

SUCCESS STORIES





connects
science meets business



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ABOUT BSC...

The Barcelona Supercomputing Center-Centro Nacional de Supercomputación (BSC-CNS) is the leader in supercomputing in Spain and home to the MareNostrum5, one of Europe's most powerful supercomputers.

4 scientific departments

Computer Sciences
Earth Sciences
Life Sciences
CASE

+1200
people

+1000
researchers

+50
teams

+100
research
lines

Transferring knowledge to the business sector

At BSC, we continuously seek innovative ways to effectively transfer our knowledge to the business sector.

As a public research center, our mission focuses on advancing science rather than directly commercializing technologies. To date, we have collaborated with companies by providing services during the early stages of technology development.

But what if we empower businesses to operate independently in the future?

Can we explore new models of collaboration that amplify the impact of our research, ensure its long-term sustainability, and facilitate its seamless integration into the market?



ABOUT BSC CONNECTS...

The BSC Connects program aims to build medium to long-term strategic alliances in order to accelerate the adoption of disruptive solutions based on supercomputing and artificial intelligence.

These partnerships will be driven by the implementation of small working teams in a hybrid company-BSC format.

Additionally, the program promotes a distinctive learning model within a singular research center, focused on business-oriented results.



Science to identify future challenges and the countless possibilities.

DIGITAL INNOVATION AND AUTOMATION IN KEY SECTORS

ABOUT THE CASES

This section includes cases that stand out for their ability to drive digital transformation and innovation through advanced technologies, such as artificial intelligence, 5G networks and climate prediction.

These case studies not only optimize processes within specific sectors, such as cybersecurity and industry, but also show

strong potential for technology transfer to a variety of other sectors, from logistics to retail. This adaptability and applicability in multiple contexts underscores the importance of these technologies in contemporary digital transformation.

INCLUDED CASES:

- Climate prediction: exponential sales growth and process optimization.
- Improved cybersecurity: rapid threat detection and cost reduction.
- Industrial plant operations optimization: improved safety and efficiency.

CLIMATE PREDICTION: EXPONENTIAL SALES GROWTH AND PROCESS OPTIMIZATION

Sector: Retail / sport.

Applied technology: Climate prediction.

ABOUT THE COMPANY

Leading company in the multi-sport retail market, with two main operating areas: creation and manufacture of sports products and distribution and sale of these products, both online and in physical stores.

CHALLENGE

Climate variability throughout the year poses a significant challenge for the development of **sales plans, inventory management and personnel allocation** for the purchase of raw materials and distribution of stock in the retail chain.

BSC SOLUTION

The Earth System Services group proposes to **deliver climate predictions at various time scales** - weeks, months, seasons and years - incorporating variables and indicators relevant to seasonal sports and to **generate reports in a language that is accessible to the company.**

OUTCOMES

1.

Distribution and geographic optimization of in-store inventory, making it more efficient and reducing logistics costs according to the season.

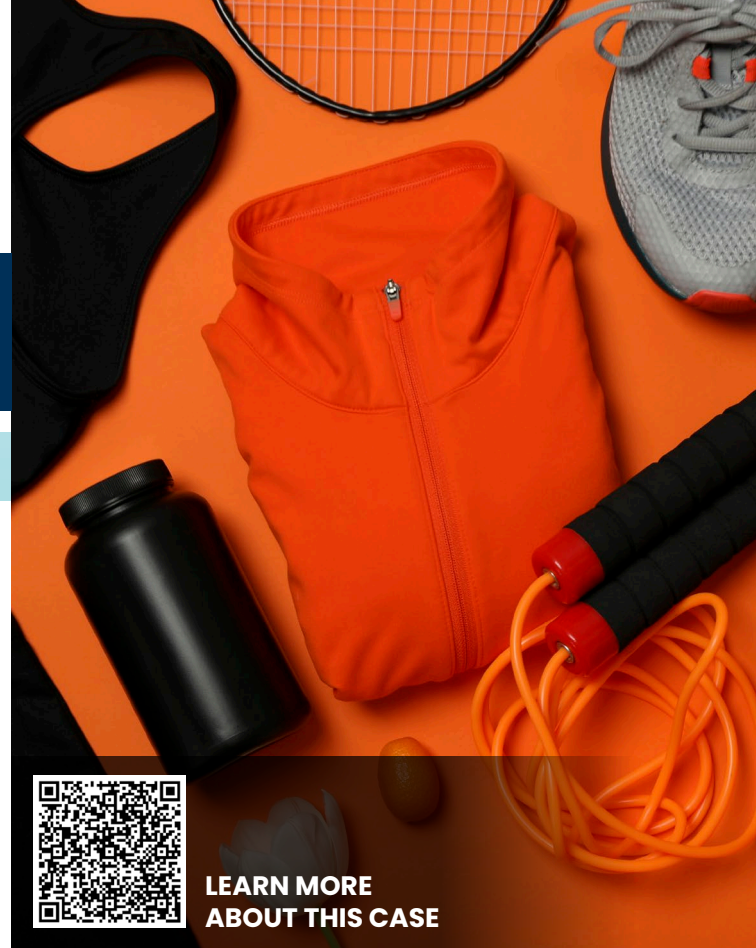
2.

