09 Digital transformation and technology development

Research and development

Nornickel's contribution to the Technological Leadership national goal

Targets and objectives:	Nornickel's performance highlights and plans
a) Ensure technological independence and foster new markets in selected areas [...]	• Development of new palladium-based components for hydrogen and solar energy, chemical synthesis, and the advancement of additive technologies and powder metallurgy • Establishment of a scientific foundation for the effective technology transfer of nickel-containing cathode material synthesis for lithium-ion and sodium-ion batteries
c) Secure a position for the Russian Federation among the world's top 10 countries by R&D volume by 2030 d) Increase domestic R&D spending to at least 2% of GDP by 2030, including at least a two-fold increase in private sector R&D investments	• RUB 192.7 million – spending on R&D and feasibility studies in 2024 • 13 R&D and feasibility study projects completed in 2024 • RUB 1.1 billion – spending on innovation in 2024 (including innovation prototyping, development of battery and palladium-based technologies, etc.) • USD 100 million – planned investment in research and development of innovative palladium applications through 2030 • Nornickel made a substantial investment in the establishment of the Battery Technology Centre in Saint Petersburg
e) Achieve a 1.5-fold increase by 2030 in the share of domestically produced high-tech goods and services based on proprietary R&D in total national consumption of such goods and services in the Russian Federation, compared to 2023 levels	• Over 100 new palladium-containing materials are planned to be brought to market. Their application is expected to drive at least 40–50 tonnes of new palladium demand by 2030

Nornickel's contribution to the Efficient and Competitive Economy national project

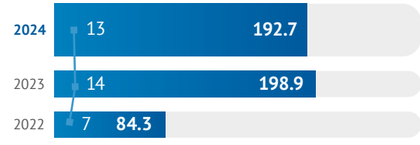
Related federal projects	Nornickel's key initiatives and focus areas	
Technology	R&D conducted by Group enterprises	Partnerships with universities for advanced technology development and testing and for training highly skilled talent

Nornickel's long-term growth and delivery on its strategic priorities rely directly on its scientific and technological efforts, which aim to improve production processes, provide technological support for operations, expand the product portfolio, and ensure the Company's technological sovereignty.

The goals, objectives, principles, allocation of responsibilities, and decision-making mechanisms in the area of science and technology are set out in MMC Norilsk Nickel's internal R&D Management Policy. The Company's R&D Panel is responsible for organising and conducting relevant consultations and expert reviews.

R&D statistics

UNCTAD A.3.3 / MED-4



■ Total spending on R&D and feasibility studies (RUB mln)
■ Number of completed R&D and feasibility study projects

The increase in R&D and feasibility study spending in 2023–2024 compared to 2022 levels was driven by new project launches and improvements to operations and individual business processes

Feasibility study of permanent exploratory conditions for sulphide copper-nickel ores of the Oktyabrskoye and Talnakhskoye deposits	Verification of shaft sinking rates for a project under existing constraints and recommendations for optimising mine development	Feasibility study on mining balance reserves within designated safety pillars and off-balance reserves at the Kalargonskoye deposit	Main drainage complex of Skalisty Mine	Feasibility study on mining remaining reserves of sulphide copper-nickel ores at the Kotselvaara and Semiletka deposits
Feasibility study on developing the mineral resource base at the Zapolyarny site	Development of general functional requirements for MMC Norilsk Nickel's autonomous and remotely operated mine machinery	Selection of a technical solution for ventilating mine development workings within the Zapolyarny Mine project. Combined development of remaining disseminated ore reserves at the Norilsk-1 deposit	Research on ionometric mapping and optimisation of pulp ionic content during flotation of copper-nickel ores at the Company's concentrators	Development of an updated nickel production operating procedure incorporating all technology solutions outlined in the updated Nickel Quality Improvement Programme

