

9. INTELLECTUAL CAPITAL

In an ever-changing world facing complex challenges, we aim to innovate tools and processes to provide people with simple, secure and tailored solutions.

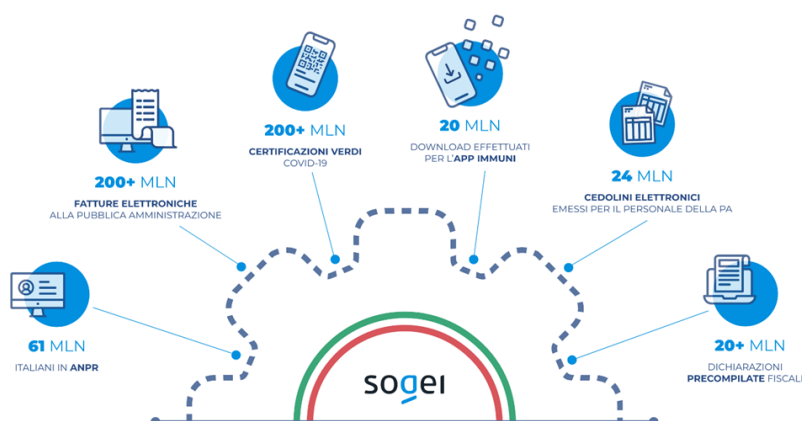
9.1 SKILLS AND KNOWLEDGE FOR INNOVATION

9.1.1 ***SOGEI FOR THE DIGITAL AGENDA***

The continuation of the pandemic has strengthened the public administration's drive towards digitisation, overcoming the residual resistance seen when Covid-19 broke out.

The pandemic has undoubtedly forced the issue, bringing with it the realisation that we have a unique opportunity to significantly modernise the way people work (the digital world increasingly supports many daily operations in both the professional and personal spheres) and, at the same time, to complete processes that, although initiated, were slow in their daily operations.

Below are some numbers that demonstrate and characterise Sogei's 2021, confirming its strategic importance and centrality in the digital transformation of the PAs: the entire Italian population, around 61 million citizens, is present in the Register of Resident Population (ANPR); 200 million electronic invoices to the public administration; over 200 million Covid-19 green certifications issued; almost 20 million downloads of the Immuni app; around 24 million payslips issued to PA staff; over 20 million pre-filled tax returns.



9.1.1.1 The PA's three-year IT plan

In December 2021, AGID published the 2021-2023 Three-Year IT Plan in Public Administration, a document for digital transformation of public administrations in the next three years.

The objectives of the 2021-2023 update, in addition to the principles of the *Government Action Plan 2016-2020*, also take into account the actions envisaged by the Tallinn *eGovernment Declaration (2017-2021)*, the indications of the new European planning 2021-2027, the 2030 targets of the Digital Compass, whose indicators measure the level of digitisation throughout the EU and detect the actual presence and use of digital services by citizens and businesses.

The plan consists of three parts, divided into thematic chapters:

- Part I - The three-year plan, consisting of an introduction, followed by a description of the strategy and an in-depth discussion of the Agency's guiding principles;
- Part II - The technological components, divided into 6 chapters corresponding to the levels represented in the Strategic Model;
- Part III - Governance, divided into three chapters describing the governance to be implemented for the digital transformation of the country and the actions to be taken by the administrations. The plan covers topics such as national IT infrastructure, interoperability model, PA platforms and data, information security, ecosystems, tools for generation and dissemination of digital services, digital transformation management.

9.1.1.2 Sogei's activities for Digital Agenda

Sogei, through its activities, following on from the previous year, is involved in 77 lines of action (LDA – 23 direct and 54 indirect) compared to the 122 lines provided in the Three-Year Plan assigned to the PA, with a percentage of about 63%².

The activities carried out by Sogei cover the following themes addressed in the Plan:

- data: Sogei is involved in management of national interest databases (ANPR, ANA, Tax databases, Land Registry databases) which represent one of the key aspects of ICT strategies at national and international level, as essential infrastructures to support interactions between public administrations and, where provided, between them and private individuals;
- Infrastructures: Sogei is engaged in the development of the PA's cloud model and in the data centre consolidation activities;

² There is a total of 223 plan LDA, but only 122 are allocated to Public Administrations as the remaining lines are AGID and MID responsibility. Sogei's involvement is calculated on the LDAs assigned to the PA.

- Interoperability: within the interoperability model, AGID will issue the guidelines to which all PAs will refer and which will address the kinds of collaboration and interfaces realized for data exchange between public administrations;
- Platforms: solutions that offer fundamental, cross-cutting and scalable functionalities for digitisation of PA administrative processes, standardizing the methods of delivery. They help administrations to build new functionalities, reducing service time and costs, and ensuring greater IT security. Sogei is involved in the management and development of NoiPA, Sicoge, Siope and Siope+, ANPR platforms. Furthermore, for “PagoPA” platform, Sogei develops interfaces for all clients receiving payments, for “SPID” develops authentication interfaces;
- IT security: Sogei, as part of its security governance activities, has transposed the provisions of the National Cyber Security Strategy (Prime Ministerial Decree of 27 January 2014) by establishing CERT Sogei as a security incident response team. As part of the monitoring, analysis and correlation of security events, Sogei has a Security Operation Centre (SOC) infrastructure that can address threats from possible cyber attacks.
- Management of digital transformation: Sogei collaborates with the Department of Digital Transformation of the Presidency of the Council of Ministers and AGID as partners in the activities that allow to support the management of the change required for transition to digital of the Country System. It also collaborates with the National School for PA, providing training to PA officials and managers to enhance their skills and knowledge on the main topics of digital transition.

9.1.2 THE PA DIGITAL TRANSITION

9.1.2.1 Training and dissemination of digital culture

As part of the activities of adherence to *Repubblica Digitale*, a national strategic initiative promoted by the Department for Digital Transformation of the Presidency of the Council of Ministers to counter any form of digital divide of a cultural nature, Sogei, in 2021, continued to contribute to the development of digital culture in PA through support activities for the National School of Public Administration with 2 online events:

- Digital Workplace: the workplace in a “digitally transformed” PA, with the aim of understanding how digital transformation could change the workplace and what tools, organizational models, decision-making processes, and ways of collaboration would be. The event was attended by 117 people;
- Technologies enabling digital transformation: cloud, edge computing, IOTs and AI, with the aim of analysing the main enabling technologies that stimulate the digitisation process of the public sector through the study of experiences of concrete use of these technologies,

with reference to projects under implementation in some public administrations. The event was attended by 96 people;

During the year Sogei participated actively, through a partnership with the Research Observatory of Milan Polytechnic, in 6 events that had as their central theme *Design thinking*, applied in different themes and highlighting strengths and weaknesses.

9.1.2.2 The Open Innovation Programme



In 2021, the "grounding" of the first two-year cycle of the *Open Innovation* Programme in the PAs 2019-2020 was concluded with the realisation of five Proof of Concepts on: Mobility solutions for civil servants with gamification, AI and fight against tax evasion, CX and interoperability, IoT and digital twins of public locations, encrypted instant messaging for the PA for cybersecurity. The Sogei *Whitebook "Open Innovation in PA: digital models and technologies for innovation in Public Administration"* was also presented to the public and its publication in English was arranged.

The second cycle of the *Open Innovation* Programme for the two-year period 2021-2022 was then developed, shared with management and the internal stakeholders, and the so-called "S. Severa 2021" innovation demand analysis and co-creation event was realised. In particular, this first stage of the 2021 *Open Innovation* Programme, held on 3-4 November with a digital format and a final team-building part at the Castle of S. Severa in collaboration with Lazio Innova (Lazio Region), aimed to involve external stakeholders with a co-creative approach aimed at identifying use cases that will then be the subject of the 2021-2022 programme.

Compared to the co-creation activity carried out in 2019, where a bottom-up approach to quantitative ideas was favoured, in 2021, also to speed up the process, we started with use cases extrapolated from the NRP. Five working tables saw Sogei staff and Administrations collaborating in the development of user requirements linked to these use cases, which, in a nutshell were:

- Digitisation and automation: an API orchestrator of the Administrations to foster interoperability and data integration;
- *Citizen eXperience*: a solution for PA contact centres, outbound, proactive to support the accompaniment of citizens to the digital transition;
- Sustainability: the development of a 'sustainable metaverse', i.e. a digital twin for predictive monitoring and risk mitigation of geographical areas through IoT sensors and artificial intelligence;

- *Employee experience*: a 'digital butler' that proactively supports employees in dealing with paperwork and finding information on intranets;
- New ways of working: a solution to make the civil servant recruitment system (InPA portal) even faster, more transparent and more efficient by basing it on the CVs, skills and experience of candidates and by matching the demand and supply of positions.

9.1.2.3 Customer eXperience Management

Pillars	Capabilities	Activities
Understand Customers	1 Voice of the Customer	Build a quant and qual listening portfolio Leverage data to create customer insight
	2 Customer Research	Take action based on customer insight Build a customer research competency Inform CX projects through customer research
Set Customer Experience Strategy	3 Strategy	Create a winning CX strategy Prioritize CX improvement opportunities
	4 Metrics	Measure customer experience Keep score in achieving strategic goals
	5 Personas and Journeys	Develop personas and journey maps Integrate UX into CX
	6 Technology	Align and prioritize tech investments
Coordinate CX Across the Enterprise	7 Purpose	Inspire motivation Justify the investment
	8 Customer-Centric Culture	Foster a customer-centric mindset Enable customer-centric behaviors
	9 Roles and Governance	Manage CX team structure Build CX team capabilities Collaborate with business partners

In continuity with the previous year, staffing activities continued in 2021 for the internal centre of excellence (CoE) that deals with customer experience (CX) and, at the same time, an extensive programme was carried out to disseminate knowledge of the methodology and supporting tools.

