



Data Science and Complexity 2026

Fundamental science applied to business: Driving innovation in IT companies

TECHNOLOGY
WITH SOUL



WE CREATE TECHNOLOGY WITH SOUL, AT THE SERVICE OF PEOPLE AND BUSINESSES.

4.980 PROFESSIONALS
*Data as at 31 December 2025

One of the technology companies with the lowest staff turnover

285 MILLION EUROS
in revenue in 2025

CERTIFICATIONS



AMÉRICA

USA:

- New York
- Miami

Colombia:

- Bogotá
- Cartagena de Indias

Chile:

- Santiago de Chile

Argentina:

- Buenos Aires

México:

- México City
- Monterrey
- Querétaro

Rep. Dominicana:

- Santo Domingo

Brazil:

- Rio de Janeiro
- São Paulo

EUROPA AND ÁFRICA

United Kingdom:

- London
- Manchester
- Milton Keynes
- Glasgow

France:

- Paris

Germany:

- Frankfurt

Italy:

- Rome
- Milan

Portugal:

- Lisbon
- Évora
- Oporto

Poland:

- Warsaw

Morocco:

- Tangier

A 360° ECOSYSTEM OF INNOVATION AND DEVELOPMENT

AI · Development, Delivery and

Hyperautomation · Data ·

Customer first · Architecture and

DevOps · Systems · Cybersecurity ·

Product · SAP · Accessibility · Digital ·

Managed Services · R&D+i

We provide services to over **80%** of the **IBEX35**

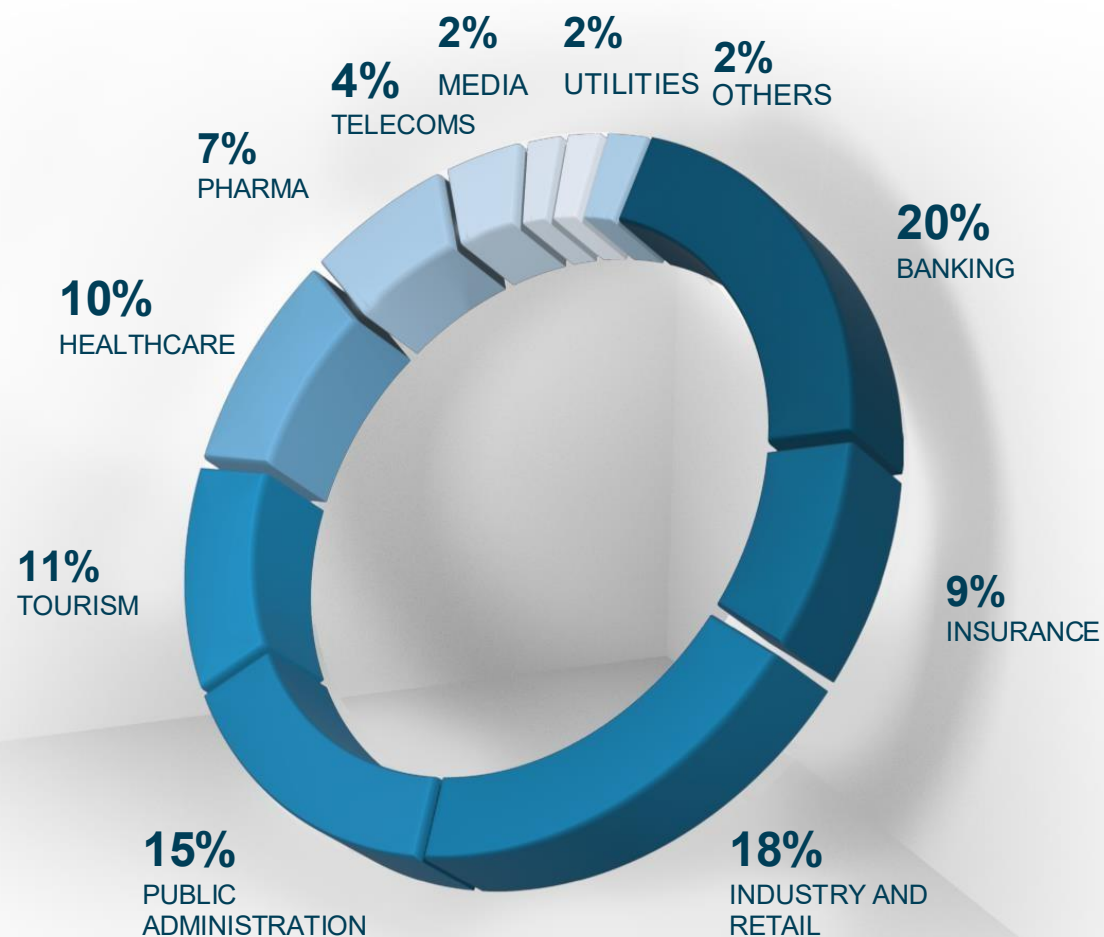
Extensive specialisation and expertise in Banking, Insurance, Industry, Retail, Hospitality and Travel, Social Services, and Healthcare.

