medium-sized city. The shift in logistic infrastructure can either be beneficial or not compared to retail building infrastructure, depending on multiple parameters.

- **Indirect Impacts**: these refer to the actual substitution effect. Single item e-purchases can be 40% more environmentally-friendly vs. dedicated store trips. Nonetheless, by pooling purchases during the same trip, traditional retail shopping can still have a 50% lighter environmental impact. If multiple e-purchases are made separately, multiple parcel deliveries will weigh negatively on the environment. This greatly varies according to the types of goods, the location and other parameters.

- **Systemic Changes**: e-commerce enables the pooling of resources for improved warehouse logistics, which is usually a positive. Unfortunately, it often also entails a strong rebound effect. E-commerce does not entirely replace traditional retail. In fact, it actually doubles consumption in some cases. Lower e-product prices induce more shopping demand. Refunded items, which represent 36% of all e-commerce in the fashion industry, cause a doubling of last-mile deliveries. In Europe alone, secondary packaging used by e-commerce boosted from 40% to 50% overall paper use from 2010 to 2019. Our proprietary Environmental Impact Analysis (EIA) provides the comprehensive framework to validate the overall balance of e-commerce, often considered an environmental champion. Although it undoubtedly presents objective positive environmental impacts, it also produces a host of hidden negative effects. Indeed, empirical evidence shows that increased e-commerce penetration from 10% to 20% in the U.S. generated an additional 5% energy use across the economy, and this was mainly attributable to the systemic changes generated in consumer behavior.”

Now that we know how to analyze a business, let’s dig deeper into possible investment opportunities that do present a positive environmental impact.

### Investing Where Digitalization Drives Sustainable Value Creation

Investing in digitalization is hot on any investor’s agenda. It is an almost perfect recipe for growth, significant operating leverage and very attractive cash returns. The massive value of ICT stocks prove this point. But these benefits should not suffice for investors who are serious about environmental sustainability. Investments must be driven by resource efficiency and/or pollution control; material, measurable net gains must be part of the equation. For this reason, in Figure 6 we highlight several businesses we have reviewed from both an investment analysis perspective and an environmental impact analysis. They fulfill both our Environmental Impact Analysis and the OECD framework for ICT businesses, and provide convincing investment cases with clear growth opportunities and identifiable competitive advantages.

What follows is a deeper analysis of two of these businesses: Remote IT Control and Telematic Solutions.

They represent attractive investment opportunities because they make a clear positive environmental contribution to Resource Efficiency or Pollution Control.

We are also pleased to present the case study of Namirial, a digital transaction management champion, and a recent Ambienta investment. Namirial fully aligns with Ambienta’s strategy of identifying investment opportunities where digital applications provide environmental solutions across different sectors.

“Investments must be driven by ... material, measurable, environmental net gains”
DIGITAL TRANSACTION MANAGEMENT: AMBIENTA CASE STUDY OF NAMIRIAL

In May 2020, Ambienta invested in Namirial, the Italian pioneer and leader in digital transaction management. Namirial’s market is growing annually at about 30% in Europe, jumping from 1.8€ billion in 2018 to nearly 5€ billion in 2022. Positive market trends include a favorable EU regulatory environment and a heightened demand for: additional security and cybersecurity, traceability and process optimization and digitalization (remotization) of transactions, which was greatly boosted by the Covid pandemic.

It is both a software provider and a certification authority, and offers the full range of legally-compliant software solutions. Namirial not only saves paper; it also: increases reliability through digital authentication, enhances transparency by allowing parties full access to records and reduces transportation. Revenues are driven by its ability to identify new applications that can transform regulatory-driven paper-based activities into high-security digital transactions. Namirial’s digital competitive advantage lies in investing in regulated digitalized solutions. The potential systemic rebound effect of increasing the absolute number of transactions is overcompensated by the initial net positive impact.

Ambienta applied its EIA methodology over the OECD impact framework to comprehensively assess Namirial’s environmental impacts:

- **Direct Impacts:** greater electricity use is compensated by a more energy-efficient transition to cloud-based technology.
- **Indirect Impacts:** substitution of paper-based processes lowers material use and resource consumption.
- **Systemic Changes:** potential increase of transactions is overcompensated by the positive impact of decoupling resource use from the low-energy digital transactions of the services offered.

Hence, Ambienta concluded that Namirial presents a clear environmental gain: its indirect impact and systemic changes offer a net positive advantage which offsets higher energy use for digital transaction services.
lock-in effect from using IT support software for multiple purposes represents a key digital competitive advantage.