Within the CX CoE, the centre of competence on accessibility was consolidated and the renewal of the certification process for internal staff responsible for the various corporate structures for assessing the level of accessibility of websites and documents and mobile applications was completed.

The customer experience structure operates through a centralised partnership organisational model, i.e. it works alongside the business lines providing support in terms of strategy, research, design, testing and monitoring of the experience, and the needs and expectations of the users of the services provided, as illustrated in the diagram opposite.

During 2021,

- in the area of accessibility:
 - the partnership with the Agenzia per l'Italia Digitale (AgID) was consolidated and the documentation produced to support the development of skills in the PA was shared;
 - guidelines for creating and verifying the accessibility of non-web documents (pdf, word, video, infographics) were created. These were disseminated in a webinar attended by 200 colleagues and for the benefit of the business lines;

- 111 colleagues received the Technical Expert in Accessibility Certificate (ETAC);
 - Vate, the tool used by the ETACs to create accessibility checks, was evolved. ETACs can now perform checks not only on web portals but also on native mobile apps and non-web documents;
 - 412 accessibility checks were carried out. For the Presidency of the Council of Ministers alone, 33 audits were carried out;
 - a course was published on the Ready2Learn corporate training platform to approach the topic of accessibility;
- on the subject of CX:
- an internal survey was carried out to understand the level of awareness of the *User Interface Kit (UIKit)*, the tool supporting the development of web interfaces, to collect feedback and to direct the path of its adoption. The results were useful for starting up a product update that is still ongoing;
 - 3 courses were published on the company's training platform dedicated to *Design Thinking, Framework CX* and *Introduction to the Customer eXperience*;
 - A *Human Centred Design* course was delivered in which various corporate structures were involved;
 - in terms of branding dissemination, the partnership regarding the *Design Thinking* observatory with the Milan Polytechnic continued, 6 hours of training were provided at SNA and there was participation in external events (*Accessibility Days, Wud*);
 - 3 trials on the adoption of crowdtesting platforms for user research and usability testing were carried out;
 - the user-centric methodological approach has been adopted in dozens of business line projects (ANPR, Customs and Monopolies Agency, Presidency of the Council of Ministers, Health Card System, Revenue Agency, RGS,) and for the benefit of employee experience projects (on line CV, Job posting, Ready2Learn, working from home Planning). The use of qualitative research techniques and co-design models were used to varying degrees in all projects. The products created included Concept for document management workflow, Talent portal, Web app for managing tax refunds in customs areas (Otello), Redesign of the Sistema Tessera Sanitaria portal, PCM intranet, Unar, Repubblica digitale, Ader intranet, Envisioning of PDL assistance portal for RGS, *Gioca Legale* native app, Dashboard for static quality for RGS;

- usability tests were carried out using the *e-Glu* protocol as indicated in the Three-Year Plan for IT in Public Administration. Guidelines for carrying out usability tests were disseminated through an internal webinar.

With the aim of demonstrating how to create citizen-centric services through Service Design and Future Research methods, and how to manage the dynamics of integration and collaboration between the PAs involved, the *FutureGov* project was developed in 2021, through which an attempt was made to overcome the already known criticalities of interoperability in the digitisation of public services through the following approach structured in 4 fundamental principles:

Life Events - use of 8 Life Events to analyse, select and map the services provided to the citizen.

Service Communities - introduce the concept of Service Communities, to bring authorities together around the citizen's experience, with a view to providing interoperable services.

Future Vision - define a shared scenario of the PA of the future to strive for and the necessary steps to achieve it.

Shared Practices - share a set of tools for disseminating to all PAs a method on which to build a unique approach.

An MVP for measuring *Customer exPerience* was carried out. The solution is based on Salesforce technology. Following the mapping of the personas and user journeys, a dashboard was created that collects data from multiple sources (Matomo, specific events, *Voice Of Customer*) to offer a summary of specific CX indicators: Net promoter score, Customer Satisfaction, Customer effort score, Service access volumes, Service volumes managed and delivered, User behaviour.

9.1.2.4 CYBER 4.0 Competence Centre

Cyber 4.0 is the highly specialised National Centre of Competence for cybersecurity tasked with developing the competitiveness of the country's system by offering companies and public administrations guidance and training services and financing research and innovation projects to raise the level of protection against the risk of cyber attacks on systems, processes and strategic, corporate and national assets.

Cyber 4.0 is one of the 8 highly specialised competence centres financed by the Ministry of Economic Development, under Directorial Decree 29.01.2018, and it is the expression of a composite, interdisciplinary and multi-actor public-private partnership, covering a wide range of competences and fostering the development of a network of qualified collaborations, of which Sogei is one of the founding members. There are several ongoing activities with the Centre, both at national and European level.

Keep Calm

On 6 April 2021, Cyber 4.0 published call 1/2021 with MISE funds, to promote innovative industrial research and experimental development projects in the field of cybersecurity, with particular attention paid to SMEs.

The KEEP CALM proposal presented by Sogei in May 2021 with ISC, LUISS and the Cyber 4.0 Association within the "*Threat Intelligence*" topic: Experimentation of big data analytics tools for the development of innovative threat intelligence services for the security of enterprises, public administrations and SMEs was selected and funded.

The KEEP CALM project aims to extend the research activities carried out in recent years within Sogei in the field of "cyber threats forecast", i.e. the prediction of cyber attacks based on observations made on the properties and characteristics of the networks of the entities involved, as well as on measurements of the parameters and types of network traffic observed. The final objective of the research activities is to create a prototype system for use in a laboratory environment.

European Digital Innovation Hub

The *Digital Europe* funding programme envisages the establishment of European Digital Innovation Hubs (EDHI) in the 27 EU Member States.

A European Digital Innovation Hub (EDIH) is a single entity or a coordinated group of entities with complementary competences and a non-profit objective to support large-scale digital transformation of enterprises (especially SMEs and small mid-cap companies) and/or public sector organisations. Typical entities contributing to an EDIH will be research and technology organisations (RTOs) or university laboratories offering technology services, which might work in collaboration with partners whose expertise lies in business development, public sector innovation or training, such as chambers of commerce, industrial clusters, trade associations, *Enterprise Europe Network* (EEN), incubators, vocational training centres or others.

In November 2021, a call for tenders to set up the European EDIH network was published. The call is open to candidates pre-selected by the EU in January 2021 on the basis of applications expressed by individual member states and the Cyber 4.0 Association, of which Sogei is one of the founding members, was pre-selected by Italy and admitted to the short list drawn up at the beginning of 2021.

Cyber 4.0 therefore set up a working group to prepare the proposal to be submitted by 22 February 2022.

9.1.2.5 Italian Blockchain Service Infrastructure (IBSI)

February 2021 saw the birth of the Italian Blockchain Service Infrastructure (IBSI) project, promoted by Agenzia per l'Italia Digitale (AgID), ENEA, SOGEI, INPS, Poste Italiane, INAIL, CSI Piemonte, INFRATEL ITALIA, Milan Polytechnic, RSE, GSE, CIMEA and the University of Cagliari,

which aims to test the design and development of an ecosystem based on DLT technologies, in line with the European Strategy that is implementing, with the Italian contribution, a similar infrastructure within the *European Blockchain Partnership*. The following entities were added during 2021: Marche Region, Apulia Region, Veneto Region, ATAC, UNINA, IPSZ and ACI.

In this context, Sogei is looking for use cases to test the use and applicability of this technology to bring to the attention of the IBSI group.

The activities that will be developed within the project are:

- experimentation of specific cases of use also on the basis of standards related to the Regulatory *Sandbox* of Law Decree N. 34/2019, at the time planned for the Fintech sector;
- smart contracts to be used, for example, in certification of qualifications or for exchange of tokens representing other digital or physical assets or a right, such as ownership of an asset or access to a service;
- proposal for prototypes and pilot projects for provision of thematic services of national interest to citizens and businesses, application trials, services and use cases at national level, including cross-border interaction. Other objectives, shared by the Parties, concern the implementation of research and development activities on the distinctive features of blockchain technology, in order to deepen its potential, such as the promotion of decarbonising cities, the use of renewable energy sources, the development of energy-sustainable and renewable models and, more generally, the fight against climate change;
- Development of smart contracts aimed at tracing production and logistics supply chain lines, also with the aim of promoting the certification and guarantee of “made in Italy” brands, by automating the exchange of information and value between the parties involved and operating on the same production chain.

9.1.2.6 Analysis and studies

Several study documents useful for the digital transition of the PA were prepared in 2021.

In particular, an initial company positioning paper on Quantum Computing was prepared and a subsequent one to outline the areas and use cases that will be tested during 2022. More details can be found in the following section on this technology.

In relation to the adoption path of Artificial Intelligence (AI)-based solutions, guidelines were produced for the implementation of AI artefacts and their management, including ethical principles for responsible AI.