Most significant R&D and feasibility studies in 2024

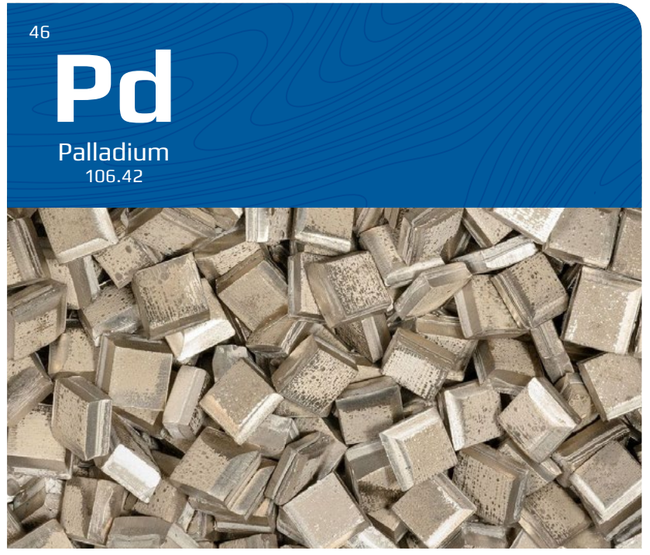
Research and development of technical solutions to improve cobalt recovery from pyrometallurgical operations for finished products at Nadezhda Metallurgical Plant	Technical audit of Talnakh Concentrator's tailings thickening section	Development of the operating procedure for processing ores and secondary resources of prospective composition for 2022–2024	Feasibility study on an implementation option of the NMP. CS-2. Construction of ShP-13.14	Development of Copper Plant smelting shop's operating procedure
Revision of the operating procedure for a cobalt production facility with a capacity of 3 ktpa of electrolytic cobalt, incorporating all technological solutions outlined in the cobalt production restoration project	Determining the feasibility of increasing nickel and copper recovery into the bulk concentrate through the use of magnetic pulse processing within the existing process flow of Norilsk Concentrator	Providing research services to improve the thickening of flotation tailings at Norilsk Concentrator, including the development of process upgrades and enhancements	Technical and economic assessment of the viability of mining high-grade, cuprous, and disseminated copper-nickel ores of the Talnakhskoye deposit's southern flank	Conducting pilot tests of a ceramic filter element for the gas cleaning system at Nadezhda Metallurgical Plant and developing technical specifications for the design of upgraded gas cleaning units

Key results of R&D and feasibility studies in the reporting year:

- research showed that ion-selective electrodes can effectively control the consumption of specific reagents, resulting in improved concentrate quality and increased metal recovery into concentrates
- recommendations were developed following an inspection of the production process at Norilsk Concentrator, which focused on concentrator operating modes and identified potential areas for improvement
- the technological performance metrics for the copper tankhouse were adjusted, resulting in better product quality and reduced defect rates
- planned production volumes were achieved for Nornickel Plating Grade full plate nickel cathodes and Nornickel High Purity premium nickel cathodes
- shipments of PGM-depleted converter matte exceeded the target, reaching over 16.6 kt vs the planned 12.5 kt
- a 19.8% reduction in SHP electrode consumption was confirmed
- the performance of core process equipment under increased raw material (converter matte) loading conditions was confirmed
- the ability to process 2.5–9.0 tonnes of pellets and agglomerates per cycle in the slag-cleaning furnace at Nadezhda Metallurgical Plant without compromising the quality parameters of the smelting products (slag, matte) was demonstrated
- the ability to effectively process spent autocatalysts was confirmed
- for the chlorine, caustic soda, and hydrochloric acid production project, technical solutions were developed, including a preliminary CAPEX estimate
- an equipment configuration for electrochemical nickel sulphate production was put in place

Research and technology development are conducted by Nornickel Group enterprises both in-house and through collaboration with specialised engineering companies and Russian universities.

Development of palladium-based technologies



A unique set of properties:

- higher catalytic activity
- hydrogen permeability
- oxidation resistance
- electrical conductivity and magnetic susceptibility

A wide range of industrial applications as:

- catalysts (to accelerate chemical processes)
- components of creep-resistant alloys (to prevent oxidation and ensure mechanical strength)
- contact coatings (to reduce electrical signal loss).

Nornickel's dedicated research centre (the "Centre") is focused on the development, testing, and commercialisation of new palladium-based materials that support the accelerated transition to green technologies and help reduce carbon footprints. The Centre's portfolio includes 25 developments across three key focus areas.

Focus areas and results of the Centre's activities

Greentech
(focus area: alternative energy)

Hydrogen power
New palladium-based materials increase the efficiency of the entire production chain:
- electrolyser catalysts increase energy efficiency by 5%–10%
- membranes for ultrapure hydrogen production reduce hydrogen production cost threefold
- fuel cell catalysts offer a 5%–10% increase in activity **and** a twofold reduction in degradation

In 2024, all materials underwent industrial testing with Chinese consumers. The first commercial batches are expected to be delivered in 2025

Solar power
Laboratory testing of new palladium-containing components designed for silicon and perovskite solar panels (offering a projected efficiency increase of 1–2 p. p.) is scheduled for completion in early 2025

Synthesis
The development of catalysts designed to enhance the efficiency of sustainable aviation fuel (SAF) synthesis from plant-based feedstocks is planned for 2025

Traditional applications
(focus area: improving energy efficiency and reducing the overall carbon footprint)

Industrial tests were successfully completed, and the first commercial batch of new palladium-containing anodes for water disinfection via electrolysis was produced. These new anodes demonstrate a 10%–20% reduction in energy consumption compared to existing alternatives, have a longer service life, and are more affordable. There are plans to scale this technology to other energy-intensive electrochemical processes for nickel, copper, and chlor-alkali production