- **Direct Impacts**: incremental energy demand from remote support ICT equipment.
- **Indirect Impacts**: reduced transportation and CO₂ emissions. TeamViewer estimates that an on-site call requires a technician to travel an average of 70 km roundtrip and produce about 10kg of CO₂ equivalent.
- **Systemic Changes**: more calls and faster response rates. On-site support, instead, not only requires technicians to travel, which generates costs and emissions, but also limits their ability to service multiple customers.

Our EIA analysis accounts for both positive and negative effects and shows a positive balance: reduced transportation of operators, which entails significant energy savings and, depending on fuels, lower GHG emissions and pollution.

**Telematic Solutions**

Telematics technology allows connected vehicles to communicate with a remote counterpart. When it originated in the 1960’s, it was intended to track vehicles. Today, its main applications are geared to commercial vehicles and insurance providers. While insurance is a relatively mature sector, fleet management has ample room for penetration: it is used by about 30% of fleet managers, with strong differences across end uses.

The market for telematic services is relatively fragmented, has very specific niches, and is well-aligned with environmental sustainability trends. Commercial and industrial vehicles represent about 30% of all transportation emissions. Through smart management of location, movements, status and behavior, telematics can cut up to 10% of fuel consumption. In fact, one third of fleet managers say that fuel efficiency is their main reason for using telematics. Plus, the digital competitive advantage of telematics is provided by high customization and additional functions for specific niches such as off-highway agricultural vehicles. Not surprisingly, churn rate is often below 10%.

- **Direct Impacts**: higher fuel efficiency and lower CO₂ emissions due to route optimization.
- **Indirect Impacts**: increased fleet utilization rates and enabling of remote vehicle monitoring, from simple position information to all possible remote diagnostics, plus capex optimization.
- **Systemic Changes**: this varies according to different applications, but it enables optimized insurance costs due to vehicle control and driving patterns, and allows car sharing of private vehicles, from simple position information to all possible remote diagnostics.

Our EIA analysis shows a positive balance for Telematics depending on its different functions. When used as a route optimization tool, it reduces the distance travelled and queuing. If used to enable car sharing, it lessens the demand for new vehicles and improves asset utilization. When simply used as a habit tracking system for drivers, it mitigates speeding and thus saves fuel.

**Summary of Key Findings**

**Remote IT Support:**

- Covid lockdowns and the Internet of Things are projected to boost the market growth for remote support software solutions that connect nearly all operating systems and provide monitoring, communication and interaction for tasks that typically require an on-site specialist, from laptop trouble shooting to performance monitoring.
- Our EIA analysis allows us to assess that, while remote support ICT equipment produces an incremental energy demand from remote ICT equipment, this is offset by the diminished travelling of operators and the resulting energy savings; depending on the fuels, GHG emissions and pollution are also reduced.

**Telematic Solutions:**

- Telematic solutions applied to commercial vehicles offer attractive growth opportunities and have multiple significant positive impacts on sustainability. Ample penetration opportunities and the ability to customize solutions that meet
We believe that digitalization to date has driven the decoupling of resource use from economic growth mostly in the service economy and especially in the information sector. It has transformed how we communicate and interact, consume information and perform services. The challenge now is to redirect the disruptive power of digitalization to transform manufacturing processes and reduce natural consumption across hard-to-abate industries.

A digital world does not necessarily mean a more sustainable one. As we have seen, technology can hide impacts that are unexpected, unclear and hard to measure. Identifying and fully assessing the overall effects of technology on sustainability is not simple. It requires a comprehensive, long-term view that factors in short-term micro and long-term macro impacts, and measures the environmental footprint as well as the economic value created.

After more than 12 years assessing digital businesses and investments, Ambienta has become the largest environmental sustainability-focused asset manager.

We use our proprietary methodology to evaluate investment opportunities in our private equity and listed equities divisions, and to single out greenwashing. Our methodology is based on the OECD Framework for ICT Environmental Impact, which analyses the direct, indirect and systemic changes produced by a wide range of digital applications. To this, we add our EIA proprietary methodology to gain a full-fledged assessment of investment opportunities. While the OECD framework provides a systemic approach to the impact analysis of an ICT solution, the EIA establishes how a solution unlocks a positive differential impact vs. the status quo.

In this newsletter we have provided our analysis of two industries, Remote IT Support and Telematic Solutions. Both offer attractive investment opportunities and a net sustainability gain. We also share our case study of Namirial, an Ambienta company and a digital transaction management champion, where sustainability and digitalization go hand-in-hand.

A sustainability-driven investor is called to do more than seek easy returns, which digitalization offers across many sectors, and choose opportunities where technology really drives sustainability. Having the right analytical tools to identify opportunities is key.