End-to-end solutions through a cross-functional integration of capabilities.

**One single partner,
all processes**

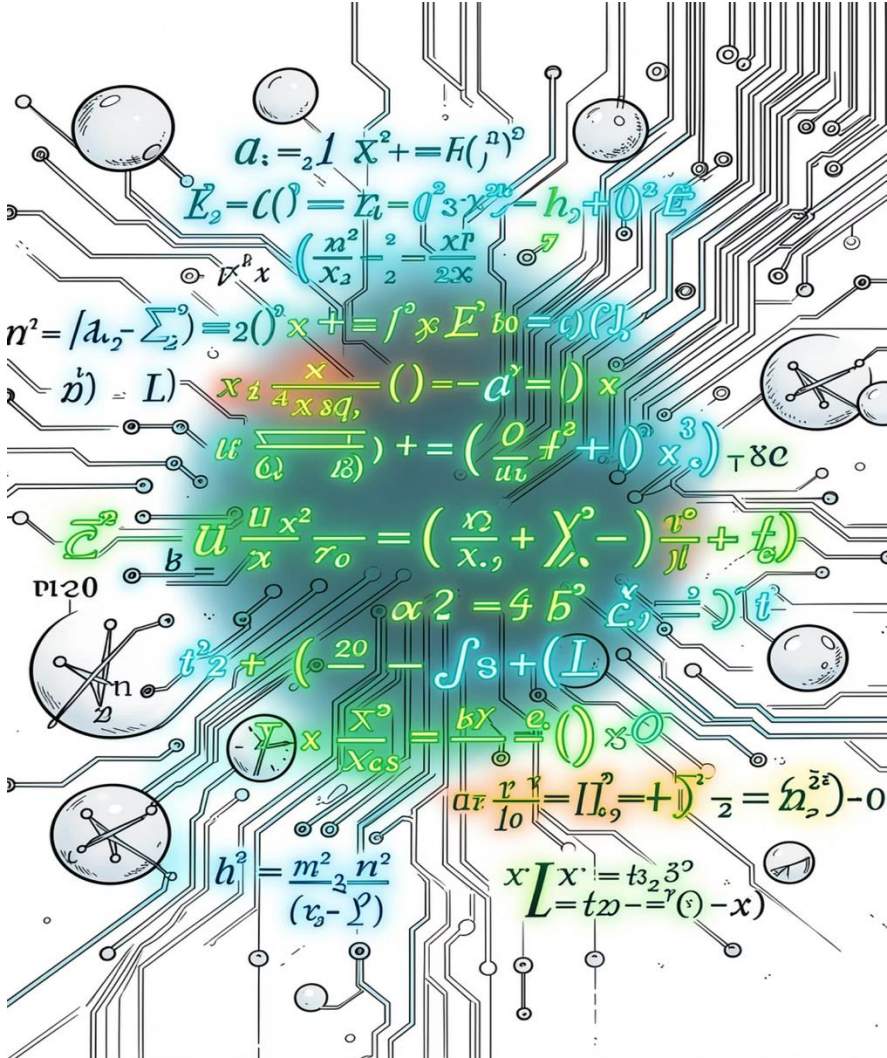
MAIN SECTORS IN WHICH WE OPERATE

Revenue diversification in recent years has positioned us in the main sectors, growing continuously and in a balanced manner.