In the context of the collaboration with the National Council of Economy and Labour (CNEL), Sogei has contributed for the third consecutive year to the drafting of the “Digital

Transformation” chapter of the “Annual Report to Parliament and Government of the Quality of Public Services”, in synergy with the Revenue Agency.

9.1.3 RESEARCH AND DIGITAL LABORATORY

The research activities developed in the internal laboratory on cutting-edge technologies have covered different fields of application.

Further efforts have been made to enhance and optimize precision positioning solutions based on *Global Navigation Satellite System* (GNSS) technologies, which are at the heart of the world of transport, which is evolving toward the connected and robotic vehicle paradigm. This mode of transport will depend, of course, on a reliable and accurate location of the vehicles, with levels that cannot be reached through the use of current commercial systems.

The applied technological edge research activities such as the Internet of Things, artificial intelligence and machine learning and, new this year, Quantum Computing and Blockchain have been intensified.

9.1.3.1 Horizon 2020 Call Proposal

Within the European funding landscape, our presence is focused on two priority axes: cybersecurity and precision satellite positioning (GNSS), in response to the 'Horizon 2020 Research & Innovation' programme.

In international partnership, in the year 2021, Sogei is carrying forward the activities related to the three projects financed:

- GISCAD-OV Galileo improved Services for Cadastral Augmentation Development on-field Validation (GISCAD-OV) for the implementation of a GNSS correction system for low-cost cadastral survey precision positioning in the European states, with total funding of approximately €315,000.00;
- HELMET High Integrity EGNSS Layer for Multimodal Eco-friendly Transportation to develop a GNSS positioning system to support multimodal transport, with total funding of approximately €165,000.00;
- CyberKit4SME for developing SME support tools to address possible cyber attacks, with a total of approximately €170,000.00 financed.

The Covid-19 pandemic continues to adversely affect project turnaround times, necessitating a reformulation of the initially planned activities, but has made international collaboration on such projects more “digital”.

In addition to the recovery of investments made in research activities, European projects are based on image returns toward institutional clients, allowing Sogei to take advantage of the

collaboration of internationally accredited partners recognized on topics related to the topics of interest.

As of 1 January 2021, the European Union has activated the Agenda 2021-2027 for the funding of projects that have research, development, innovation and digitisation as their defining elements. The funds made available include the *Horizon Europe* programme to support research and development, with a total budget of around 95.5 billion. Sogei is carefully monitoring the calls for tenders for new proposals.

In addition, in order to ensure participation in working groups or Public Private Partnerships (PPP) on topics of interest (GNSS and cybersecurity), Sogei joins international associations accredited at European level:

- Galileo Services: to develop an all-encompassing vision that meets the needs of users and the market for precision positioning with GNSS technologies;
- ECSO(*European Cyber Security Organisation*): to develop, together with the European Commission, common policies to ensure European coordination on cybersecurity.

9.1.3.2 Galileo

During 2021, Sogei, within the framework of the projects funded by the GSA (European GNSS Agency, today EUSPA, EU Agency for Space Programmes), contributed to the setting up of an experimental Control Centre for the provision of high accuracy GNSS precision positioning services for seven European countries within the framework of the GISCAD-OV project. This allowed the implementation of two Pilot Projects in Italy and France, with the collaboration of the respective national boards of surveyors, for the validation of the services.

Sogei also participated in the Galileo HAS signal testing campaign organised by EUSPA, which involves a limited number of European companies. These tests will continue during 2022 and will see Sogei as one of the key players in the validation of the new European service.

An experimental activity was carried out in collaboration with the University of Roma Tre, Faculty of Architecture, and with the Civil Protection for the monitoring of the critical infrastructures, with particular reference to a bridge in central Italy, through the integration of GNSS precision positioning systems and accelerometers.

In addition, the system was developed to provide experimental precision positioning services for the railway and automotive sectors, and the first tests were carried out in the BRNO area (Czech Republic) to meet the requirements for autonomous driving.

The development of Sogei's SDR GNSS Software Receiver also continued, with the development and testing of the data acquisition system with different satellite frequencies.

In order to facilitate the implementation of joint study and research programmes through the exchange of knowledge in the area of geodetic network calculations, the collaboration with the Istituto Geografico Militare (IGM) continues.

The work will continue during 2022, with the extension of the architecture to multi-frequency processing for efficient and time-saving precision positioning.

Precision Positioning Services (Outdoor) - Evolution GRDNet

The extension of the GRDNet network to the Tyrrhenian Sea and Central Italy has been launched in the context of the applications for the Revenue Agency and Customs Agency. This extension envisages the realization of twenty-two additional stations in Central and North-Eastern Italy.

In addition, the usual maintenance and assistance activities were provided to the Revenue Agency, Local branch, for the use of the GRDNet precision GNSS positioning service.

9.1.3.3 GEOPOI® (GEOCODING POINTS OF INTEREST)

GeoPoi, registered trademark of Sogei, refers to the research line that sees the digitisation processes focus on the possibility of geo-reporting phenomena to the territory. In the context of intensive Location Intelligence applications, the Geopoi community framework, also in 2021, recorded a further increase in institutional users, reaching almost 50, and increased its use by approximately 40%. The confirmed use of Geopoi in the applications "18app", "Carta del Docente", "Observatory of the Real Estate Market (OMI, Osservatorio Mercato Immobiliare)" and the "Trova sportello" services of the Revenue Agency - Collection Department, certifies the considerable efficiency of the product and the significant cost savings due to licences of commercial cartographic products. The Revenue Agency, through development of the SIT (Integrated Territorial System), makes extensive use of the services offered by GEOPOI and uses, for its own architectures, solutions prepared with the support of Research & Development.

9.1.3.4 Machine Learning & Artificial Intelligence

In 2021, several corporate initiatives were followed up, which made it increasingly possible to study and apply modern machine learning and artificial intelligence techniques on cross-cutting applications to the whole company organization.

New machine learning and deep learning algorithms were developed and tested, which made it possible to analyse and validate a large number of reports, including paper ones, in order to automate the process of installing new equipment and its protocol. The algorithms used fall into the categories of natural language processing, image processing and entity extraction and recognition.

Further research and development has been applied to the analysis of satellite images in order to automatically extract spatial entities such as buildings, roads, etc.

All algorithms have been developed in an Open Source perspective in order to apply them in new projects with similar case histories and to be in line with the state of the art in the literature.

9.1.3.5 Internet of Things

The Internet of things (IoT) is a technology that is coming into use at a very high rate, due to a particular set of circumstances: the explosion of low-cost sensors, affordable connectivity, the availability of large computing resources and data space on scalable cloud platforms, the spread of mobile applications (mobile Apps), and the evolution of machine learning technologies.

In this context, the *Industrial Internet of Things* (IIoT) has become a term commonly adopted in projects to redefine the management and development processes of companies.

Research and development activities usually carried out in Sogei follow technological edges destined to turn into potential spin-offs for the company's business. A technical analysis of the state of the art of the IoT solutions market for the smart management of vertical solutions for asset management, building and office automation, data centre management, energy management, smart tracking and others, capable of integrating and dialoguing with existing IT infrastructures, was carried out. These solutions are capable of collecting, visualising, cataloguing and analysing data through dashboards and data analytics tools and can be made available to PA. This analysis is used as a basis for defining the IoT architectures of the various projects in which Sogei is involved, thanks also to the support provided by the Digital Research & Laboratory.

In 2021, a low-code platform was also developed that allows a humanoid robot (Pepper) to be programmed using the protocol used for IoT devices, and to be orchestrated using cloud-based services. This platform can be used for training and the development of hackathons.

9.1.3.6 Quantum Computing

Quantum innovation represents a new computing paradigm and could be an epoch-making turning point, especially in relation to all complex computational tasks that have so far been considered impractical or impossible. With the evolution of quantum computing, we will arrive at the so-called quantum advantage, i.e. the realisation of computational machines that, in certain specific cases, will have a significant performance advantage over classical computers.

In 2021, the Position Paper "Quantum Computing @ Sogei - Introduction to Quantum Computation and Possible Applications" was presented to the company's management. It is the result of experience gained from meetings and seminars at major industrial and research facilities, with the Observatories on Quantum Technologies of Milan Polytechnic also participating in the discussion. The Position Paper outlined various aspects of quantum computing: hints at the underlying physical theory, industrial solutions, application areas, possible applications in Sogei.

Despite the fact that this technology is still considered immature, the paper aims to emphasise the need to experiment with this new mode of computation in the areas of Cybersecurity, Machine Learning and Combinatorial Optimisation right from the start, since in the medium term it may be essential to tackle complex problems that only Quantum Computation can handle.

Following the Position Paper, it was decided to produce a second document "Proposal for a Proof of Concept on Quantum Computation". This constitutes an element of continuity of the Position Paper and goes into even greater detail in describing the feasibility of some necessary pilot projects that can be achieved with the use of this technology, with the aim of proposing and exploring through PoC some applications with benchmarks and comparison of results with respect to classical computation.

9.1.3.7 Collaboration and partnership agreements with universities, research institutes and international organisations

In 2021, several new collaborations with the academic world were activated:

- Agreement with CNR-Istc on the use of artificial intelligence in taxation and the fight against evasion;
- Agreement with CNIT on IoT and business models in the public sector;
- Agreement with the University of Padua for the systematic calculation and monitoring of a geodetic network of GNSS stations with national coverage.

