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The opportunities of sustainable digitalization and green technology for your SME (Green IT and Green Tech)

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"Una manera de hacer Europa"

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1. Introduction

The future is technological, and it is green. **Sustainability and digitalization have to go hand in hand**, it is necessary for our planet, our society and our economy and businesses. The European Next Generation pandemic recovery funds focus on these two vectors of change for sustainable development. **The Recovery, Transformation and Resilience Plan**, which includes the Spanish strategy for channeling these funds, allocates 33% of the 72 billion to 2026 for digitization and 37% for "green" investment, which shows the priorities of public policies and public aid in the national and European framework. This is the so-called **double transition, green and digital,** and the synergies between the two, leveraging the power of technology to accelerate the path towards a sustainable, low-carbon and socially just production model.

Digitalization and sustainability are thus indisputable premises of the present and future of the economy and companies and offer **business opportunities** that respond to generational and social demands.

On the one hand, **new technologies and digitalization present sustainability challenges**, especially in terms of the generation of CO2 emissions. It is estimated that 4% of global greenhouse gas emissions come from digital technologies and energy consumption is increasing by 9% per year (The Shift Project, 2020). This is equivalent in tons of Co2 to 200,000 Eiffel Towers per year. It is therefore necessary to **ensure sustainability criteria and standards** in their design, development and use. To address these challenges arises Green IT, which seeks to digitize by **minimizing negative** environmental and climate **impacts** and considering sustainability criteria such as the reduction of hazardous materials, energy efficiency or the circularity of the materials and products **used.**

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But on the other hand, **cutting-edge technology can be a lever for change** to find more sustainable business solutions, through so-called **Green Tech**. The Climate Change Mitigation Report of the IPCC (the panel of specialists on climate change linked to the UN) shows how **innovation and technology, when properly applied, contribute to improving energy efficiency and reducing greenhouse gas emissions** [REF-01].

In the same vein, the World Economic Forum in collaboration with Accenture has estimated that thanks to **digital technologies, global carbon dioxide emissions could be reduced by 20% in 2050**, in high emitting sectors such as transport, energy and materials. [REF-02].

Digitalization can also be a vector of sustainability and circular economy, making the use of resources more efficient and accelerating and maximizing the impact of climate and environmental policies. [REF-03].

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For SMEs, achieving sustainable digitalization (Green IT) and using or developing cutting-edge technology to make their business or that of others more sustainable (Green Tech) is a way to position themselves in a leading sector full of **opportunities and achieve a very good reputation** that will boost the company's growth, for which they can also take advantage of funding opportunities in technology and sustainability.

Sustainable growth is therefore as positive for the **planet and society** as a whole as it is for **SMEs, microenterprises and startups, when ecology and innovation go hand in hand, their opportunities multiply.**

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2.Green IT y Green Tech definition

Both Green IT and Green Tech are linked to sustainable technology, but the differences lie in their scope and focus.In 1992, the concept of "green computing" or "green IT" emerged as a result of a U.S. Environmental Protection Agency program to recognize and promote energy efficiency in the use of information technology.

Green IT refers to digitizing in a sustainable way, taking advantage of this digital transformation to optimize energy use and minimize environmental impact. It is about **choosing options that promote energy savings and avoid planned obsolescence. [REF-04], [REF-05].**

Green Tech is a broader term that encompasses the use of all types of **innovative technologies to create products, services and processes that help mitigate negative impacts on the environment** and people to combat climate change and achieve sustainable growth. Their use is linked to very diverse sectors, such as industry, energy, transportation and agriculture.

However, they are concepts that are linked, and it is common for them to share areas of application.

3. Green IT y Green Tech applications

Green IT

It should be borne in mind that **information and communications technologies consume energy** and therefore have a significant impact on the climate. However, there are **options that allow this consumption to be significantly reduced** and thus contribute to more sustainable growth. Similarly, it is possible to go a step further and take advantage of information technology to manage electricity and other resources more efficiently. **[REF-06]**.