Fundamental Science and Technology

The intersection of mathematics, physics, and computer science is not a vague abstraction, it manifests at specific, identifiable points where **theory becomes the basis of every system.** From the abstract machines of Turing to the silicon transistors in every processor, from Boolean algebra to Shannon's information theory, each breakthrough rests on a precise mathematical or physical insight. This presentation traces the most consequential connections between foundational science and the digital world we inhabit.



The Invisible Engine

Most people treat technology as pure magic, something that just works. Most ICT professionals treat technology as a craft, a set of tools to be assembled. **But beneath every system lies a rigorous mathematical and physical substrate.**

What We'll Explore

- ✓ The mathematical laws governing information flow.
- ✓ How physics constraints shape system architecture.
- ✓ Real-world examples of theory application, that can drive billion outcomes.
- ✓ The transition from artisanal coding to scientific engineering.

Why It Matters

Organizations that understand the theoretical basis of their systems make better architectural decisions, anticipate failure modes earlier, and innovate with greater precision. IT is not just about models, it is about the physics and mathematics behind.

Science and Software Development

Cutting-edge software isn't just code: it's physics, mathematics, and logic applied to real-world problems.
Every sophisticated digital product hides scientific equations and principles at its core.



Video games and digital cinema rely on optics, equations of motion, collisions, light refraction, and fluid dynamics, calculated in real time to generate believable visuals.



Linear algebra and neural networks allow for the **detection of tumors, the analysis of X-rays, and the diagnosis of diseases** with an accuracy that surpasses many human specialists.



Computational complexity determines whether an algorithm is feasible at a real-world scale. Mathematics is the difference between the possible and the impossible.

Mathematics and business: Beyond the Code

Applied mathematics is a direct business tool. Companies that master it optimize resources, anticipate scenarios, and manage risks with scientific precision.



Linear programming and graph algorithms solve routing, inventory, and distribution problems. Logistics companies save millions annually thanks to combinatorial optimization.



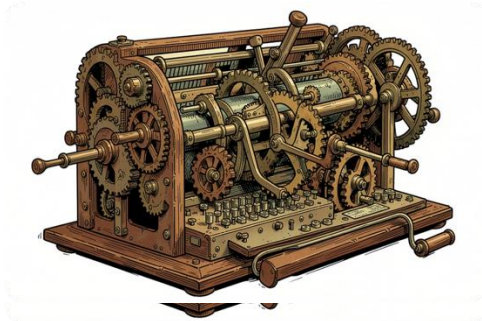
Statistics and ML allow us to anticipate market trends, product demand, and customer behavior. Regression, inference, and time series are everyday tools in data-driven companies.



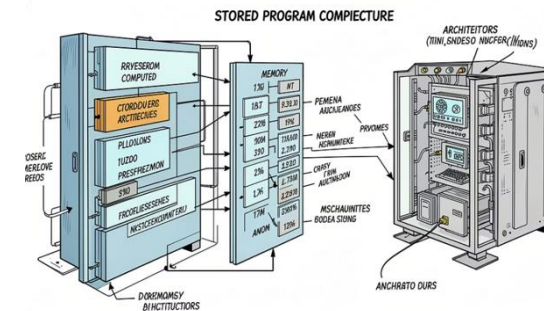
Value at Risk (VaR) models and Monte Carlo simulations are mathematical cornerstones of modern banking, without them global banking will be impossible.

Mathematical Foundations of Computing

Before a single transistor was built, two mathematical frameworks had already defined **what computation is and how a machine should be structured to perform it.**



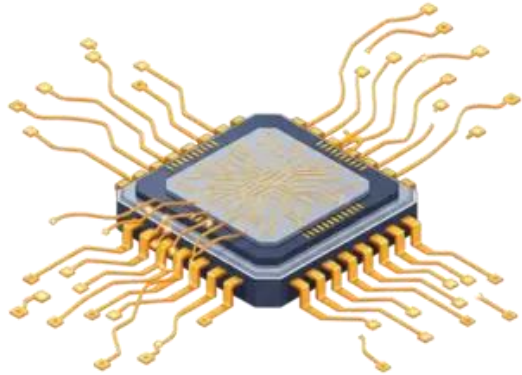
Alan Turing proposed an abstract device that reads and writes symbols on an infinite tape according to a finite set of rules. This model captures the essence of any algorithmic process.