As part of the RTCM SC-134 standardisation committee, of which it is Chairman, Sogei is carrying out the definition of protocols and messages for high integrity precision positioning that will form the basis of future positioning services for the automotive, railway and maritime transport sectors.

Sogei is also a member of the international Space Y consortium (formerly Galileo Services) and, in the role of Secretary, participates in the Consortium's regular coordination meetings. During 2021, it participated in the definition of the consortium's strategies and promoted activities of interest to institutions, with particular reference to institutional applications for land registry survey and customs applications.

Furthermore, meetings were held with a view to signing agreements with other institutional players to "lay the foundations" for GNSS precision and integrity positioning.

9.1.4 DIGITAL TRANSFORMATION IN SOGEI

The pandemic and the related economic, social and political volatility continue to have a radical effect on organisations around the world. Old business and operational models need to adapt

quickly beyond digital transformation to cater for the new economic realities and the market requirements for recovery. Not only does the strategy need to be reset, but the strategy setting process also needs to become adaptive to manage chaos and infuse reactivity into IT planning and innovation. Technological innovations offer many opportunities to facilitate this adaptation and shape the necessary business and operational models.

The management of innovation calls for the choice of suitable tools to tackle the path which tends to develop on the 3 dimensions described in the following diagram:

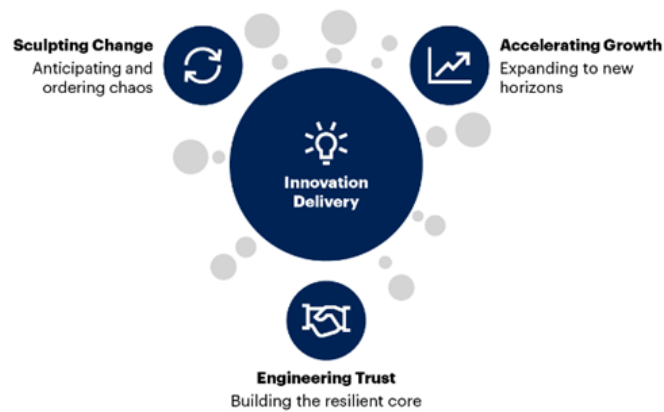


Figure: Innovating through trust, growth and change (source: Gartner)

Designing on the basis of trust, accelerating growth and supporting change are guiding principles that help drive the momentum and recovery needed to tackle the transformational journey that organisations are experiencing.

9.1.4.1 Employee Experience Management

9.1.4.1.1 The EXM framework adoption model

The assessment process that preceded the setting up of the *Employee eXperience* framework and the subsequent creation of the journey maps, with the identification of the tools enabling the management of the Framework itself, highlighted the importance of adopting an adoption model that would guarantee the effective implementation of the Framework and allow a deep permeation of the principles and guidelines contained therein. For this reason, and given the complex flow of interactions that revolve around the Framework, the most appropriate methods were identified to make it widespread within the Company, immediately raising the quality of the experience of adopting this methodology. A correct understanding of the context has made it possible to identify eight project levers to enhance the benefits brought by the new model in the operational processes of design, planning and implementation of services/experience aimed at employees, to stimulate employee participation in Employee Experience initiatives by strengthening the communication methods and style adopted, and to

PVT-2
PVT-3
PVF-3
PVF-5

support the adoption of the new model towards the entire company population, also through the direct involvement of ad hoc figures, such as Employee Experience Agents. The effectiveness of the plan to support the new EXM is developed in stages of progressive target activation, according to a roadmap that translates key messages into a new culture.

9.1.4.1.2 Dissemination of digital culture within the Company

In 2021, the commitment to disseminating *Digital eXperience* was constant and increasingly incisive, and took concrete form in internal initiatives, activities and events, intended as experiential moments of sharing and participation and a tool for transferring know-how and best practices to support collective knowledge, facilitating active learning and increasing the circulation of ideas.

In continuity with 2020, the possibility for all employees to attend events online has been maintained and, in particular, a new format has been added, "Innovation Thursdays", appointments that are always held on the same day of the week, led by professionals, entrepreneurs, CEOs of companies or start-ups active in the field of artificial intelligence, Big Data or other disciplines, and which represent an opportunity to learn about new products and solutions on the market, while at the same time creating opportunities for active discussion with these businesses.

There were a total of 27 events, with a total of over 5,800 participants. Delivered through the Teams platform and diversified according to different targets (Management, employees, IT or Corporate profiles) and formats, it has been possible to organize:

- 10 "Innovation Thursdays" ("Translated srl: AI and Natural Language Processing", "Artificial Intelligence: from Cognitive Robotics to Intelligent Vision", "Public-Private Ecosystems and Blockchain: use cases and pilot cases", "ContaminAction. Innovating by connecting different worlds", "AnotheReality: the metaverse is coming", "The first quantum computers for business and research", "Metamorphosis: the IoT platform to support the Digital Renaissance", "Modern methodologies and tools for building a hybrid data platform "on premise" and "Cloud", "The era of Transparent Technology: Human Interaction - focus Xr", "A model for an inclusive and efficient Citizen eXperience");
- 2 #Techstorytelling, corporate storytelling events focused on technological aspects and related to solutions or projects implemented ("Evolution of the TERADATA platform in Sogei: from "Vintage" to VANTAGE", "Receipts Lottery");
- 3 Innovation workshops, for the acquisition of concepts, methodologies, new technologies and products ("Customer eXperience Management", "From deterministic to stochastic: the era of anticipating needs", "WorkingSmart Day");

- 2 Webinars ("Accessibility of non-web content: PDF documents and videos", "Usability testing. When user feedback becomes strategic");
- 4 Open Innovations, events related to the path to involve partners/customers in the process of change, *eXperience* and digitisation of PA (*Whitebook* presentation, Open Innovation in PA and NRP and 2 plenary sessions).

On 27 October, the event 'BeSogei: Presentation of the 2021-2023 Business Plan" was organised, during which the CEO presented the Plan to all employees.

Also in 2021, a project was carried out to share all those elements - semantic, linguistic, lexical and stylistic - that make up Sogei's verbal identity and thus complement the digital identity of our brand.

In the era of social networking tools, the company's values and culture must in fact pass through new forms of communication and an intentional use of language: the correct tone of voice, the most appropriate style, visual identity, a single and unambiguous vocabulary are all instrumental in creating a recognisable and reliable image, both in internal relations and towards the Public Administration, suppliers and, above all, citizens, the end users of our work.

Sogei's Intranet has thus been enriched with a new section - Communication Tools - specifically designed to create a link: guidelines, best practices, sound matrices, colours and fonts, indications for the creation of accessible products, a graphic gallery of "*Tips&Tricks*". In short, a structured information support to facilitate the drafting of content for the various corporate channels.

Even the idea of ethical business is now part of Sogei's verbal identity: we are talking about a company that, aware of its social role, acts in accordance with a scale of shared values, to protect the interests of all stakeholders in civil society, using a style of communication based on empathy, inclusion and kindness.

In this context, we must finally highlight the adhesion to the Manifesto of non-hostile communication, an important operation that has seen the personal involvement of our CEO, as the first signatory of the manifesto, and the company management, through the realisation of personal reflections on the individual items of the manifesto, published regularly through the Yammer channel.

9.1.4.2 *Working Smart*

9.1.4.2.1 *Methods and approaches (Design and future thinking, lean, agile)*

During the year a new programme of interventions was launched called *Working Smart*, a new way of working that boosts our potential and promotes transparency, trust and openness through new methods and working tools that will allow us to share knowledge and collaborate

in a safe and efficient way, by allowing everyone to invest more time, focusing on what really matters: Us, as citizens.

In the second half of the year, an in-depth course on Design themes was provided, offering staff involved in the field of competence and activity, sessions aimed at deepening the themes of UX Writing, Smart Objects, Inclusive Design, Speculative Design, Data Informed and UI Bases.

9.1.4.2.2 Enabling solutions and technologies

Office automation, social, communication and smart learning solutions



In 2021, the new methodologies and working tools put in place, focused on sharing, flexibility and accountability, fostered the expansion and circulation of knowledge and skills and enabled safe and efficient collaboration.

WorkingSmart, as a path of adoption & change management, in parallel with the introduction of the Company Digital Platform, integrated with the new tools of social communication, collaboration and storage, has supported the change as a powerful means to include, relate, involve and enhance the many skills present in Sogei, involving in a circular process all aspects and players of the organisation: people, leadership style, business, procedures and processes.

This is primarily a cultural change, but it has also resulted in the creation of a dynamic, business-oriented working environment which, through the tools adopted, has considerably reduced time and distances, while at the same time ensuring effective collaboration and widespread dissemination of information.

TEAMS and YAMMER have facilitated collaboration, communication, participation and sharing, enabling a different way of experiencing operations by confirming commitment, reliability, responsibility and solidarity.

ONEDRIVE, regardless of the physical devices used, has enabled full access, in the office, at home or anywhere else, to documents, data and work information, optimising efficiency, speed and productivity and improving the employee experience.

The adoption plan, which began in July 2020, was boosted with the introduction and onboarding of the *WorkingSmart Advocates*, 113 people spread across all business areas, trained ad hoc on change management and adoption of the new tools.