There are several applications of green IT for SMEs **[REF-07], [REF-08], [REF-09]:**

1. Cloud Computing (or cloud technology):

Its use is key when we talk about Green IT. Cloud technology consists of accessing software (computer programs) directly through the Internet, instead of having them installed on the computer. That is, "it is a technology that allows remote access to software, file storage and data processing via the Internet, thus being an alternative to running on a personal computer or local server." **[REF-10].**

The Cloud under a correct migration, well sized and executed, can **help a company reduce its carbon footprint by more than 90%** according to large companies such as AWS or Microsoft. [REF-11]. At **least 41.1% of microenterprises and 71.2% of SMEs and large companies already use this technology**, according to the 2021 SME digitization report by the State Secretariat for Digitization and Artificial Intelligence. **[REF-12].**

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The migration of IT services to the cloud allows **greater efficiency compared to traditional software, because it avoids taking up space on local devices, reduces the need for physical infrastructure and consumes less energy**. Examples of cloud computing are e-mail services, software office services or online file storage.

It also has other advantages: it is **multiplatform** (it can be used on any electronic device, allowing access from anywhere), it allows collaboration to work on the same applications and documents by workers, it is **more secure** against attacks, and it is **easier to maintain**, with automatic updates. In short, it not only provides more sustainability but also greater efficiency for the company.

Within Cloud computing we can essentially differentiate 3 types:

- **SaaS -software as a service-**, it is the most used universal Cloud service, especially by micro-companies or startups, due to its lower initial cost. Complete, ready-to-use applications are offered over the Internet. The provider manages the hardware and software, which frees the company from software management while guaranteeing the security of the application and its technical maintenance. Examples of SaaS are cloud-based file storage such as Dropbox, applications for daily work management such as Trello, messaging applications such as Slack or design and presentation tools such as Canva.

- IaaS: the IaaS model - Infrastructure as a Service - allows access to basic resources, such as virtual servers and storage. The providers of these services are in charge of the physical administration and infrastructure, while the users of this cloud service have control over the systems and applications, because they are responsible for maintaining their own virtualized structure. It allows greater flexibility and scalability for SMEs. It is a pay-per-use model. An example is Amazon Web Services or Microsoft's Azure. [REF-13].

- PaaS: the PaaS model - Platform as a Service - the provider is responsible for the maintenance of the operational system, network, servers and security. It is used for the online development of applications without the need to maintain the platform that supports them. It is the best option for SMEs seeking more advanced performance, greater agility in their management and more functionalities, for example, with business intelligence tools. An example is the Zoho Creator platform that allows to easily create several applications [REF-13].

In short, it varies the level of responsibility and scope or control over the management of the software and infrastructure that supports it. For SMEs it is easiest to use SaaS applications. [REF-14], [REF-15].

Other ways to apply Green IT beyond Cloud:

2. Use of low-consumption and energy-efficient technologies.
This involves using computer systems and equipment that **consume less energy**, that have energy efficiency certifications, as well as configuring equipment to save energy. This includes such basic aspects as turning off electronic devices or suspending them when they are not being used.

3. 5G technology

The 5G network enables higher speed connection, connecting more devices at a time, but also consuming less electricity.

4. Devices with Green materials

This involves using mobile devices with more efficient materials or chemical components, avoiding programmed obsolescence.

5. Communication technologies

The use of videoconferencing can reduce the energy consumption of travel, promoting teleworking or avoiding unnecessary travel. This applies especially to long distances that can nowadays be avoided and is of particular importance for SMEs because of the cost savings involved.

6. Consumption monitoring

This involves using technology that tracks and monitors energy use in all company processes. For this purpose, Big Data or "Green Data" is used, the analysis of massive data on water and energy consumption to seek sustainability.

7. Paper and ink consumption

It is essential to reduce the use of paper and printing and encourage a more responsible use. Similarly, its impact can be minimized by using recycled ink and paper.

8. Technological recycling

This is not only about choosing products with a longer life, but also about responsible management throughout their life cycle. In other words, seek to **reuse devices** whenever possible and recycle technological components.

9. Sustainable software

For the development of software or technology in general, it is possible to opt for alternatives that comply with the standards of sustainable IT or Green software. That is to say, **good practices to reduce pollution in the developments**. Some guidelines of these standards are those of the **"Green Software Foundation" [REF-16]** and those of the non-profit organization **"Sustainable IT" [REF-17]**.