John von Neumann formalized the structure of a stored-program computer: a central processing unit (CPU), memory holding both data and instructions, and input/output mechanisms. This model became the blueprint for virtually every computer built since, enabling the software revolution.

Logic, Algebra, and the Birth of ICT

Boole's algebraic formalization of logic provided the foundation that Shannon's used to represent and manipulate binary information, forming the **core of modern digital computing and ICT**.



George Boole developed an algebraic system where variables take only the values true (1) or false (0), operated on by AND, OR, and NOT. **Claude Shannon** demonstrated that Boole's algebra maps directly onto electrical switching circuits, transforming abstract logic into physical hardware, forming the foundation of all digital circuit design.



Claude Shannon's paper "A Mathematical Theory of Communication" introduced the bit as fundamental unit of information and defined channel capacity and entropy. He proved information could be quantified, compressed, and transmitted over noisy channels if error-correcting codes were used. His work is the basis of all modern comms and storage.

Reliability and Abstraction

Two additional mathematical breakthroughs address the twin challenges of **trustworthy data and computational expressiveness** - both essential to modern ICT.



Richard Hamming developed a family of codes that not only detect but correct single-bit errors in transmitted or stored data. By adding carefully positioned parity bits, a Hamming code can identify and fix a flipped bit without retransmission. These codes form the basis for ensuring integrity in noisy environments.



Alonzo Church introduced lambda calculus as a formal system for expressing computation through function abstraction and application, **Church-Turing** thesis asserts that anything effectively computable can be computed by a Turing machine. It is the theoretical foundation of modern compiler design.

Mathematics & Plexus



Multi-Protocol Indoor Positioning for the Digital Era

Location data analytics platform for real-time customer information analysis, aimed at improving their shopping experience and contributing to increased sales. Using trilateration positioning algorithms for geolocation indoors with mixed protocol (BLE, UWB, WiFi, etc.) technologies.



Decision Support for Airline Fleet Optimization under Operational Uncertainties

Designing a system that evaluates real-time flight schedules, aircraft availability, business rules and operational constraints to decide whether deploying an additional plane is necessary or if adjustments to existing flights can maintain service quality, based on mathematical optimization and decision-support algorithms.

Mathematics & Plexus



Building an immersive across-countries and multi-user solution for holography and AR/VR/XR applications

Aiming to leverage the benefits of cloud computing and edge computing for virtual and augmented reality technologies, improving behavioural modeling & communication latency for these applications.



Deployment and Exploitation of Multicloud and Hybrid-Efficient AI Models

Development of a complex platform that provides a solid and realistic solution to four problems resulting from the use of Cloud & AI: energy consumption, heterogeneity of services, democratization of use and sovereignty. AI models are required to be edge-cloud efficient.

Mathematics & Plexus



Resilient Multi-Drone Network for Aerial Surveillance and Adaptive Connectivity

Coordinated multi-drone system designed for intelligent surveillance and resilient aerial communication. Includes real-time recognition, deployment of 5G communication bubbles and network traffic optimization techniques that dynamically reroute data and balance load across available nodes.



Secure Information for a New Digital Era

Development of a platform that allows the analysis of information transmitted between systems from point A to B, and application and development of encryption libraries (AES, PQC, etc.). It includes the development of optimized criterias for file-risk classification, new encryption formatting and fault-tolerance detection.

Physics and business: Limit and frontier

Computer systems are not abstract entities: they are **physical systems subject to the laws of nature**. Physics imposes fundamental barriers to computational performance.



Without quantum mechanics, there would be no transistor; without the transistor, there would be no modern information technology.