Industrial trials of glass fibre bushings with palladium-based current leads designed to enhance energy efficiency and reduce product costs were successfully completed. There are plans to enhance the product by incorporating palladium into the alloy

High-tech materials
(focus area: artificial intelligence and electrified transport)

Research and development efforts are currently underway to extend the service life of OLED displays by a factor of 2–3 through the integration of palladium-containing components which increase the luminescence lifetime of blue LEDs

3x

Replacing lithium-ion batteries with lithium-sulphur batteries incorporating palladium catalysts could triple the driving range of electric vehicles[1]

In parallel with these focus area-specific initiatives, the Centre will also focus on completing fundamental research into the integration of new palladium catalysts into lithium-sulphur batteries. The goal is to increase battery service life and power output while reducing weight, thereby enabling their use in the aviation industry.

The projects and initiatives pursued by the Company are aimed at achieving the goals outlined in Nornickel's 2030 Socially Sustainable Development Strategy. These endeavours contribute to technological and societal progress through the application of Nornickel's products.

[1] Preliminary estimates.

Research and development of battery materials

In 2024, Nornickel inaugurated its Battery Technology Centre in Saint Petersburg, marking a new phase in the Company's efforts to advance technological capabilities in the promising field of nickel-containing cathode active materials – a key component in modern batteries.

The new centre will focus on the development and research of battery materials using state-of-the-art process equipment unique in Russia, enabling the full cycle of synthesis and testing under specialised conditions.

Nornickel's R&D centre has already produced the first samples of cathode materials for NCM 811+ chemistry, with further research planned to develop new products. The outcomes of the Battery Technology Centre's efforts are expected to lay the groundwork for future projects in the battery materials sector.

Additive manufacturing

Considering the scale of Nornickel's operations, its focus on technological sovereignty and import substitution, as well as the remoteness of its host regions, additive manufacturing technologies have become an essential enabler of the Company's operational continuity and future development. These technologies facilitate the scanning of broken parts, development of 3D printing documentation, and identification of material requirements for additive manufacturing. Computer modelling significantly reduces part replacement costs and enhances technical performance, resulting in components with longer service lives.

3D printers are deployed at multiple enterprises within the Group. On top of this, a dedicated 3D printing centre is currently up and running. Looking ahead, the Company is considering the construction of a dedicated large-scale facility to accommodate 3D printers – not only to meet in-house demand but also to serve the wider market.

Nornickel is investing significant resources in developing new R&D capabilities, which are set to become a vital element of the Company's global strategy to expand its technological expertise. The establishment of a scientific foundation for the research and development of cathode active materials is one of the steps in implementing this strategy.

Vitaly Busko,
Nornickel's Vice President for Innovation

Additive manufacturing is closely linked to powder metallurgy, as 3D printing requires specialised materials, including nickel-based powders. In collaboration with partners, Nornickel has developed nickel powders that have undergone testing in Russia and are now in the certification process in China.

Digital technology development

Nornickel's contribution to the Data Economy and Digital Transformation of the State national project

Relevant UN SDGs

Related federal projects

- Internet Access Infrastructure
- Domestic Solutions
- Artificial Intelligence
- Cybersecurity Infrastructure

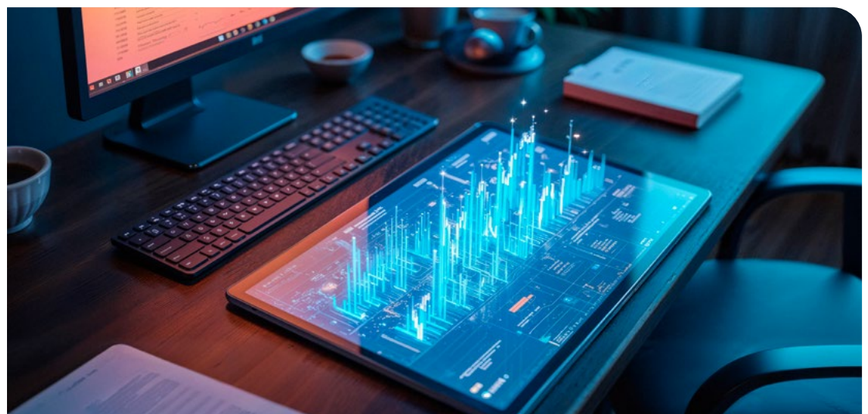
Nornickel's key initiatives and focus areas

- Ensuring technological sovereignty, including the development of sector-specific solutions within the established framework of industrial competence centres (ICCs)
- IT infrastructure and telecommunications, development of urban services and communications systems for employees and local communities
- Automation of core and auxiliary business processes
- Implementation of intelligent technologies in production, development of the Data Lake ecosystem

RUB 8.7 bn

Total spending on IT initiatives and projects (119 projects in total)

Integration of digital tools across Nornickel's operations contributes to the streamlining of business processes, ensures safety and continuity of operations at the Company's assets and units, and enables prompt data analysis and timely management decision making, ultimately enhancing the quality of life for local communities in its regions of operation.