Management, hiring and training of personnel according to the needs foreseen for each season.

3.

Prediction of optimal conditions for cotton cultivation to facilitate the purchase decision for garment manufacturing.

+14% INCREASE IN SALES



LEARN MORE ABOUT THIS CASE

BENEFITED AREAS



Logistics



Commercial



Purchasing Department



Human Resources

TRANSFER POTENTIAL



Logistics



Retail



Food industry

IMPROVED CYBERSECURITY: RAPID THREAT DETECTION AND COST REDUCTION

Sector: Cybersecurity.
Spin-off: Qbeast.

Applied technology: AI-based data design.

ABOUT THE COMPANY

Qbeast - a BSC spin-off reduces computational costs and optimizes data storage for analytical and AI workloads, accelerating queries regardless of the data format. This is achieved by integrating the scalability of big data software with the high performance of information technologies.

CHALLENGE

Qbeast's client is a well-known cybersecurity company, and its platform must **process vast amounts of data** to protect its clients. However, managing and accessing this data was challenging: their **storage solution couldn't handle the load, integrating and using tools was difficult, verifying data took too much time and resources, and data processing speeds were very slow.** All these factors posed a risk to their clients, potentially exposing them to cyberattacks.

BSC SOLUTION

Qbeast enabled its client to operate with maximum efficiency by optimizing storage through the **implementation of larger indexed files.** It also integrated an **easy-to-use platform** for managing data and cloud infrastructure, **optimized file monitoring and secondary processes** by eliminating unnecessary operations and **provided powerful visibility tools.** This allowed the company to focus on protecting its clients from sophisticated cyber threats.

LEARN MORE ABOUT THIS CASE



OUTCOMES

1.

Reduction of query processing time **from 38 minutes to 1 minute**, optimizing threat detection speed.

2.

Improvement in **data management, performance, and cost** by optimizing file size and reducing the number of files required for queries.

3.

Better monitoring, visibility, and quick issue resolution thanks to Qbeast's Universal Storage Engine, which allows data to be viewed from a new perspective.

-97% REDUCTION IN QUERY PROCESSING TIME

BENEFITED AREAS



Operations



Data Analysis



Product Development



Information Technology

TRANSFER POTENTIAL



Health



Retail



Finance



Manufacturing

INDUSTRIAL PLANT OPERATIONS OPTIMIZATION: IMPROVED SAFETY AND EFFICIENCY

Sector: Industry.

Spin-off: Nearby Computing.

Applied technology: 5G and private networks.

ABOUT NEARBY COMPUTING

Nearby Computing - a BSC spin-off - helps Telcos and enterprise customers to unlock the potential of Edge Computing technology by orchestrating and automating Multi-access Edge Computing (MEC) and 5G. Its NearbyOne orchestration platform exceeds market standards by managing all levels of the network, from the cloud and data center to the network edge, from a single interface.

CHALLENGE

Factories and critical industrial environments face significant challenges due to their high-risk nature and the constant need to monitor people, vehicles, and assets. A clear example is the difficulty in tracking trucks carrying hazardous materials within the facility, where maintaining connectivity or resolving technical issues in real time remains a challenge.

BSC SOLUTION

Nearby Computing delivers a 5G + Edge computing solution that simplifies the integration of next-generation applications and enables companies to implement use cases tailored to their specific needs, such as video analytics, precise geolocation, critical communications, and remote assistance with VR, among others.

OUTCOMES

1.

The flexible size of the solution allows for **lower CAPEX** and remote orchestration services allow for **controlled OPEX**.