Magnetic materials and understanding **magnetic domains** allowed the **invention of magnetic tapes and HDDs**. Giant Magnetoresistance increased storage capabilities.



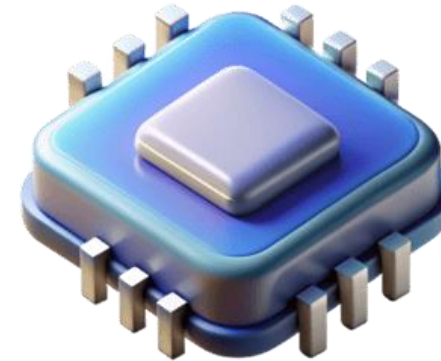
Modern networking depends on learning to control electromagnetic waves. **Internet is fundamentally an electromagnetic phenomenon.**

Physics in Every Chip

Thermodynamics sets the **energy floor for computation**, while silicon's semiconductor properties **make transistors possible**.



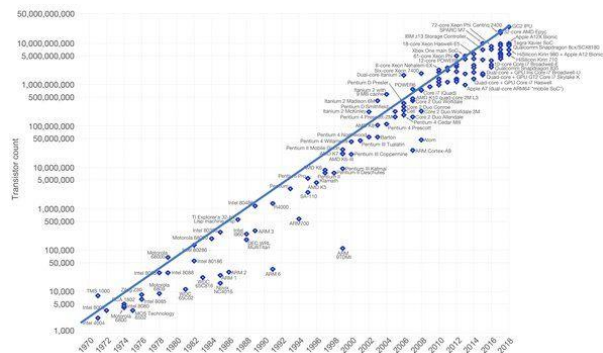
The Second Law of Thermodynamics imposes a fundamental cost on information processing. **Rolf Landauer** stated that the minimum energy needed to erase one bit of information is proportional to the temperature at which the system is operating, establishing a lower bound on computation: irreversible logic operations must generate heat.



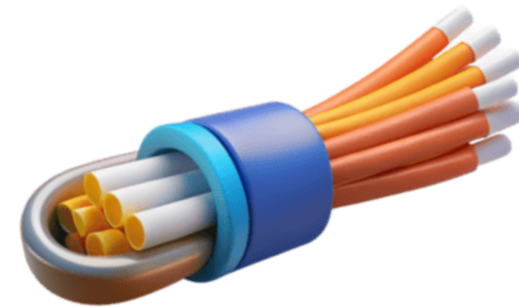
Silicon's unique structure and properties –cost, stability, quantity- makes it ideal for transistors. Doping silicon with phosphorus or boron (p-type) creates the junctions that form MOSFETs, the fundamental element of all modern processors. The ability to grow ultra-pure single-crystal silicon is what transformed theoretical switching logic into billions of transistors.

Growth and Propagation

Advancements in **device miniaturization (growth)** and **data transmission (propagation)** have driven the rapid expansion of modern information technology.



Gordon Moore observed that transistor density doubles approximately every two years, driving exponential growth in computing power while costs fall. This empirical trend has been the economic and engineering engine of the digital age, but it is now approaching physical limits imposed by atomic scales and heat dissipation.



The physics of **light propagation through glass fibers**, governed by Snell's Law and total internal reflection, enables data transmission at near-light speed with minimal loss. Low-loss silica fibers form the physical backbone of the internet, carrying terabits per second across continents.

Physics & Plexus



AI-Intensive Digital Twin Creation Platform

Development of an AI-Intensive Digital Twin Creation Platform that supports the application of a Digital Twin Development, requiring the modelization of physics-based behaviours of different models, and Validation Methodology, supported by a library of AI-based components that facilitate the creation of Composable Digital Twins.



Computing simulations of the Earth's atmo

Based on multi-source data ETLs to predict short-term weather (hours to days) and long-term climate patterns (months to decades), focused on environmental-risk heavy areas. Project based in fundamental physics, from fluid dynamics to thermodynamics to chaos theories, allowing a faster response to weather changes and emergencies.