Ensuring technological sovereignty

Nornickel's objective is to enhance the effectiveness of IT solutions through participation in their development. By collaborating with domestic IT vendors, we strive to maintain agile control over IT product development and mitigate risks to business processes through the prioritisation of Russian software solutions.

Liana Ermishina,
Vice President for Information Technology

Approach to corporate IT architecture

Given its focus on ensuring the stability and reliability of the IT landscape, as well as compliance with regulatory requirements, the Company systematically selected domestic alternatives and approaches to replace imported solutions across all layers of its IT landscape throughout 2024.

A number of domestic products were successfully piloted, specifically pilot implementations of backup and virtualisation systems were completed. A key milestone in the reporting year was the completion of the selection process for target solutions across all infrastructure applications and software projecting the corporate image. A standard operating system for user workstations was established for the Group, and a prototype corporate IT image was developed. The implementation of a pilot to migrate users to the Linux-based infrastructure is planned in the short term.

Increasing the technological independence of IT infrastructure

- Launch of a pilot to implement a Linux-based core of multi-purpose infrastructure solutions (to test the compatibility of the main components of the Company's future IT infrastructure).
- 2024–2025: pilot implementation, employee training on targeted automation tools.
- 2026–2027: development of targeted plans for migration of the entire IT infrastructure and workstations to domestically sourced Linux-based solutions

- Commencement of the development of virtual workplace infrastructure based on Russian-made Termidesk software (to ensure users' continued access to legacy corporate information systems that are incompatible with the Linux operating system).
- Simultaneous use of both the legacy automated environment and the new one enables flexible management of import substitution costs, allowing them to be spread over a more extended implementation period, if necessary

- Launch of a domestically sourced Cyber Backup-based backup system, deployed at the Moscow corporate data centre. The new backup system meets the Company's requirements for data security and fault tolerance of the target IT landscape, while complying with regulatory guidelines on import substitution.
- Standard backup system configurations were also designed to support future scaling and rolling out across Group enterprises

Nornickel's projects in technological sovereignty. Results for 2024

- Migration of information systems to zVirt, an independent virtualisation platform, with over 30% of all information systems moved. Start of the solution rollout across Group enterprises.
- 2027: completion of the migration for all current legacy systems

Completion of production testing of the explosion-proof aggregation switches for underground communications networks, designed specifically for mining environments. This equipment, developed to meet the Company's functional requirements, is fully compliant with information security standards and recommended for use within underground communications network upgrade or expansion projects

[1] For example, Resolution of the Russian Government No. 1912 dated 14 November 2023 and Resolution of the Russian Government No. 1478 dated 22 August 2022.

Ensuring technological independence of industrial automation systems

In 2024, the Company:
- expanded the software and hardware of its automated process control system (APCS) testing laboratory
- updated the list of programmable logic controllers (PLCs) and SCADA systems
- strengthened the methodological support for the Company's APCSs, specifically:
  - updated the methods used to define technical requirements for APCS components and supporting documentation
  - is developing methods for classifying industrial automation systems and implementing emergency protection for hazardous facilities
  - under the supervision of the Russian Ministry of Industry and Trade and with the involvement of in-house experts, continues to work on technical requirements for specific components of an open APCS to meet the needs of production units
  - developed requirements for an open-software PLC and an open integrated development environment.

Complying with legal requirements to move critical information infrastructure facilities to trusted hardware and software

In 2024, Nornickel launched a programme to transition the Group's critical information infrastructure facilities (CIIFs) to the priority use of trusted hardware and software solutions (HSSs).

In the reporting year, the Company, through joint efforts of its relevant functions, managed to systematise its CIIF-focused initiatives. This included legislative monitoring, updating CIIF information for the Federal Service for Technical and Export Control, and developing plans around transitioning CIIFs to trusted HSSs. Furthermore, we are collaborating with government agencies on enhancing the regulatory framework with a view to accounting for objective factors that necessitate extending the use of the existing equipment fleet.

10
Russian business units housing critical information infrastructure facilities

DevSecOps platform

Nornickel is enhancing its DevSecOps (DSO) platform to integrate the development, operations, and information security processes, enabling standardised and automated secure software development. The platform serves as a single source for storing, downloading, and verifying source code and as a trusted repository for dependencies.

In September 2024, the DSO platform went live. A conceptual design for integrating ML application development (MLOps) and secure development was also completed. The number of projects implemented on the platform more than tripled over the reporting year.