Green Tech

In line with the fourth industrial revolution, the digital revolution, Green Tech proposes how **cutting-edge technologies can be a driver of change for sustainable growth**. This is a growing market niche, in which technological and innovative SMEs are opening an important space. **[REF-18]. Green Tech** therefore refers to any technology committed to the environment and sustainable development.

Here we can highlight IoT, Internet of Things, 3D Printing, 5G, Artificial Intelligence, Big Data, Digital Twins, Blockchain or renewable energy technologies themselves as sustainable digitization solutions. It should be noted that their interrelation is common, thus, the use of Big Data and advanced data analytics is used to analyze data obtained through other technologies. The 5G is the internet connection that employs IoT and this in turn can be created with 3D printers. **[REF-19]**.

At the institutional level, RETEC, the **Territorial Networks of Technological Specialization**, stands out, which coordinate different regional projects focused on digital transformation and specialization, to ensure good coordination, collaboration and complementarity, making it possible to identify emblematic projects in various technological areas to promote them, Green Tech being one of them. **[REF-20].**

IoT

It can be defined as **"connected things that are equipped with sensors, software and other technologies that enable them to transmit and receive data - for the purpose of informing users or automating an action"[REF-21].**

In the green tech framework, an SME can apply IoT for the following uses:

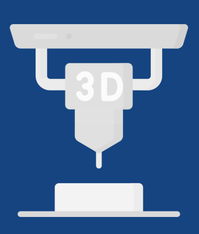
1. Improve energy efficiency: by installing sensors in stores or workspaces, together with automatic smart metering systems, it is possible to forecast consumption and optimize the use of energy resources such as light or electricity, avoiding unnecessary consumption. This includes measuring temperature and optimizing air conditioning. [REF-09].

2. Use in agriculture: it is essential to achieve efficient water management to avoid waste, especially with the endemic problems of drought in Spain. Therefore, the use of smart irrigation, thanks to IOT sensors, is expanding in SMEs in our country. [REF-22].

3. Waste management: IoT sensors are used for optimal waste management, controlling, for example, when waste garbage cans are filled and the correct classification for recycling.

4. **Logistics and transportation:** IoT allows reducing emissions linked to transportation, thanks to the real-time tracking of vehicles and the optimization of the routes to be followed, to minimize travel and delivery times. This has a positive impact on citizens and workers. Likewise, knowing where each shipment is and whether it has been loaded and delivered serves to optimize the process at the business level. [REF-23].

In turn, **IoT** typically **uses** the ultrafast 5G network to function better and be more efficient. You can also **connect this technology with AI, which analyzes data collected by IoT sensors, and with 3D printing, as it is common to print IoT objects with this technology.**



3D printing (or additive manufacturing)

3D printers, also referred to technically as "additive manufacturing", consist of **devices that convert a 3D design model made on a computer into a physical 3D model.** Their use by SMEs is especially useful for making design **prototypes or for very unique or more customized parts that are produced on a small scale**. Therefore, in SME sectors such as jewelry, fashion, architecture or research and medicine its use can be more useful.

The application of 3D printing contributes to sustainability in different ways:

Reduced energy consumption enables a faster process because less manufacturing time is required, which in turn means fewer resources used. In addition, digitally manufactured parts are lighter, which means they require considerably less energy to operate.

Local production, manufacturing only what is needed and skipping some of the steps in the traditional supply chain, achieves significant savings in transportation costs, thus contributing to the reduction of emissions.

Finally, it allows recycling an important part of the material that has been used during the printing process. [REF-24].

AI or Green AI

Artificial intelligence can be defined as the "ability of a machine to exhibit the same capabilities as humans, such as reasoning, learning, creativity, and the ability to plan." [REF-25].

AI works by receiving data, processing it, and responding to it. There is a great variety of types of AI, with technology having greater or lesser autonomy in decision making and learning capacity.

In the context of Green Tech, it is about driving AI that is sustainable and provides solutions to ecological challenges. While AI may require a lot of energy to maintain it also stands out as having the potential to analyze a large volume of data to implement solutions to environmental challenges, to reduce energy and resource consumption and boost the circular economy. Therefore, it is a question of making sustainable and responsive use of AI to meet these challenges. [REF-26].