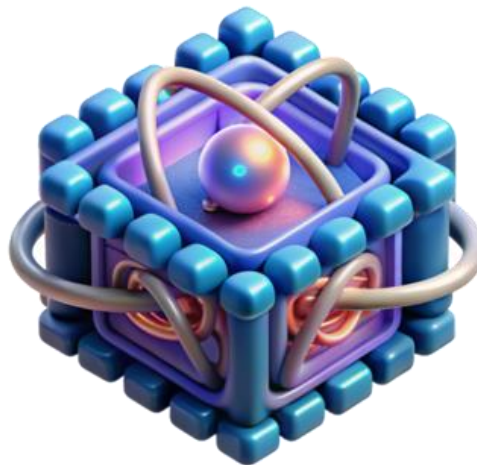
Quantum Revolution

Quantum mechanics is reshaping ICT: computation in multiple states at once, ultra-secure communication, and powering next-generation devices.

The rules of classical physics are evolving into the quantum era.

Physics & Mathematics at the core of the next generation

Quantum computers exploit **superposition, entanglement and interference**. Superposition makes the state space of n qubits grow as 2^n , enabling massive parallelism. Entanglement links qubits into a single correlated system, while quantum interference biases measurement outcomes toward correct answers.



Expected Impact on IT

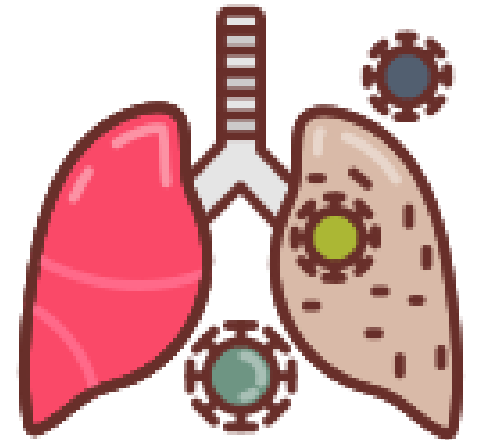
- ✓ Speedup for **integer factorization**, threatening cryptography.
- ✓ 4x increase speed for **unstructured search** of information.
- ✓ **Solving impossible problems** for classical computers due to complexity.
- ✓ New **mathematical frameworks** to secure comms.