DevSecOps project implementation effects

Accelerated release of updates, improved software quality and security, and quick adaptation to changes

Reduced costs for regulatory compliance, development, and acceleration of software delivery processes in line with circular programming approaches

Support for import substitution in the IT sector

Enhanced employee skills through training in DSO methodologies, stronger information security expertise of IT specialists, and improved team productivity

The platform promotes sustainable software testing through automated testing, virtualised test environments, and continuous integration and delivery.

Project development plans for 2025 and beyond:
- expand functionality and connect new development teams to the platform
- establish network integration with segments deployed at the Company's remote branches
- enable generation of DSO-based reports on team performance metrics
- upgrade dashboards to track platform performance
- elaborate the concept for integration with the corporate hybrid cloud platform
- develop security templates to speed up development processes
- create a knowledge base of information security settings

Developing industry-specific solutions within the framework of industrial competence centres

Metallurgy ICC

Nornickel is an anchor customer of the ICC

The Company is responsible for three projects

- Geological and mining information system
- Mine planning
- Underground mining dispatch system

The Magma suite of products provides a foundation for technological independence across a range of the most widely used IT systems in the mining sector

- Product Magma-Geo
- Product Magma-Plan
- Product Magma-Control

During 2024, the core functionality of the Magma suite of IT products was under development and subsequently showcased at multiple industry exhibitions, including Smart Mining & Metals, Minex, and CIPR. A site was also selected for testing, validation, and feedback collection, scheduled for 2025 in collaboration with the project co-sponsors. The results of the relevant key projects will be submitted to the Russian Ministry of Industry and Trade and the Ministry of Digital Development, Communications, and Mass Media by the end of 2025. Plans for 2026 include launching pilot projects at Nornickel and scaling across the industry.

Environment ICC

In 2024, a predictive emissions monitoring system (PEMS) was developed to monitor and account for pollutant emissions. The system's operation relies on digital twins of production processes.

Testing of the Axioma software was conducted at the Norilsk production site towards the end of the reporting year. The tests aimed to assess the consistency of outcomes from Axioma mathematical models, accredited laboratory sample analyses, and real-time instrumental readings from certified gas analysis equipment. The measurements were conducted in accordance with metrological standards, under supervision of the Mendeleev All-Russian Institute for Metrology (VNIIM).

Based on the results of the tests conducted by Rostest, a recommendation by the State System for Ensuring the Uniformity of Measurements was registered.

A certificate of compliance was also received from an accredited centre, confirming that the Axioma software meets the requirements for AI-based measurement instruments.

Within the ICC project portfolio, this project is among the most important and prioritised. The solution was showcased at numerous all-Russian exhibitions and forums and received a number of awards (for more details on the awards, please see the Awards appendix).

IT infrastructure and communications for employees and local communities in the regions of operation

GRI 203-1, 203-2 GRI 14.9.3, 14.9.4

>24 ths
IT facilities are covered by the corporate IT monitoring service (+15% y-o-y)

>1.8 mln
behavioural metrics are collected and analysed around the clock, enabling proactive and timely, well-informed management decisions regarding IT service operations

Maintaining IT infrastructure reliability

The Company's wealth of in-house IT expertise and its collaborations with technology partners contribute to the mitigation of IT infrastructure and system software failure risks associated with the unavailability of updates from Western vendors or shortages of spare parts and components for foreign-made IT equipment.

A corporate monitoring system for IT infrastructure and business applications is a key tool designed for proactive prevention of IT incidents.

Efforts are ongoing to upgrade the corporate data network at key Russian business units. A number of facilities in Norilsk have been equipped with modern IT infrastructure built entirely on domestically manufactured network hardware, ensuring, among other things, compliance with applicable regulatory requirements. In 2024, a project to deploy a trunked radio network meeting high standards was completed.

Development of the Moscow enterprise data centre cluster

In 2024, the Company completed the relocation of the Group's IT capacities and information systems to its new data centre. The high level of fault tolerance offered by the corporate IT infrastructure has enabled the seamless migration of approximately 268 physical servers, over 300 virtual machines, and more than 200 business-critical information systems and services without materially impacting business processes or significantly disrupting information system availability.

Leveraging cloud IT infrastructure

Since 2022, the Company has been using public cloud services which offer increased development speed and convenience, enable rapid scaling to match project needs, reduce the workload on operational staff, and optimise overall costs.

In the reporting year, the Company conducted an in-depth analysis of the market for private cloud solutions offered by Russian vendors and developers. Some products underwent testing for compliance with the Company's functional and information security requirements.

In 2025, the Company plans to leverage a secure and resilient communications channel, protected by information security tools, between its corporate network and a public cloud environment to start migrating non-critical information systems to a cloud landscape, which will enable it to optimise CAPEX for import substitution initiatives.