It is estimated that AI alone will be able to help reduce 2.6 to 5.3 gigatons of Co2 by 2030, equivalent to 5-10% of total global emissions (BCG, 2021). [REF-27].

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In the field of AI, the **National Plan for Green Algorithms 2023-2025** stands out, with Next Generation funds, to promote Green Tech in the use of AI and Green Design (Green by Design).
Within the Plan's axes for SMEs can be useful the **funding of research in innovative** AI products in green technology and that of certification for companies with sustainable hardware and software services, implementing a **'Green Tech Quality Seal'.** The latter helps to give visibility to companies with sustainable technology criteria. **[REF-28].**

AI thus serves large-scale data analysis for energy efficiency and resource optimization. By employing machine learning algorithms, AI predicts consumption patterns, areas of inefficiency and areas of improvement to reduce consumption. **In addition, IoT can be combined with AI for more evolved data processing,** which empowers measures such as sustainable agriculture views with irrigation, waste management or environmental monitoring. **[REF-29].**

Digital Twins

It is a **virtual representation of a physical product,** thanks to the real-time incorporation of several sources (sensors, databases...) to digitize it and replicate its use. This allows its **simulation in the digital realm** and can be combined with other technologies such as AI. It thus **serves to test products before launching them. [REF-30].** Digital twins can contribute to sustainability and circular economy because they speed up the design of products and services, allowing to gain in innovation while reducing the carbon footprint and the cost of prototyping. The areas of SMEs where they are most used are those linked to industry, such as manufacturing, transport logistics and fleet management, the automotive industry and the medical industry. **[REF-31].**

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Blockchain

This is a **transaction recording technology, which tracks assets (whether tangible or intangible) to trace them along the value chain.**

This technology is used to **calculate and record the carbon footprint,** making it possible to control the traceability of the carbon footprint of products from their origin to the consumer. This is done through smart IoT sensors that measure energy and generate data for analysis. This monitoring serves to drive the Circular Economy and position itself in the market with a niche technology. **[REF-30], [REF-32].**

Renewable energies

Renewable energies are those derived from natural sources, which can be replenished faster than they can be consumed, and which emit far fewer emissions than burning fossil fuels. The most common are solar, wind, geothermal, hydroelectric, bioenergy and ocean energy. **[REF-33].**

It is no news that its use is essential to mitigate climate change, and should be a pillar of Green Tech. In addition to helping to reduce pollution, they are investments that, while they may initially seem high, achieve greater cost savings in the medium term. As examples of use for SMEs, they **can buy or consume this energy, install solar panels or use electric vehicles.** [REF-8].

4. Benefits of sustainable digital transformation

The main advantages are the following [REF-34], [REF-8]:

Sustainability

The **more sustainable use of IT** and technology in general allows for a reduction in pollution. Similarly, **the application of Green Tech with innovative solutions** to address challenges such as climate change, circularity or biodiversity protection are key to achieving the goals we have set as a country and as a society for 2030. It is the **contribution of SMEs to the global challenges of climate change and sustainability,** achieving compliance with the SDGs and the Sustainable Development Agenda for 2030.

Long-term cost savings

In addition to the contribution to environmental sustainability, the application of Green Tech and Green IT leads to cost savings for SMEs. It may involve **an initial investment, but in the long term it leads to a significant reduction in costs,** thanks to the reduction in energy consumption and the optimization and recycling of resources.

Reputation

The so-called **"green marketing"** is gaining weight in society, connecting with a growing trend of sensitivity towards sustainability and climate change. Consumers are increasingly aware of the importance of sustainability and this **"eco-friendly" label represents an added value.** In particular, the **new generations** (the so-called generation Z) are especially concerned about this issue. To achieve this reputation as a sustainable company, it is essential to have a good marketing strategy that **communicates the Green Tech or Green IT actions of the SME.** Likewise, the search for **awards and certificates** serves to strengthen this reputation.

Business opportunities

Investing in **new market niches s**uch as Green Tech allows strategic positioning and business expansion. If the future lies in innovative technologies and sustainability, combining these two worlds represents a business opportunity in an increasingly competitive world.