Quantum & Plexus

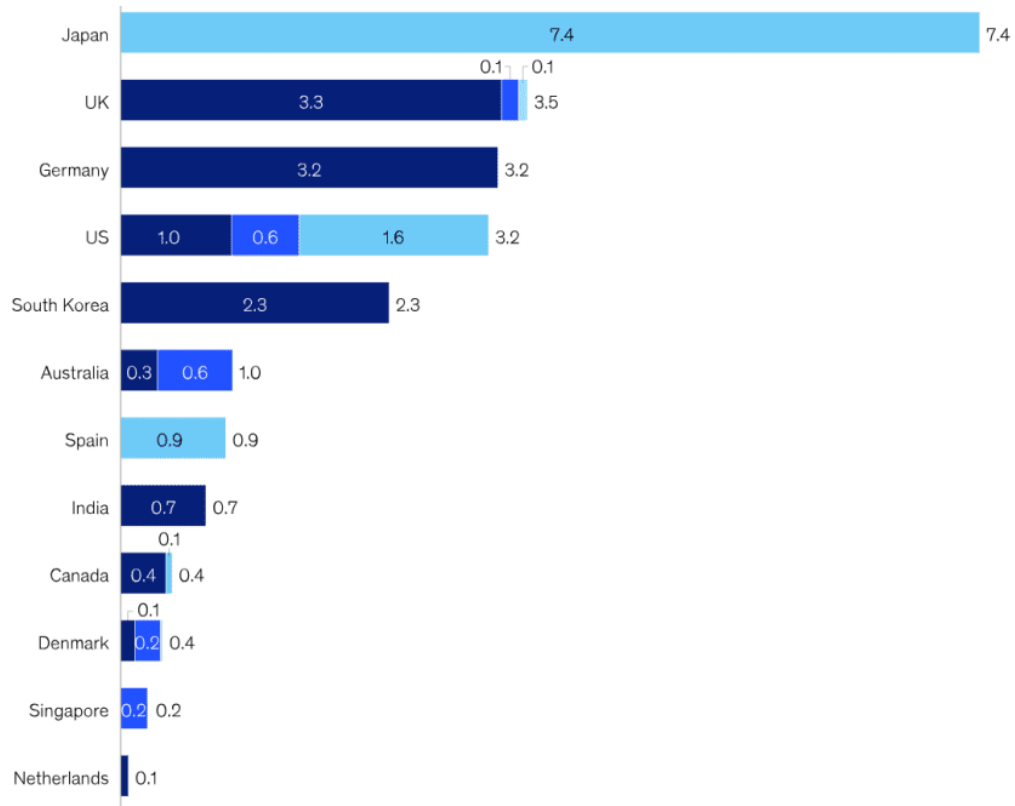
QUANTUM SOLUTIONS AND TECHNOLOGIES FOR ADVANCED AND RESILIENT SECTORS



This collaborative project focuses on basic and industrial research activities to advance (starting from a TRL of 2 and aiming for a TRL of 4) the **application of quantum technologies to generate algorithms & optimization and artificial intelligence techniques** that can solve complex problems in strategic sectors such as health, energy, and industry. Problems to be addressed include predicting risks associated with multidrug-resistant infections, improving the efficiency of electricity market management, and optimizing industrial processes.



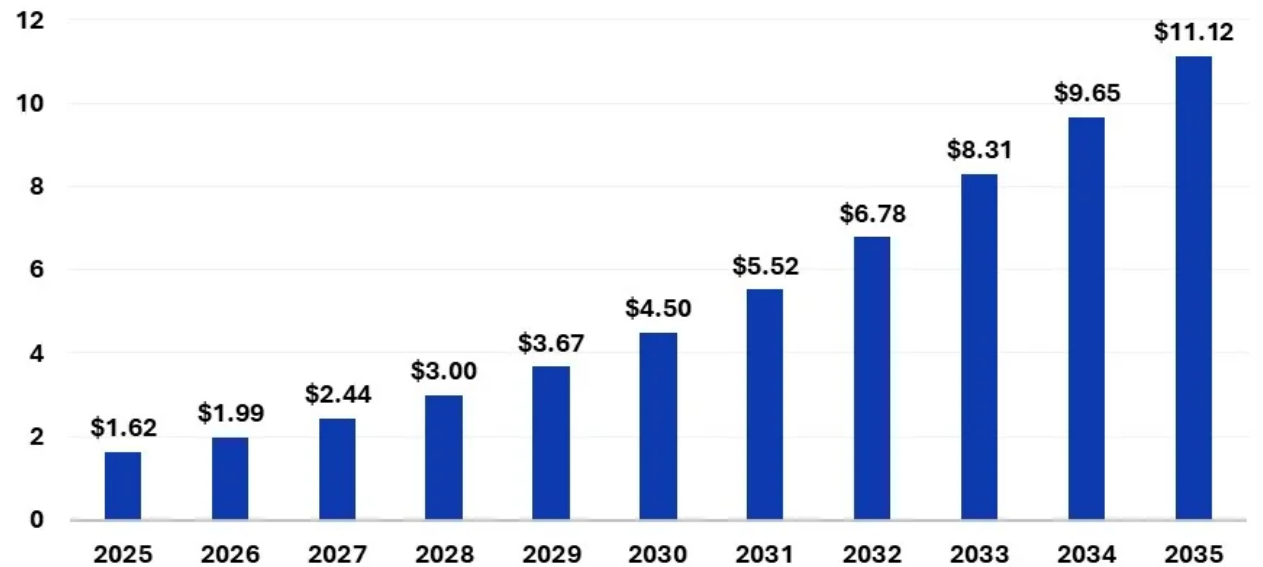
Quantum Market



Total (for selected countries) 2023: ~11.4 2024: ~1.8 2025: ~10.0



Quantum Technology Market Size 2025 to 2035 (USD Billion)



Market of ICT: From Craft to Science

The Global ICT market is anticipated to rise at a considerable rate **from 2025 to 2030, expecting to double the market share** due to digital transformation, AI adoption and specific infrastructure.