Improving IT infrastructure reliability at Norilsk Airport

To ensure the uninterrupted operation of IT infrastructure at Norilsk Airport, its upgrade was launched in 2023. The project will be delivered using domestically produced equipment and software. In the reporting year, an internal audit of the airport's information systems was conducted, and the technical requirements for the server room upgrade project were defined. Implementation of engineering solutions to ensure the continuous operation of IT infrastructure and APCS equipment is scheduled for 2025 and 2026.

Fibreoptic communication line in the Norilsk Industrial District

In the reporting year, as part of the 981-km fibreoptic communication line (FOCL) project along the Novy Urengoy–Norilsk route, several expansion initiatives were implemented, including:

- completion of a project to ensure IT and business continuity along the Dudinka–Norilsk–Talnakh section. To achieve this, 359 km of fibre were installed along the railway lines of the Polar Division's industrial railway transport operator, thereby providing stable connectivity to 38 production sites of the Polar Division
- commissioning of the Igarka–Vankorskoye deposit route section and the completion of work to ensure full FOCL redundancy. The Novy Urengoy–Norilsk telecommunications network section was fully switched to backup cable redundancy mode, preventing communications outages due to incidents on line sections. The communications channel maintained 99% availability, with emergency recovery times not exceeding 72 hours.

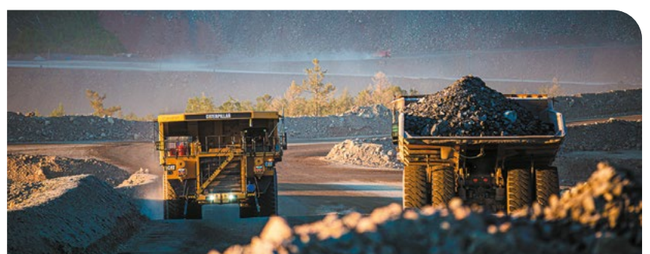
Automation of Nornickel's core and auxiliary business processes

Transport planning and management system (SPRUT)

SPRUT is a tool designed to automate transport management processes, matching transport customers and service providers.

Transport planning and management system

- Enhanced driver safety and reduced road accident rates
- Lower risk of violations and property damage during transport service delivery
- Driver compensation calculated based on actual work performed and recorded, including through the Driver mobile application



The system was awarded a winner's diploma at the annual ComNews Awards. Best Solutions for the Digital Economy market leaders awards ceremony.

In 2024, the development of the system's core modules was completed, functional testing was carried out, and compliance with customer requirements was confirmed. The system was implemented and rolled out across Polar Division enterprises in response to high demand.

At the initial stage, the SPRUT system is designed to monitor road transport operations only. Further development will extend its capabilities to cover the planning and tracking of rail and water transport. This functionality will support the transition to multimodal chain planning.

The SPRUT system is scheduled for commercial deployment in December 2025.

Automated system for mining data processing and analysis

The Company has continued to implement a project to build a unified digital platform facilitating end-to-end automation of core business processes across a mining enterprise. The selected system was sourced from a Russian developer and is currently being customised to meet Nornickel's requirements.

In 2024, functionality was implemented to enable the recording of mine planning and design data and the management of mine surveying calculations. In addition, a functionality was designed to automate planning and execution of geological exploration activities, geological modelling and calculations, and mineral reserve tracking.

The system will secure the quality, availability, and accuracy of production data across all levels of the Company, enabling timely and effective management decision making.

Measurement consistency

A working group was formed to develop a methodology for determining whether measuring instruments fall under state regulation. In the reporting year, the group reviewed the existing algorithm and identified the list of additional information required to assess whether mandatory calibration is needed due to the instruments being subject to state regulation. The Company intends to continue this effort to assess the accuracy of determining whether mandatory calibration is required for measuring instruments across all its production sites and Russian business units.

4

Russian business units deployed an automated metrological service management system in 2024 (with deployment underway in another two Russian business units), improving transparency in measuring instrument tracking and maintenance planning

Automated system for monitoring compliance with the Golden Rules of Safety

The project is aimed at creating an automated system for monitoring compliance with industrial safety rules, powered by computer vision.

The implementation of this system will reduce work-related injury rates caused by violations of H&S requirements, provide 24/7 monitoring of compliance with the Golden Rules of Safety in areas that are difficult to access for real-time supervision, and reduce equipment downtime caused by accidents.

In December 2024, the prototype was successfully tested at Severny Mine. The tests achieved the performance targets for automated detection of H&S violations.

Precise personnel positioning system at mines

In 2024, the implementation of a precise personnel positioning system was completed across Komsomolsky, Oktyabrsky, Mayak, Skalisty, and Taimyrsky Mines. Enabled by technical solutions, a collision avoidance system was implemented on self-propelled diesel machinery to alert the operator of potentially hazardous proximity to pedestrians and other vehicles. The further enhancement of this functionality included the design and implementation of an automatic braking and stopping system for self-propelled vehicles, enabling the vehicle to stop in dangerous situations.