2.

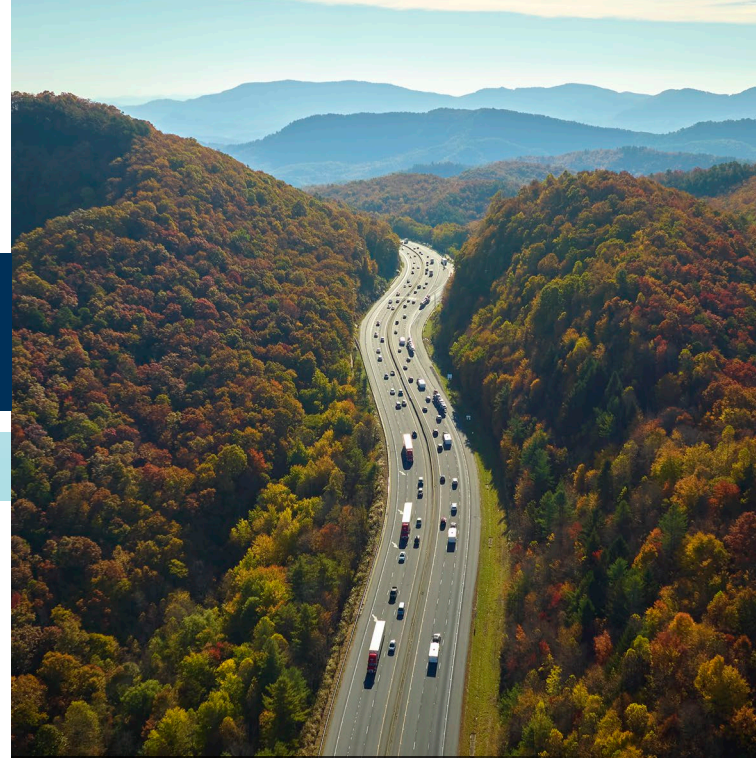
Automated vehicle guidance through an LED screen that displays directions, powered by a routing algorithm and video analysis technology.

3.

Improved overall efficiency in preventive and corrective maintenance using an App with AR technology, enabling remote team assistance.

EDGE COMPUTING BENEFITS

- Increased privacy and security
- Lower latency
- Increased bandwidth



**LEARN MORE
ABOUT THIS CASE**

BENEFITED AREAS



Maintenance and Safety



Finance



Operations



Logistics

TRANSFER POTENTIAL



Automotive Sector



Energy Sector



Mining



Retail

HEALTH AND BIOTECHNOLOGY

ABOUT THE CASES

This section presents cases that illustrate the impact of innovation in the field of health and biotechnology, including the accelerated development of vaccines and biotechnology.

This example not only improves the ability to anticipate and respond to public health challenges, but also demonstrates a high technological transfer potential to other sectors, such as pharmaceuticals and

biomedical research. Moreover, by integrating new digital and sustainable tools, these advances underline the central role of biotechnology in the future of personalized medicine and in the optimization of healthcare resources.

INCLUDED CASES:

- Transformation in vaccine production.

TRANSFORMATION IN VACCINE PRODUCTION

Sector: Health.

Colaboradores: IrsiCaixa e IRTA-CreSA.

Applied technology: Electronic and atomic protein modeling.

CHALLENGE

The rapid mutation of viruses allows them to quickly develop resistance, necessitating the faster development of new vaccines. Protein-based vaccines work by introducing a **viral protein** into the body to stimulate an immune response without causing disease. However, **these proteins can be unstable**, meaning they may lose their shape and functionality, which are critical for the immune system to recognize them and generate an effective response. To address this, **stabilizing mutations have been introduced to help these proteins maintain their native structure**. Nonetheless, these stabilizing mutations **occur at very low levels**, making it crucial to explore alternatives that enhance their production, thereby improving protein stability and enabling the development of effective, safe, and accessible vaccines.

BSC SOLUTION

Using supercomputing techniques, **researchers are able to identify mutations that enhance protein stability**. This increases the production capacity of these proteins, **leading to improvements in vaccine quality**.

These improvements are reflected both in the strength of the immune response generated and in the standardization of vaccine doses.

OUTCOMES

1.

Highly effective vaccines with **production levels up to 5 times higher** than currently marketed vaccines based on the same protein.

2.

High-volume vaccine production with improved resistance to degradation, extending shelf life during storage and transportation.