Less than a year after the project's introduction, structured promotion and support of the model has achieved significant results, with a reduction of more than 60% in e-mails and an increase in productivity due to collaboration of 194%, with around 73% of users active on TEAMS.

In this kind of context, in which the relationship between person and work is changing, communication is supporting this process by encouraging the creation of a workspace that is made more dynamic, interconnected, delocalised and collaborative, strengthening cross-communication modes, by improving the *eXperience* and by targeting their activities to inclusion, adaptability, dialogue and maintaining continuous contact and interaction. Specifically, an information campaign was carried out through the distribution of 13 thematic newsletters that accompanied the introduction and adoption of new tools and functionalities, with the administration of periodic surveys aimed at investigating the level of awareness of staff and identifying any areas for improvement, and with the activation of a Yammer channel dedicated to support and assistance on *WorkingSmarttools*.

In addition, in 2021, the *LearningSmart* training platform, dedicated to Microsoft 365 products, and embedded in the company's new virtual learning space, *Ready2Learn*, grew as the company expanded its content, services and functionalities, offering online learning paths with flexible timing and modes of use.

9.1.4.3 Company Digital Platform

The Company Digital Platform (CDP) is the ICT product offering designed to support the company, ensuring the functionality, reliability and integration of applications and systems. It is based on a stack of technologies that enable the creation of digital assets to support business operations by enhancing the centrality of the employee experience concept.

The guiding principles for continuous and progressive evolution of the products implemented by the Company Digital Platform, aimed at enabling digitisation, the Employee eXperience and cloud adoption, are summarized in:

- *Enterprise Collaboration*, for knowledge sharing, communication and team working;
- *Digital & mobile first*, in order to facilitate the interaction between the working ecosystem and the employee and facilitate the path of change toward smart working methods;
- *Inclusive, accessible & user-centric products*, closely related to people's needs;
- *Data driven*, for the enhancement of the assets of company information and development of a data-based culture;
- *Agile mindset*, to cater quickly for the satisfaction of business scenarios;

- *Cloud & Hybrid cloud* to accelerate platform evolution by putting together on-premises products and cloud solutions.

Consistent with the guiding principles outlined above, in 2021 a major programme was launched to develop the *Company Digital Platform*, with a view to achieving, over a three-year period, a new scenario characterised by the innovation, rationalisation and streamlining of the CDP's technology stack through the gradual adoption of cloud platforms, moving from a fully on-premises approach to hybrid solutions that integrate the two worlds so that the user experience is seamless.

In particular, the adoption of Oracle's SaaS solutions in the areas of finance, procurement and Human Capital Management, will make it possible to prioritise the operational efficiency, standardisation and simplification of business processes through the improvement of the user experience thanks to a simplified user interface, the facilitation of information exchange, and the reduction of efforts connected with system upgrades, patching and bug fixing.

Still on the cloud front, the adoption of Microsoft's low-code/no-code platforms (Power Apps) and Salesforce represents an important accelerator in the reengineering of corporate services in a mobile first perspective, also through the rapid connection with existing applications thanks to the progressive exposure of specific services accessible through an API management infrastructure.

The consolidation of the company's Datalake on Oracle architecture will enable a new analytics eXperience through the availability of 'shopping for data' interfaces, visual and self-service analysis tools and machine learning algorithms for predictive analysis.

For technological evolution to be truly enabling for a digital business, it will necessarily have to be accompanied by the parallel adoption of a renewed development process. In this sense, to support agile practices based on *SCRUM* and orchestrated by Azure Devops, it will be important to adopt a new development framework that enables Test Driven Development, the use of build pipelines and quality assurance in a logic of container and microservices development.

The main streams of activity characterising CDP's development project are set out below.

9.1.4.3.1 *Corporate Social Intranet (CSI)*

Corporate Social Intranet (CSI): a tool for greater sharing of innovative solutions, activities, strategies and technologies enabling the development of a continuous digital transformation.

The best collaborative tool, in line with the *People Value* strategies, as well as bringing benefits in terms of simplifying access to information, improving business processes and speeding up activities. CSI strengthens the sense of belonging, by fostering dialogue and therefore by becoming an engagement solution.

From a technological point of view, the Corporate Social Intranet is based on the following enterprise collaboration tools:

- Microsoft Teams, a unified communications and collaboration platform that combines persistent chat about work issues, video conferencing, meetings, content sharing (including simultaneous file exchange and work), application, workflow, and chatbot integration;
- Microsoft Yammer, an effective, secure and private corporate social network; it enables open and dynamic communication throughout the organisation; improves engagement and optimises communication within the organisation. Through Yammer, communities of interest are developed, ideas and feedback are gathered, and everyone is kept informed, aligned and forward-looking;
- Microsoft Sharepoint, a service that lets you share and manage content, knowledge, and applications to strengthen teamwork, find information quickly, and collaborate effectively across your organization.

In 2021, a "*Job Posting*" section was created on the intranet to automate the internal mobility process, templates for the beacons, the "Let's get to know each other and recognise each other" section, and the Events section.

9.1.4.3.2 *Data Lake:*

As part of the *Company Digital Platform*, the company's data lake has the dual objective of exploiting the complex and articulated information heritage of the data managed by internal applications and, at the same time, encouraging an approach that sensitises employees to be the driving force behind the adoption of a culture and expertise based on data.

The goal for the next few years is to consolidate and evolve the data lake on the new Oracle Cloud platform, which will enable a renewed analytics experience (greater autonomy and ease for the business user in data exploration, self-service BI, dashboarding and reporting), an innovative approach to predictive analytics thanks to machine learning algorithms, and greater sustainability in terms of reducing the operational impact on the information system thanks to the exploitation of the cloud and consistency with the CDP's technology architecture.

To this end, in 2021 work began on the adoption of the Oracle Cloud solution, through the migration of the previous project carried out during the year in the area of labour costs, while integrating it with the management of reversals and provisions.

In particular, the following functional aspects have been improved:

- greater autonomy and ease for the business user in data exploration, self service BI, dashboarding and reporting (Analytics Experience);

- application of machine learning solutions to support the forecasting of potential staff redundancies in order to estimate labour costs in future periods.

9.1.4.3.3 *Low-code/no-code platforms:*

In the evolution path of the *Company Digital Platform*, Low-code/No-code platforms represent an important accelerator of execution in the activities of progressive reengineering of company services.

For the CDP, the choice fell on the respective platforms proposed by Microsoft and Salesforce; in the course of 2021, in order to speed up the connection with existing applications, a special map of services was created to be exposed through an API management platform.

In particular, the following apps have been implemented:

- Virtual HR Help Desk to enable employees to forward requests for assistance on HR issues to the relevant offices;
- Staff ChatBot to automatically respond to support requests on slips;
- Management of *Smart Working Roll-OutPlan*: Mobile app used by the various players in the process to manage the phases of anonymising the workstation and switching to the virtual workstation;
- The VD support platform built on Salesforce that enables centralised management of support flows for the new Virtual Desktop working mode.

9.1.4.3.4 *Adoption of the new Oracle cloud platform for ERPM (Finance Transformation)*

The migration of the current *eBusiness Suite on-premises* to Oracle ERPM cloud and the adoption of the new SaaS modules to complete the coverage of all processes in standard and natively integrated mode, will allow the standardisation and simplification of operations in line with the company's strategic lines aimed at simplification, innovation and streamlining.

The solution-driven approach, where different solutions are built in accordance with Oracle's process best practices, will eliminate or significantly reduce existing custom solutions, with immediate benefits in terms of operational efficiency.

In addition, the adoption of the OA cloud solution will allow the *Company Digital Platform* to take advantage of the latest technologies and capabilities natively integrated into the platform, such as:

- Embedded and real time BI that enables the use of pre-packaged analysis dashboards, reports, charts, metrics that offer complete visibility over the entire enterprise scenario and provide greater governance of the information managed;
- collaboration tools natively embedded in the applications, which allow easier interaction between users by automatically taking in a lot of transactional data and providing a cross-process audit;
- mobile applications that are immediately usable by users, simplifying day-to-day operations on the managed processes;
- innovative technologies (e.g: Internet of Things, Blockchain, Digital Assistant, Artificial Intelligence,...) that enable the journey towards the digital experience.

In line with the company's *Finance Transformation* project, the adoption of the new Oracle Cloud ERPM platform will initially affect all Financial Management Processes.

During 2021, analysis specification activities were carried out in preparation for the definition of the subsequent application design and implementation streams of the solution.

9.1.4.4 *Measuring innovation and the Digital Report*

One of the first steps in reducing the gap between Italian and European performance is to monitor it over time using performance indicators. This is why it might be useful to introduce a single national platform that would allow the public administration, on the one hand, to collect data that feeds the indicators and, on the other hand, to provide a tool that gives the possibility to follow directives to improve the level of these indicators.

Sogei has therefore introduced the Digital Report, a tool that follows the approach of a Balanced Scorecard visible and accessible to the whole company and aims to calculate and monitor over time the state of digitisation of Sogei. The performance of the indicators is calculated on the basis of a comparison with a target value and a critical threshold. If the KDI(Key Digital Indicator) value is above the target threshold then it can be said to have a positive trend, vice versa if the KDI value is below the critical threshold then the indicator has a negative trend.

Once valued, the indicators were grouped according to logical-mathematical aggregation logics to define a three-level tree.