The project is aimed at enhancing the safety of employees working in the hazardous operational environment of the mine. The system not only enables emergency notification of personnel but also helps determine their location and reduces response time for rescue services during emergencies. In addition, the solution includes features such as employee immobility detection, alerts for hazardous proximity to vehicles, and access control for hazardous areas.

Further project development is planned, including features such as managing safe routes for personnel underground movement from the lamp room to their workplaces and a mobile solution for mining supervisors, designed to improve the speed of production process management without involving the mining dispatcher.

66

underground mine facilities of MMC Norilsk Nickel's Polar Division are scheduled to be equipped with fully compliant, modern fire extinguishing systems, including functionality for system component performance monitoring and real-time dispatching

Protecting facilities from potential threats

To enhance the protection of facilities against potential fire hazards and to comply with the federal standards and rules of industrial safety, specifically the Safety Rules for Mining and Processing of Solid Minerals, the Company initiated projects to retrofit underground facilities with automatic fire extinguishing systems.

Rapid Hazard Identification service

As part of its digital transformation of health and safety, the Company is deploying modern technologies and tools. One such innovation is the launch of the Rapid Hazard Identification service. This service runs on the Supernika corporate mobile application and the Control. Management. Safety automated system. Following a successful implementation at the Kola site, the service is scheduled for testing at the Norilsk site in 2025. The service is designed to provide timely and immediate hazard alerts. Identifying the hazard, taking a photo, and completing a few simple data entry steps in the Supernika application is now all that is required. A designated service administrator assigned by the unit will process the information and take appropriate action.

Enterprise resource planning (ERP) systems

As part of the automation and development of core processes, all key financially significant Group enterprises are included into the unified business template and relevant automation systems,[1] with the groundwork laid to further increase the maturity of related business processes and improve their operational efficiency.

15.4 ths

users leverage the ERP system to interact and perform business roles

32

Group enterprises covered by the corporate ERP template

>40

related automation systems within the Company's architecture are integrated with ERP

Nornickel is expanding the ERP system's process coverage to reflect new legal requirements, modifications to its production chains, changes in organisational structure, and new targets aimed at enhancing business process efficiency and capturing economic benefits – all while taking into account sanctions and budgetary constraints. Moreover, efforts are underway to improve data quality and reliability within the ERP system. These initiatives include the development of process performance metrics to identify areas requiring user support or additional training, and the analysis of accumulated historical documentation, followed by large-scale updates. In 2024, this work was carried out across all units of a production enterprise at the Norilsk site, covering the end-to-end supply chain from needs identification through to write-offs.

Digital Treasury

In 2024, Nornickel started using the Transit 2.0 Russian multibanking platform to ensure real-time exchange of electronic documents with banks.

Furthermore, in the reporting period, the Company launched the design phase of the Unified Treasury Solution information system. This initiative aims to create a dedicated workstation for treasury experts, providing them with access to real-time liquidity data and advanced analytical tools, which will enhance planning accuracy and increase transparency into cash flows and financial transactions.

In addition, the processes for checking supplier reliability and monitoring delivery timelines for materials and services were streamlined. At the same time, enhancements were implemented to simplify operations through the SRM platform, thereby increasing its appeal to suppliers.

[1] The accounting process is handled within the ERP (enterprise resource planning) template, the supplier interaction process is managed within the SRM (supplier relationship management) system, and the warehouse logistics process is controlled within the EWM (extended warehouse management) system.

Tax monitoring

GRI 207-3 GRI 14.23.6

In 2024, a comprehensive solution for tax monitoring was implemented to facilitate the publication of Group reports through a data mart by integrating with the Nalog-3 AIS for all key tax categories. The solution was scaled across ten Group enterprises (spanning from the Kola Peninsula to the Trans-Baikal Territory). The implementation of this project facilitated real-time monitoring of almost all Group transactions, reducing the number of audits, document requests, and cutting risk closure time.

This comprehensive tax solution received the Project of the Year 2024: Finance Automation award, which underscores the Company's digital leadership, inspires innovation, and strengthens its position in the fintech sector.

Corporate data management

To optimise planning and improve the efficiency of production business processes, a heuristic model for generating planned metal balances at concentrator sections was developed on the Russian-made Knowledge Space platform. Testing of two scenarios was completed, and technical documentation was finalised for the Concentration module as part of the Nornickel Group's Production and Economic Planning System Implementation project. The system will cut production programme preparation time by a factor of three (from 12 weeks to 4) and extend the planning horizon to 42 months, enabling more agile responses to external challenges and changes in business environment factors.