3.

Potential of the variant to optimize molecules for commercialization, **reducing production time and costs**.

5x INCREASE IN IMMUNOGEN PRODUCTION



BENEFITED AREAS



Logistics



Commercial



Human Resources

TRANSFER POTENTIAL



Pharmaceutical Industry



Promotion of R&D+I



Health and Wellness



ENERGY AND SUSTAINABILITY

ABOUT THE CASES

This section showcases cases that highlight the power of supercomputing and digital innovation in transforming key sectors of energy and sustainability. From optimizing energy consumption in data centers to improving the accuracy of wind farm production estimates, these examples underscore the use of advanced technologies to drive efficiency and minimize environmental impact.

Additionally, the application of innovative techniques in resource detection, such as oil and gas, demonstrates the potential of these solutions to maximize energy utilization responsibly.

INCLUDED CASES:

- Energy optimization and sustainability in high-performance data centers.
- Enhancing wind farm production estimates with supercomputing.
- Revolutionizing oil and gas detection techniques with supercomputing.
- Climate predictions for viticulture sustainability and adaptive strategies.

ENERGY OPTIMIZATION AND SUSTAINABILITY IN HIGH-PERFORMANCE DATA CENTERS

Sector: Energy.
Spin-off: EAS.

Applied technology: Energy optimization.

ABOUT EAS

Energy Aware Solutions (EAS) a spin-off from BSC and the Polytechnic University of Catalonia offers advanced solutions to improve energy efficiency in data centers, reducing energy bills and CO₂ emissions, while optimizing the system's energy performance.

CHALLENGE

Data centers and research facilities handle massive databases and require **supercomputers that often consume energy similar to that of a small city**. However, manufacturers of these systems usually prioritize speed over energy optimizations and efficiencies, leading to a **lack of transparency in energy consumption** and making it **difficult for centers to manage resources efficiently**.

BSC SOLUTION

EAS develops the EAR (Energy Aware Runtime) software **to monitor, control, and optimize energy usage, reducing CO₂ emissions** in high-performance data centers. EAR **enhances energy performance** through advanced policies and non-intrusive monitoring, ensuring operational limits and **improving the data center's sustainability**.

OUTCOMES

1.

10% reduction in energy bills, operational cost savings, and a decrease in CO₂ footprint.

2.

Energy consumption optimization without compromising performance, enhancing data center productivity and efficiency.

3.

Detailed and transparent monitoring of energy consumption and application performance, providing accurate insights for decision-making.

10% REDUCTION IN ENERGY COSTS



LEARN MORE ABOUT THIS CASE

BENEFITED AREAS



Operations



Finance



Management

TRANSFER POTENTIAL



Research centers



Universities with HPC Technology



High-Performance Data Centers



ENHANCING WIND FARM PRODUCTION ESTIMATES WITH SUPERCOMPUTING

Sector: Wind energy.

Applied technology: Advanced fluid mechanics methods using supercomputers.

ABOUT THE COMPANY

A leading renewable energy company with extensive experience in developing and operating wind energy projects, both onshore and offshore.

CHALLENGE

The company faced significant challenges in **estimating energy production in wind farms** due to the **limitations of current models** in calculation time and the resolution of physical models. These issues not only increased **uncertainty in decision-making** but also heightened the **risk when investing** in new wind energy projects.

BSC SOLUTION

Development of a project utilizing **advanced supercomputing techniques** to overcome time limitations in current model calculations. This significantly **improves estimation accuracy and enables the identification of optimal locations** for wind turbine installation, allowing for **more reliable wind farm design**.

OUTCOMES

BENEFITED AREAS



Operations and Maintenance



Finance and Investments



Project Planning and Development

TRANSFER POTENTIAL



Solar Energy



Mining



Precision Agriculture

1.

Optimization of onshore and offshore wind farm production estimates throughout their entire lifecycle, enhancing overall efficiency.

2.

Reduction of investment uncertainty in these projects, thanks to the guarantees provided by new wind energy installations.

3.

Improved estimation of electricity production in wind farms before construction, reducing uncertainty in decision-making.

5% REDUCTION IN WIND PREDICTION ERRORS

REVOLUTIONIZING OIL AND GAS DETECTION TECHNIQUES WITH SUPERCOMPUTING

Sector: Oil and gas.

Applied technology: Geophysics.