The digitisation score is in fact calculated on the basis of three perspectives: Employees, Citizens and Customers/Suppliers. In 2021, only the first of these three perspectives was explored in depth, and on the basis of studies conducted, three thematic areas were created, each of them having a score representing its performance:

- Employee Experience, is the cornerstone of the Digital Transformation in its set of cultural, organisational and technological changes. It measures the experience the employee has throughout his or her working life;
- ICT development, which measures, in quantitative and qualitative terms, the enabling factors made available by the company to the employee with the aim of simplifying, speeding up and optimising the path to digitisation;
- Digital Sustainability, which measures the business ecosystem for the creation, preservation and promotion of digital content through the use of enabling technologies.

The objective is to allow the company not only to provide numbers, but also to have returns in terms of performance, identifying for each indicator strategic actions to put in place in order to improve the performance of individual KDIs and consequently that of the phenomena analysed. The KDIs were also correlated with the indicators feeding into the DESI. In fact, by studying the relationships between the indicators and those of DESI, it is possible to identify concrete actions to improve Italy's performance also within the European digitisation indicator. In addition, it should be reiterated that the objectives and lines of action set out in the Three-Year Plan for IT in PA, the NRP, the Recovery and Resilience Facility, RFF and the 2030 Digital Compass - The European way for the Digital Decade were also taken into account.

9.2 INFRASTRUCTURE AND TECHNOLOGIES FOR CHANGE

Technology is the heart of Sogei's data centres, from which the complex system of services is provided which guarantees access to the information stored in the databases of the Ministry of Economy and Finance. There are several technological levels that contribute to the creation of the infrastructure: communication between components (LAN, SAN, WAN), perimeter and logical security, server, appliance, storage and monitoring. Sogei possesses and applies the skills necessary for the design, sizing, implementation, management, control and evolution of each component of the infrastructure on a daily basis.

9.2.1 TECHNOLOGICAL INFRASTRUCTURES

9.2.1.1 *Open and Storage Systems*

The launch of Sogei's new Strategic Plan 2021-2023 has made 2021 a year of transition in terms of infrastructure for Sogei's Data Centre.

The goal of transforming the current Data Centre into a *New Hybrid Multicloud Data Centre*, through the implementation (in 2022) of a private cloud in green field entirely based on Software Defined technologies, together with the provision of Public Cloud and Distributed Cloud solutions at the same Sogei Data Centre, in 2021 saw a concentration of efforts on two strands in terms of investments and activities:

- evolution of the Legacy part in terms of processing capacity, increase of available disk space and technological refresh to continue to ensure the same levels of service and security as usual;
- grounding with executive projects of what was developed in the previous three-year plan for the start-up of a new Data Centre.

Converged infrastructures, made up of components with certified interoperability and characterised by high levels of resilience, are now the default allocation target for highly critical services and for the provision of IaaS (Infrastructure as a Service) or hosting services to new institutional customers. In order to facilitate the provision of new services and to proactively reduce the time needed to provision them, these infrastructures were upgraded.

Hyper-converged infrastructures, due to their distinctive software-defined nature (unlike converged infrastructures, the SAN/Storage layer is abstract and implemented via software) and the consequent flexibility, deriving above all from the possibility of using standard servers, are now an important part of Sogei's Data Centre, with an increasing degree of adoption. Investment in these technologies, introduced in the early stages of the pandemic in 2020, enabled the company to quickly address the need to provide services designed to favour agile working, ensuring business continuity for more than 33,000 users. Today, hyper-

converged infrastructures, based on the use of VMware vSAN technology, are the standard for Virtual Desktop Infrastructure (VDI) and for many important areas and initiatives, including the hosting of major Platform as a Service (PaaS) services and the implementation of the Software-Defined Data Centre (SDDC) paradigm.

Notable examples of this are the hyper-converged infrastructures hosting the Red Hat OpenShift clusters for the Green Pass and Immuni projects.

In 2021, this type of infrastructure was used for the provision of IaaS (Infrastructure as a Service) services on the Sogei cloud platform.

The table below shows the number of servers in the Data Centre located at the Company's headquarters (Via Carucci, 99, Rome) with the distribution per family, broken down into physical and virtual servers (or partitions).

Environment	Quantity (physical)	Quantities (logics/partitions)	Total quantity	%
Linux	354	6,336	6,690	72.87
Unix	89	244	333	3.63
Windows	89	1,480	1,569	17.09
ESX	589	0	589	6.42
Total CED Carucci	1,121	8,060	9,181	100.00

In the area of storage, the procurement process for the new All-Flash block storage space was completed. In addition to bringing new resources to the virtual farm and to all the main consumers, it allowed the efficiency of Sogei's Data Centre to be increased in terms of occupancy and energy savings, thanks also to the higher storage density offered.

In order to support the growing demand for file storage, mainly linked to the new storage needs to support agile working modes (based on the use of VDI services), the availability of this type of resource was increased with the purchase of horizontally scalable NAS (Network Attached Storage) equipment from Dell EMC Isilon.

Object storage, which is characterised by flexible access to data and a natural predisposition to interfacing via APIs, continues to show steady growth in the trend of use. In this context, the Dell EMC Cloud Storage (ECS) platform, due to its resilience, performance and scalability features, is the main choice in Sogei and is used to support services such as Digital Storage and Document Management.

As far as the centralised backup infrastructure is concerned, the new DataDomain Backup Storage was activated in 2021, improving the current infrastructure in terms of performance and simplifying the data backup process. In addition, a process for further enhancement was

initiated in 2021, due to the need to provide additional repositories for storing data from new and expanding workloads such as VDI, open systems and virtualisation environments.

Traditional RDBMS (Relational Database Management System) systems, such as Oracle, for which the use of the Exadata platform is now consolidated, host over 80 Database Instances for a total allocated net of 3700TB, divided into 2400TB linked to the Production databases and 1300TB to those for H24 services. The DR databases (2400TB) must be added to these numbers.

Alongside these RDBMS, there was a significant increase in the presence of DB No-Sql such as MongoDB, graph-DB Neo4j, PostgreSQL and Redis in accordance with the trends of the previous year.

In the middleware area, in 2021, the presence of traditional IBM WebSphere and JBOSS application servers and portals based on Liferay technology is confirmed in Java. Container and microservice-based application architectures, conforming to the cloud-native paradigm, are now the reference for implementing new services. There was also an increase in Kubernetes clusters, intended for container hosting.

Following on from last year's initiatives, which saw the implementation of major projects based on innovative technologies such as Kubernetes Apache Kafka, Mongo DB, Hadoop, Redis and others, architectural solutions based on the micro-services paradigm were consolidated.

It is also interesting to note the information on server systems, the number of which significantly exceeded 9,181 units (of which about 1,121 were physical and the rest virtual), in line with a very high growth trend that has even increased as a result of the development of environments supporting Agile working, the onboarding of new Administrations, new services and the growth in volumes of those already provided.

In this sense, a number of quality indices of the service provided during 2021 can be indicative of the state of the services:

- response times on simulated user transactions, calculated on the most significant services (classified as Platinum). The index in 2021 maintained, as in previous years, an average value below one second (0.84 sec vs 0.63 sec in 2020 and 0.96 sec in 2019);
- incidents resolved in relation to the type and according to the overall events (ITIL methodology). This index clearly represents the incidence of significant stops or slowdowns on services (EMERGENCY level) compared to the total of events that occurred in a data centre with more than 8,000 systems and several Petabytes of disk. The 2021 value is equal to 0.51% (vs. 0.64% in 2020 and 0.82% in 2019) of Emergencies with respect to the events that occurred, i.e. malfunctions without impact on services, demonstrating the very high reliability of the design and construction.

Having such challenging quality indices arises not only from design but also from maintaining the efficiency of the data centre through the use of new technologies.

In this sense, the data centre renewal index (no. of physical machine decommissionings/total number of physical machines installed at the end of the year), equal to 41.66%, can represent an average life cycle of the systems equal to around 5 years, taking into account the presence of technologies, especially Enterprise, whose average life can be longer.

9.2.2 ***THE CLOUD***

In its 2021-2023 business plan, Sogei has defined a clear strategy for adopting the Cloud paradigm, both in terms of technological choices regarding efficiency and speed, and in terms of how to provide new services. The medium-term objective is to guarantee institutional customers an increasingly autonomous, fast and intuitive experience when using new services. From an operational efficiency point of view, during 2021, Sogei continued its progression in the gradual evolution of its Data Centre into a Private Cloud with an incremental investment in projects oriented towards standardisation and automation of processes inspired by the best practices of "Continuous Integration, Continuous Deploy". In particular:

- development of a business portal (DES) for managing the processes of evolution and use of services in the digital ecosystem;
- transformation of the provisioning portal, implemented during 2020, to integrate with DES as the infrastructure provisioning engine;
- start-up of the installation of the infrastructure of the New Cloud Data Centre in a Green Field perspective;
- assessment of operational, technological and security processes for the design of new governance methods for the Cloud infrastructure;
- definition of a Hybrid Multicloud Data Centre strategy;
- acquisitions of infrastructure components to speed up the transformation process to the New Cloud Data Centre.

In terms of design efficiency, the strategic objective is to progressively speed up the "time to market" of new solutions thanks to the standardisation of technological assets and the simplification of their use and composition in order to assemble new solutions.