5. Successful cases

There are many successful cases of companies betting on digitization and sustainable innovation [REF-35]. The following are some examples of Spanish startups and SMEs:

- **Exxita:** Startup that applies Green Tech, specifically Artificial Intelligence, Big Data and Blockchain technology, working both as innovation consultants for other companies, as well as in **technology repair (laptop, Tablet, smartphone) to combat planned obsolescence.** This SME has been mentioned in national newspapers and has funding from large companies that have bet on it. **[REF-36].**

- **Cajamir:** This company from Zamora has won a €30,000 prize from an insurance company for being an example of a sustainable SME. It manages a care center for the elderly and has created a **zero-emissions building model.** It has done so with thermal insulation installations, leakage control and low energy consumption. With the prize they also installed photovoltaic panels. **[REF-37].**

- **Designable:** In line with the above, this startup helps to **create 100% electric buildings that produce 0 CO2 emissions, with energy and water savings,** complying with international sustainability certificates. It works through a "Crowdbuilding" system (connecting buyers with available land and architects). **[REF-38].**

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- **Encantado de Comerte:** Start up that shows how digitalization can be used to achieve greater sustainability. It has created an **app against food waste,** publishing food lots with discounts. It has won a UN award for its implementation of the Sustainable Development Goals (SDGs). **[REF-39], [REF-40].**

- **To Good To Go:** This is another example similar to the previous one of how a startup can create a simple innovative solution that has an impact on the environment. It allows to **buy surplus food from restaurants** through surprise food packs to avoid waste. **[REF-41].**

- **Smart Biosystem:** The Andalusian SME Smart Biosystem has created an **intelligent irrigation system,** with controls and telematic monitoring from any smartphone, and this IoT application is also used by other SMEs in the agricultural sector. **[REF-42].**

- **Nax Solutions:** A startup similar to the previous one, specialized in **precision agriculture,** which with artificial intelligence can see where there are anomalies and where more water or fertilizer is needed, providing real-time images to farmers. **[REF-41].**

- **Liq**: This is a startup that uses **3D printing to create glasses with polyamide,** which allows to create more customized models, and does so under a sustainable business model. They **only manufacture what they are going to sell (no stock),** they do not waste material, compared to traditional manufacturing of glasses, and they can print isolated components of any model, extending the life of the product. **[REF-43].**

- **ClimateTrade**: A platform that **connects large companies seeking to offset their carbon emissions with a wide variety of verified environmental projects.** They use **blockchain** technology to ensure the traceability of their projects. Their main objective is to support companies on their path to carbon neutrality by providing "carbon offsetting" services. **[REF-41].**

- **CO2 Revolution:** Through the use of drones they calculate the carbon footprint of institutions and companies, to compensate through reforestation projects. They use Big Data and drones to plant trees by launching intelligent seeds. **[REF-41].**

6. Conclusion

Green Tech and Green IT are **key present and future concepts for SMEs**. It is about joining the double green and digital transition.

For SMEs and startups, it represents a way to **contribute to sustainable development, mitigating the climate impact of energy use and turning it around to increase energy efficiency and make intelligent use of resources.** These are changes and investments that result in cost savings. In addition, positioning itself as a sustainable digitization company contributes to generate a **good brand reputation** that translates into growth for the business.

Within **Green IT,** the migration of computer systems and applications to the **Cloud** stands out, which can not only reduce the carbon footprint, but also represents other advantages for the company, such as ease of access from anywhere. In addition, there are other ways to apply IT in a sustainable way, such as choosing **products that avoid planned obsolescence** and configuring them to save energy.

Green Tech goes one step further, and seeks to use cutting-edge and innovative technology that contributes to more sustainable solutions, **driving green growth and a circular economy** that takes advantage of all resources and reduces waste. We find solutions such as **IoT (Internet of Things), 3D printing or Artificial Intelligence. Cutting-edge technologies that until recently sounded like science fiction and that today many SMEs and startups apply in their businesses in new market niches.**

These technologies have the potential to be used to achieve very precise monitoring of resources and manage them efficiently (IT, AI...) as well as to create only the products that are needed with sustainable materials, avoiding travel costs (3D printing).

SMEs, microenterprises or startups can join the change in many different ways, and while not all of them will become great innovators in the fight against climate change, small transformations such as a more responsible use of energy, a shift to Cloud applications or a reduction of paper printing are already advances to be implemented to help mitigate climate change and build a greener and more sustainable future..

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