ABOUT THE COMPANY

An energy multinational with operations in over 90 countries, offering a wide range of products and services. The corporation drives digital projects to foster innovation and technological transformation.

CHALLENGE

The company detects oil and gas using technologies that explore the subsurface; however, **these technologies are not fast or effective enough**. This presents a **challenge in exploring complex areas**, leading to considerable **costs and negative impacts on the ecosystem**.

BSC SOLUTION

The Kaleidoscope project uses high-performance computing to process large volumes of data and **produce and interpret subsurface images**. This technology employs seismic and electromagnetic methods, enabling the **creation of reliable seismic images significantly faster** than other companies in the sector.

OUTCOMES

1.

Development of a technology capable of processing seismic data **15 times faster** than other companies in the sector.

2.

Identification of new oil and gas deposits thousands of meters below the surface, without the need to drill into the Earth's crust, thus **preserving the environment**.

3.

The Kaleidoscope project has received awards such as **the Platts Award and the Innovation Award** and has also been recognized by the IEA as **one of the most innovative projects globally**.

70 Million Euros

IN SAVINGS THROUGH COST REDUCTION



LEARN MORE ABOUT THIS CASE

BENEFITED AREAS



Energy



Information Technology



Innovation and Development



Operations & Logistics

TRANSFER POTENTIAL



Mining



Construction



Civil Engineering



Geothermal Energy Industry



CLIMATE PREDICTIONS FOR VITICULTURE SUSTAINABILITY AND ADAPTIVE STRATEGIES

Sector: Viticulture.

Applied technology: Continuous/integrated climate predictions.

ABOUT THE COMPANY

A producer of high-quality wines and cavas, the company stands out as one of the oldest wineries in the region. Additionally, it is one of the largest vineyard owners in Europe and a leader in sustainable practices within its sector.

CHALLENGE

The company's wineries and vineyards face numerous challenges due to **climate change**, requiring them to **adjust their production processes and business strategy** to adapt to climate shifts and ensure environmental sustainability.

BSC SOLUTION

The European project ASPECT develops an innovative solution that will generate **robust climate predictions** ranging from the **upcoming months to the next 30 years**, integrating different temporal and spatial scales to **support decision-making and the development of adaptation strategies**.

LEARN MORE ABOUT THIS CASE



OUTCOMES

1.

Ability to anticipate unusual weather conditions and effectively adapt agricultural practices.

2.

Development of more efficient soil conservation and water management strategies, promoting environmental sustainability in its vineyards.

3.

Effective and efficient planning of future investments in infrastructure and innovative technologies.

BENEFITED AREAS



Logistics



Commercial



Human Resources

TRANSFER POTENTIAL



Agriculture



Finance



Governance



Insurance

CLIMATE PREDICTIONS FOR THE NEXT **30 years**



SIMULATIONS AND ADVANCED MODELLING

ABOUT THE CASES

This section presents cases where simulations and advanced modeling act as catalysts for innovation, enabling the optimization of complex processes across different sectors.

From the aerodynamic design of vehicles, which leverages precise simulations to improve efficiency and reduce emissions, to urban planning, where advanced modeling enables the development of more sustainable environments that are better suited to current needs.

Additionally, the use of these tools in climate risk analysis and management offers companies a strategic advantage, helping them make informed decisions and mitigate potential impacts.

INCLUDED CASES:

- Simulations and supercomputing to optimize vehicle's aerodynamics.
- Urban development optimization: improvement in planning and sustainability.
- Climate risk analysis and management: optimization of business decisions.



SIMULATIONS AND SUPERCOMPUTING TO OPTIMIZE VEHICLES' AERODYNAMICS

Sector: Automotive.

Applied technology: Large-scale computational fluid dynamics.

ABOUT THE COMPANY

A car manufacturer, part of an important international automotive group, that has a presence in over 70 countries through an extensive network of dealerships. In recent years, it has positioned itself as one of the leading exporters from its home country.

CHALLENGE

Improving a car's aerodynamics in order to make it safer and more efficient involves reducing its aerodynamic drag coefficient. To achieve this, **full-scale clay models** are currently used – which tend to **deteriorate and require frequent changes** – along with simulations and **wind tunnel** tests. This whole process is quite **costly**.

BSC SOLUTION

The Large-Scale Computational Fluid Dynamics group conducted **aerodynamic studies** on one of their models. They introduced the geometry of the wheel - converted into grid points- into the supercomputer, where each point was analyzed by a set of processors working in parallel. This way, they were able to **simulate not only the moving tire but also its behavior under different circumstances**.