As regards the standardisation and ease of internal use of technological assets, during 2021 Sogei embarked on the development of a Digital Ecosystem with the aim of creating a platform and a methodological framework for the publication and internal use of technological assets with different degrees of granularity and complexity.

Through the objectives of the business plan in 2021, the implementation of the Green Field for Sogei's new Cloud Data Centre was launched. The new infrastructure follows the most advanced paradigms of the Software Define Data Centre, where automation and standardisation are the basis for optimising production processes, improving defectiveness and increasing security. As early as March 2022, Sogei will provide the first services in this mode in an integrated manner, unlike today in its Legacy environment where cloud technologies already operate, but in a less structured manner and with non-unique models.

The context in which Sogei operates and offers its services, together with the choices and experiments carried out in recent years, has made it clear, for some time now, that the adoption of a cloud first approach is an essential element for the design of services and infrastructure of our Data Centre in order to take advantage of the benefits that the delivery model and technologies provide with the cloud.

In this sense, the last three-year plans have prepared the ground for a profound transformation that will be implemented, especially with the last plan 2021-2023.

The "Cloud Italia" strategy outlines clear guidelines: adoption in PA of the Cloud First principle, both to achieve greater efficiency and standardisation, and to respect sovereignty and security constraints to protect Italian assets.

Sogei, which already has a cloud infrastructure, in the last three years had already made choices that moved in this direction, both in terms of application architectures, creating an infrastructure ecosystem based on cloud technologies that fostered the development of cloud-native, efficient, secure and time-to-market solutions, and in terms of technological evolution of its own cloud solution. This transformation needed to be accelerated in two directions: infrastructure and business.

The initiatives of the 2021-2023 Three-Year Plan go in this direction. Thanks to significant investments and on the basis of already consolidated analyses and experiments, Sogei will build its own new private cloud based on Software Define technologies in the green field, alongside the current Legacy Data Centre with the aim, over time, of transforming it into a complete Cloud Data Centre.

Sogei's strategy, however, is not limited to enhancing its cloud capabilities; this will be accompanied by the Public Cloud offering of multiple hyperscalers in its various guises, in order to create a Hybrid Multicloud Data Centre.

On the other hand, Sogei's catalogue of offerings had to be aligned with the cloud model, which enables, thanks to the technologies and development models it uses, greater integration of services, faster development processes and the election of data access interfaces (APIs) that can facilitate the development of new services according to Cloud best practices. The point of arrival, as mentioned above, is a digital ecosystem where internal and external demand for

technological solutions can be met quickly with common solutions that are best adapted to the application scenario.

The creation of a business portal (DES) linked to the creation of a digital ecosystem that favours the realisation of its own Platform Company model, combined with the provisioning of infrastructure services, will complete the scenario that will govern Sogei's new Cloud Data Centre.

In this sense, in 2021, the focus was on finalising the designs and starting the implementation of the technology infrastructure (as mentioned above), the DES and the infrastructure provisioning portal.

Also thanks to another of the projects included in the 2021-2023 Three-Year Plan (devsecops), the implementation of the components necessary for the automation of all the delivery & deployment pipelines has continued. This will continuously increase Sogei's cloud offering over the next two years, starting with the IaaS, PaaS and SaaS services already implemented in 2020.

Clearly, technological transformation, especially when it is as profound, if not as disruptive, as that brought about by the cloud, is nothing without a change in organisation, processes and skills. Thanks to the dissemination of interdisciplinary skills among the various structures and the Agile approach, already launched in 2020 with design thinking sessions, in 2021 the technical structures, together with HR, began to review, with specific assessments, the operating models and training paths. This led, among other things, to the design of a specific Competence Centre for the cloud, with the aim of encouraging the introduction of new professional figures to accompany the needs of the new operating model.

9.2.2.1 New Green Field Cloud Data Centre

Sogei is now called upon to respond to a series of challenges related to the acceleration of the digitisation of the PA, for which a major overhaul of the CED infrastructure is now inevitable, including the readiness also to use services offered by public clouds such as AWS, Azure and Google.

Using a definition that is widely used today, Sogei must become a '*cloud native* enterprise', i.e. a company that is able to design, build and operate *cloud native* applications, i.e. - borrowing a definition from Gartner - applications that can exploit an almost unlimited horizontal scaling capacity, that are portable, and that have very fast deployment and adaptation times as their defining element.

Even if, in order to make a company a *cloud-native enterprise*, it is not enough to undertake a thorough overhaul of the ICT system, but requires a global transformation of the production processes, designing a new CED, in a hybrid and multicloud sense, is, however, a crucial element for these purposes.

A project was therefore launched in 2021 to set up a new CED infrastructure (called *Greenfield*) and the automation services made available therein. The *Greenfield* will initially work alongside the existing infrastructure (*Brownfield*) with the main aim of extending automation principles and technologies to these environments.

At the same time, the process of acquiring the components of the new infrastructure was started, certainly with a high degree of technology, but with great care not to run into lock-in problems.

The reference model for this transformation is that of the cloud services in which a high level of automation emerges, which not only imposes precise requirements on the infrastructure components that must adhere to the Software Defined Data Centre (SDDC) model, but also has organisational impacts.

Another basic element is standardisation and the use of clear and shared infrastructural and architectural patterns.

The new backbone infrastructure is supported by the following service areas:

- IaaS service area: area tasked with providing services at the infrastructure level;
- Automation governance area: area in which all the components designed to manage automation are included;
- Data Functionality Provisioning Area: area intended for the provision of database as a service for DB management and services for application configuration;
- Openshift platform provisioning area: offering unmanaged clusters and provisioning of cluster areas (namespaces);
- Provisioning area for Kubernetes clusters and containerised opensource products in standard packaging (e.g. Moodle, Wordpress, Drupal, etc.).

9.2.3 **NETWORK**

In 2021, work continued on updating and upgrading the various infrastructures that make up the Network component of the Data Centre, with the aim of making its management more flexible and timely, both in terms of the acquisition and production of new elements, and in terms of the time taken to process requests and resolve problems.

The EVPN "fabric" dedicated to the Data Centre 's internal networks has recently been upgraded with appropriate "leaf" equipment to accommodate and connect the many powerful new hosts dedicated to the "working smart" project, for the progressive virtualisation of all the company's workstations.

A second EVPN fabric, dedicated to DMZ environments, was upgraded to accommodate both additional administrations and applications from the existing area.

In addition, the version of the Cisco DCNM product used to manage the EVPN 'fabrics' was updated. This activity was necessary, both on the main site and on the Disaster Recovery sites, in order to exploit the new DCI (Data Centre Interconnect) features, already present on the hardware concerned, and thus facilitate the onboarding and management of the networks of some of the new customers (such as the Presidency of the Council and the Collection Department of the Revenue Agency).

In the same vein, it was planned, through the acquisition of the necessary hardware and licences, to set up a specific area of the Data Centre according to the Cisco ACI architecture, to be configured as a "green field", in order to exploit its highly automated features and thus create a Software-Defined Data Centre. Worldwide shortages of raw materials for hardware components have delayed the start of implementation, which is now planned for the second quarter of 2022. The new 'green field' will be able to accommodate projects, both for customers and for Sogei, that can exploit its features of extreme flexibility and automation in a self-consistent environment.

A technical discussion has also begun with a number of suppliers and vendors for a radical upgrade of the network infrastructure dedicated to the campus, which will therefore involve all the subnets dedicated to workplace connections. 'Workplaces' are to be understood in the broadest sense, i.e. as generic, multi-platform business devices, both wired and wireless. Key requirements that these architectures and all management and control components will have to meet have been identified, and a *Proof of Concept (PoC)* exercise will commence shortly, which will test both the implementation, configuration and deployment methods, as well as possible ways of migrating from the current architecture.

During 2021, the migration of services exposed and balanced via old generation hardware balancers (Cisco CSS and Cisco ACE) to the new Citrix ADC (Application Delivery Controller, formerly known as Citrix NetScaler) hardware balancing equipment continued.

In addition, work began on adjusting and reconfiguring the entire fleet of computers (Citrix SDXappliances) to enhance the various hardware platforms and to optimise their load, also in light of the new computational power requirements.

In the meantime, all the approximately 80 VPX instances hosted on the 16 SDX devices present and used in the server-farm, both in the internal networks and in the DMZ networks, were successfully aligned and updated. The update was also necessary to mitigate possible security issues and to optimise performance with the new TLS/SSL encryption suites adopted.

During the year, the entire 'agile work' reception platform made available to Sogei customers and staff was manned, and continuous assistance was provided to both end users and agency representatives to enable authorised users to access the applications.

Thanks to the continuous enhancement and optimisation work carried out on all components of the platform, it was possible to enable the service to more than 48,000 unique users in 2021.

Below is a summary table of the users enabled to access the Virtual Computing platform:

Data as of 31/12/2021	Number of authorised users
Sogei and consultants	2,899
State property	1,134
Customs and Monopolies Agency	8,932
Revenue Agency	28,180
Dept Finance	1,879
RGS	4,935
Equitalia Giustizia	354
Consip and Digital Team	20
Total	48,333

9.2.3.1 Mainframe systems

The *Mainframe* has always been a highly strategic infrastructure in Sogei's Data Centre and for this reason, following the economic and feasibility studies carried out between 2019 and 2021, it was decided to undertake an evolution of the platform. The choice, which goes against the older trend of decommissioning, was made, on one hand, on the basis of the great capabilities in terms of power, security and reliability that this architecture offers, and, on the other hand, of the now widespread availability of opensource technologies on this architecture that allow it to evolve, while maintaining its key features, and that will allow the mainframe (both in its more legacy sense and with regard to the connotation linked to Linux on Z) to become part of Sogei's hybrid cloud.