ICT expansion is driven by an annual growth rate ranging from **5.2%** to **6.2%**. COVID increased the investment rapidly across all industry, making ICT one of the top markets in the world.

2025: +4000B\$

2030: +8000B\$



The Discontinuity: From Craft to Science

The software industry is at an inflection point. The era of artisanal coding — building systems by intuition and iteration — is giving way to scientific engineering, where design decisions are grounded in information theory, complexity analysis, and statistical guarantees.

Science as a competitive advantage

Organizations that integrate scientific thinking into their DNA achieve measurable results. These cases demonstrate that **fundamental science is not an academic luxury, but a business driver.**



Cloud and Quantum for a strategic reinvention

Transformation from hardware manufacturer, nearly bankrupt in the 90s, to AI and cloud powerhouse in the 2020s, and a Quantum Pioneer now.



From gaming to a powerhouse

GPUs, originally designed for rendering graphics in gaming, are optimized linear algebra engines for DL and scientific computing. NVIDIA leveraged physics to dominate HW.



A giant network to connect everyone

Search algorithm, that works built upon a rank applied to each page based on the structure of the web, relies heavily on linear algebra calculations.

Current tensions and challenges

Despite the clear potential, **structural barriers prevent full integration between fundamental science and the business world**. Recognizing these barriers is the first step toward overcoming them.

The Gap between academia & Business

University curricula often prioritize abstract theory over practical application. Graduates in mathematics or physics frequently lack software skills and knowledge of the business context.

- ✓ Non-training real-world projects.
- ✓ Limited connection with industry.
- ✓ Undervaluation of digital knowledge.



Abstraction as a tool

ICTs operate in reactive mode: they solve immediate problems without investing in fundamental research. Disruptive advances were born from fundamental research with no immediate application.

From theory to economic value

Translating a mathematical or a physical principle into a commercial product requires a maturation process that companies are rarely willing to fund.

Innovation is about applying the fundamentals

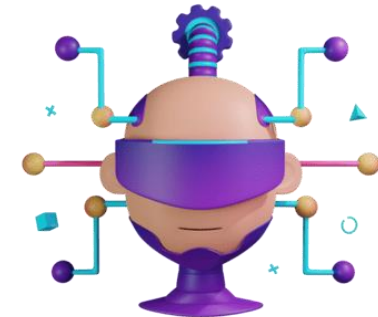
Fundamental science is not an academic luxury: it is the **hidden engine of all sustainable competitive advantage in the technology sector**. Those who understand the laws that govern technology are best positioned to lead its evolution.



Mathematics, physics, and computer science form a **virtuous triangle**. Mastering their intersections allows one to solve problems that others cannot even formulate.



It is necessary to foster **real collaborations**: internships in companies, joint R&D projects, and continuing education programs that update applied scientific knowledge.



In a world of tools that change every year, **scientific principles remain**. Investing in deep understanding is the most robust long-term career strategy.

The Professional Profile of the Future

The job market increasingly values **professionals who transcend disciplinary boundaries**. The combination of mathematical thinking, physical intuition, and programming skills is rare and highly sought after.

Interdisciplinary Talent

Companies are looking for hybrid profiles: engineers with math background, physicists capable of programming, mathematicians understanding environments, etc.

Applying the Scientific Method

Foundation of agile development and A/B testing. Teams that adopt it make decisions based on data, not intuition.



Abstraction as a tool

The ability to abstract a complex problem to its mathematical essence is a business skill. It allows you to identify patterns, generalize solutions, and communicate technical ideas effectively.

The Centaur Scientist

Requiring deep interdisciplinary expertise to bridge IT & sciences. This role demands more than just coding; it necessitates a strong foundation in mathematics, physics, and domain-specific knowledge.

Working Methodology

Our expert teams integrate
following the methodology

AGILE PODs

- ✓ We form multidisciplinary teams **(PODs)**, created ad hoc for each project and designed to scale.
- ✓ We have expert teams in various areas of expertise.
- ✓ Key strategic profiles at the CLIENT for smoother collaboration

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