LEARN MORE ABOUT THIS CASE



OUTCOMES

1.

Significant **improvement in efficiency** thanks to processors working in parallel, allowing the study to be completed in **hours instead of months**.

2.

Cost reduction by decreasing the use of hours of test in the wind tunnel, as well as the need for full-scale clay prototype prints.

3.

More sustainable vehicles, by reducing their fuel consumption and CO₂ emissions, as well as **safer** thanks to the aerodynamic improvements made using simulations.

98% REDUCTION IN CALCULATION TIME

BENEFITED AREAS



Logistics



Commercial



Engineering



Human Resources

TRANSFER POTENTIAL



Aeronautics



Insurance



Industrial Sector

URBAN DEVELOPMENT OPTIMIZATION : IMPROVEMENT IN PLANNING AND SUSTAINABILITY

Sector: Public administration.

Projecto: vCity.

Applied technology: Urban digital twins (UDT).

ABOUT vCity

vCity is an integrated platform for creating Urban Digital Twins that enables the analysis of hypothetical scenarios, providing urban planners with a multi-layered view of a city. Its holistic approach helps policymakers make data-driven decisions and build sustainable, people-centered cities.

CHALLENGE

The city council faces significant challenges in planning and managing **urban projects** due to the **complexity and interdependence** of these systems. Moreover, evaluating the impact of new developments on the city's **mobility, access to public services, sustainability and reduction of the carbon footprint** is crucial.

BSC SOLUTION

The vCity platform develops an **urban digital twin** that allows for the creation of virtual replicas of real cities. With vCity, the city council can **simulate different scenarios, evaluate impacts, and make adjustments before implementing** projects, ensuring a more efficient and sustainable urban planning.

OUTCOMES

1.

Improvement in urban **planning** by being able to design and adjust projects using realistic and accurate simulations that enhance decision-making and the effectiveness of development.

2.

Cost reduction and **resource optimization** by anticipating challenges or problems and optimizing projects before their implementation.

3.

Facilitating the **compliance with regulations** and promoting **sustainable practices**, resulting in more responsible and environmentally friendly urban developments.

BENEFITS OF vCity

- Being part of vCities network
- Receiving BSC's support
- Receiving training



LEARN MORE
ABOUT THIS CASE

BENEFITED AREAS



Bike Lane
Networks



Urban
Mobility



Sustainability



Proximity
Cities

TRANSFER POTENTIAL



City Councils



Regional
Governments



Autonomic
Governments



National
Governments



CLIMATE RISK ANALYSIS AND MANAGEMENT: OPTIMIZATION OF BUSINESS DECISIONS

Sector: Real estate, finance, industrial sector, insurance.

Spin-off: Mitiga Solutions.

Applied technology: AI and simulations.

LEARN MORE
ABOUT THIS CASE



ABOUT MITIGA

Mitiga Solutions combines science, artificial intelligence and high-performance computing to generate intelligence on climate risks, helping its clients understand and act on their exposure to climate risk through its EarthScan™ SaaS platform and their high-precision risk models.

CHALLENGE

New European regulations, such as the CSRD and SFDR, are compelling companies to assess and manage their exposure to climate risks while facing challenges like making informed and sustainable investment decisions, which require advanced tools to analyze large volumes of climate data and project future scenarios.

BSC SOLUTION

Mitiga Solutions – a BSC spin-off – commercializes EarthScan™, a SaaS platform designed to analyze, report, and act on the exposure of physical assets to climate risks. This platform allows companies to obtain personalized information on seven types of climate risks across different time horizons and climate scenarios, in a matter of seconds.

OUTCOMES

1.

Regulatory compliance with the European CSRD and SFDR regulations, ensuring adherence to climate risk disclosure and management requirements.

2.

Improvement in the investment decision-making process thanks to detailed and personalized information on climate risks.

3.

Efficient and effective resource planning and management by identifying climate risks across different temporal horizons.

5 billion Euros IN ASSET VALUE ANALYZED BY EARTHSCAN

BENEFITED AREAS



Risk Management



Legal Departments



Finance



Operations

TRANSFER POTENTIAL



Financial Entities



Insurance Providers



Energy Sector



Real Estate Industry



Industrial Sector



Asset Management & Private Equity



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Hosting Consortium:



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