Through the adoption of open-source technologies, the technological lock-in which characterised this platform in the past, is becoming less and less evident. This was also confirmed by the latest AgID opinion on the renewal of the IBM ELA software contract, in which the report indicated the path of evolution of the Z platform. No clarifications or recommendations concerning the Z platform were highlighted in this opinion, indicating that the development path presented is sound and sustainable.

In 2021, several experiments were carried out related to the aforementioned transformation path.

In the same *Legacy* area, Sogei is conducting testing of a product (IBM Z Operations Analytics) which, by analysing the system and subsystem logs within the z/OS, is able, thanks to a machine learning engine, to detect anomalous behaviour with respect to a defined model, and to trigger a number of alarms before a potential problem occurs, allowing intervention to take place before the service stops.

The IaaS architecture on the Z platform, delivered through the *Cloud Infrastructure Centre* product, is a cloud technology and as such can be linked to infrastructure automation and provisioning frameworks such as, for example, Terraform and Vrealize. IaaS and PaaS test services were defined on this infrastructure.

This strategy lies in the integration of the Z platform into the Hybrid cloud, capable of delivering native cloud services.

Sogei participates in an experimental programme with the *Cloud Infrastructure Centre* product development labs and during 2021 many suggestions and requests for functionality implementations were accepted and implemented by the product labs. This program allows the structures involved to influence product development to suit business needs.

In 2021, Sogei also presented to the IBM Technical University a use case for automating the *Cloud Infrastructure Centre* platform on Z to provide cloud resources in fully automated mode.

At the end of 2021, two very interesting experiments were launched on the possibility of using Z systems to train machine learning and AI models, and the exploration of using the Z platform as a ready-made architecture for quantum safe algorithms.

These issues are very interesting because in the next generation of Z machines, the telum processor will integrate specific accelerators for these technologies. This could be a great advantage in using the Z platform for these specific use cases.

The path of evolution has only just begun, but the possibilities are very promising, because they will allow us, on one hand, to evolve the legacy content typical of the mainframe platform by exposing it as consumable services in the cloud, and, on the other, to implement the latest technologies on enterprise machines capable of providing the highest standards in terms of performance and security to be used to host business critical applications.

9.2.4 ARCHITECTURES AND DATA

9.2.4.1 *System architectures*

The path taken in recent years in the area of data management and governance platforms has laid the foundations for the creation of a *Big Data* & AI Platform, consisting of all the necessary components capable of acquiring, processing, storing and displaying data for analysis purposes.

In 2021, the Big Data platform(*DataLake*) was extended with *Data Science* components to enable the execution of analysis algorithms capable of producing insights and predicting results and trends to support business decisions. Specifically, the Apache Zeppelin *Notebook* was industrialised and made available, enabling data analysts, data engineers and data scientists to increase productivity by developing, organising, executing and sharing code and data and visualising results. In particular, for the Department of Finance, the "RAPID" solution was designed and implemented, which makes data preparation tools available to various types of users in self-service BI mode and *Notebooks* for Data Scientists.

The Data Analytics Pipeline was defined, describing the standards, best practices and procedures adopted for the definition of a pipeline on the Data Lake platform in order to allow the standardised and regulated implementation of end-to-end processes on data, aimed at the production on Data Lake of prepared and consumable data (Data Product) for business analytical needs. These guidelines have been transposed and formalised for the clients Revenue Agency and Department of Finance.

On the same topic, market solutions such as Cloud Pak for Data, IBM's data and AI platform, and the Cloudera Data Platform (CDP) and Cloudera Data Platform Plus solution were studied and tested.

For the client State General Accounting Office, the *Data Lake* solution on CDP platform has been designed and is being released. It provides dashboards and reports for business users and *Notebooks* for Data Scientists. The Cloudera Data Platform Plus analytical platform was tested, conceived as an evolution of the current *Data Lake* environments as it is Cloud Native. A Technology Observatory was also set up to study Advanced Analytics solutions for power users.

In 2021, activities continued on machine learning and cognitive computing solutions.

In this context, ML services were developed for text classification applied to Document Management, for the classification of incoming e-mails in the certified mailbox of the Revenue Agency (ALICE). The ALICE solution is being adopted by the Treasury Department.

9.2.4.2 *Application architectures*

During the course of the year, the focus was on consolidating and expanding some experiences already started in the previous year to create a knowledge base, consisting of assets such as

libraries and archetypes, which made it possible to standardise the structure of applications and the automation of builds and releases from a CI/CD perspective.

New frameworks were introduced, both low-code (RedHat Fuse was used) to speed up the implementation of applications in the context of integration, and cloud-native (the Quarkus framework was used) to improve the efficiency of applications on microservice architectures to be run in containerised mode.

New patterns for microservice architectures have been introduced, needed to improve the resilience, availability and reliability of applications.

9.2.4.3 Data

The path taken in recent years in the area of data management and governance platforms has laid the foundations for the creation of a *Big Data* & AI Platform, consisting of all the necessary components capable of acquiring, processing, storing and displaying data for analysis purposes.

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The Data Analytics Pipeline was defined, describing the standards, best practices and procedures adopted for the definition of a pipeline on the Data Lake platform in order to allow the standardised and regulated implementation of end-to-end processes on data, aimed at the production on Data Lake of prepared and consumable data (Data Product) for business analytical needs. These guidelines have been transposed and formalised for the Revenue Agency and Department of Finance markets, while for the RGS market, as mentioned, the CDP and CDP Plus solution for setting up the Data Lake is currently being implemented.

9.2.5 IDENTITY & ACCESS MANAGEMENT AND CYBER SECURITY

9.2.5.1 Identity & Access Management

Identity and Access Management (IAM) in Sogei's IT it is the process of defining and managing the roles and access privileges of individual users to application services according to business needs, if the user is internal, and according to the conditions of agreement with the Administration, if the user is external.

By 2021, the new IAM platform, based on modern enabling technologies, had extended its scope of integration into new markets and achieved almost complete coverage in existing areas.

In the era of decentralised systems and the increasing use of cloud services, Sogei's IAM platform has been integrated with the providers' offerings, guaranteeing digital identity management with a *'zero trust'* approach. The system, equipped with processes and procedures that comply with relevant legislation, allows markets to validate the identity of users with access permissions, in the growing flow of data and on a wide range of platforms and systems.

The new platform has made it possible to standardise and automate authentication processes in particular, reducing implementation costs and increasing security.

In this area, in 2021, we should highlight the introduction of *Multifactor Authentication* based on OTP verified by the platform itself, the extension to the professional SPID and the study for the adherence to the new Digital Delegation System introduced by the Istituto Poligrafico Zecca dello Stato (IPZS).

Another strength of this project is the unification in a single system of the infrastructure intended for the protection of internal services and that for the services used by the employees of the agencies. In this regard, the adoption of a single point of access for the Revenue Agency's applications, which acts as a centralised node for the implementation of security policies, has taken on great importance. In this way, it does not burden the applications and allows for a more rapid detection of any abuse.

Finally, it should be noted that the adoption of the centralised system of tracking data, based on Big Data technologies, has been further extended, and an Identity Governance solution has been acquired which, implemented gradually in the various perimeters, will allow better governance of the security policies and risks associated with the use of credentials for access to services.

9.2.5.2 Cybersecurity

The year 2021 was characterised by evidence of the continuous growth of the cyber threat, which heavily impacted public and private institutions in Italy as well as in all the most developed countries.

In order to respond effectively to this scenario, at the beginning of 2021 Sogei adopted a new organisation that will centralise in a single function responsible for managing and developing technical capabilities to protect its own and its customers' information and technology assets. Subsequently, during the first half of the year, an assessment of the maturity of the security management technology framework was carried out to check its strengths and areas for improvement. The assessment, implemented on the basis of the *National Cybersecurity Framework*, will form the basis of the strategy to refine prevention, detection & reaction capabilities against cyber attacks over the three-year period 2021-2023. Within the strategic plan, a key role was assigned to the adjustment of staffing levels, especially with regard to the ongoing supervision of security events and the management of post-incident phases. The new

technicians will be inducted during 2022 following an appropriate training phase. In the meantime, the strengthening of some key processes will rely on the support of external expertise from companies with proven experience in cybersecurity.

From the technological point of view, the main implementation and investment activities concerned the following issues:

- deployment on servers and clients of the new EDR (Endpoint Detection & Response) software, which can significantly increase both the ability to identify malware using artificial intelligence mechanisms, and the response by being able to manage the remediation phase in a centralised manner. The solution is integrated with the other elements of the platform by being able to send and consume IOCs (indicators of compromise);
- evolution of perimeter protection systems through the technological replacement of both firewalling components and intrusion detection systems;
- evolution of cloud-based protection systems both for services provided by Sogei directly in the cloud and for those widely used services released during the year;

evolution of the software development cycle (SDLC) through the use of automatic software and infrastructure vulnerability checking systems. In this context, the processes adopted within the company were also adapted through the use of *Security Champions*, i.e. the identification of reference points in the development groups with specific skills in 'secure' code development.