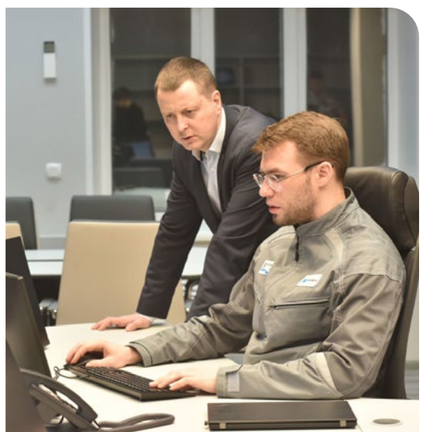
In addition, the containerisation of the corporate data warehouse (CDW) was implemented using domestically produced software: CDW data tiering by functional area was brought into commercial operation, and work is ongoing to apply data tiering to consolidated reporting. This will ensure continuous, high-performance operation of the current CDW solution in the context of growing volumes of corporate data.

Digitising HR processes

In less than a year, the Supernika corporate app was adopted by over 80 thousand users across the Company. They have access to the corporate messenger, portal, and employee's personal account. The application was enhanced with a new Personal Protective Equipment (PPE) service enabling employees at Oktyabrsky and Komsomolsky Mines to access and evaluate PPE information, and to generate PPE request lists without supervisory intervention. The app received numerous prestigious awards, including recognition from TAdviser IT Prize, IT HR Awards, WOW!HR, Employer Brand Summit, HR Impact, HR Brand, and GlobalCIO.

In addition, preparations are underway for the pilot launch of Nornickel's HR electronic document management system (HR EDMS). The HR EDMS will minimise the use of paper-based documents, increase the productivity of HR staff, enable the technological unification of business process documentation, and provide the ability to forecast and respond quickly to changes affecting document flows in HR and social business processes.

Throughout 2024, the functionality of core corporate systems and services for Nornickel employees and management was significantly expanded. These improvements are expected to substantially enhance the efficiency of internal business processes, including HR administration, the Golden Rules of Safety, and employee training and evaluation.



Automated software control and management system deployment

The project automates the audit process, enabling the generation of prompt, up-to-date, high-quality, and reliable reports in real time.

The project resulted in the creation of a Russian platform-based licence management system, which ensures:

- automated collection of information regarding installed and actually used software and features
- report generation based on automated data collection regarding installed software, including the number of actually used licences
- development of operation budgets and licence acquisition cost planning.

Renovating the CADMCS mobile application

The Corporate Automatic Document Management and Control System (CADMCS) mobile application upgrade facilitated uninterrupted mobile document flow for Company managers while ensuring compliance with information security requirements, thus improving the level of agility, productivity, and reliability of mobile document management.

Integrated Document Management programme

The transformation and technological development programme for business process documentation continued in 2024. A key achievement of the reporting year was the transition of all Group enterprises to legally binding electronic document management (EDM). In addition, the volume of automated routine tasks related to accounts payable processing increased, compliance with legal requirements for machine-readable powers of attorney within the EDM system was achieved, the scope of electronically processed contractual documentation was expanded, and digital signing of work/service orders was introduced.

14.34%
Proportion of legally binding electronic document management for 1C-based organisational perimeter (3.59% in 2023)

55.49%
Proportion of legally binding electronic document management for SAP-based organisational perimeter (37.28% in 2023)

100%
of the work/service order traffic was converted to electronic format at two Group enterprises.

Deploying intelligent technologies

Data lake ecosystem

Data lake, a scalable platform for storing and analysing data, drives additional synergies by enriching data in external systems with new information. The data lake solution is built using domestically produced Russian products and open-source systems and consists of four primary components.

Components of the data lake ecosystem

- Data Platform – storage and processing of big data (tables, text, video, and audio)
- Containerised environment – for deploying ML applications and Industrial ML instances
- ML Platform (ML environment) – a corporate platform for developing and integrating machine learning (ML) models into operational processes
- ML Clusters – a geographically distributed infrastructure for the deployment of ML solutions at production sites

In 2024, the Data Platform and ML Platform were launched into commercial operation.

In the short term (2025–2026), ML clusters are scheduled for commercial launch. This will accelerate the implementation of digital production initiatives by removing the need for iterative design and deployment of integration infrastructure, as well as reduce the analytical load on production control and dispatch systems.

Video analytics

During the reporting period, Nornickel expanded the use of video analytics (computer vision) across its production processes in general, and in health and safety routines in particular. As part of this initiative:

- the automated PPE usage monitoring system, developed in-house, was rolled out at a Norilsk site production enterprise
- the range of detected H&S violations was expanded (working at height, entering hazardous areas around active equipment, and the unauthorised transport of people using machinery not intended for that purpose)
- a mobile computer vision system was created for safety control monitoring and supporting various work processes in areas where fixed surveillance cameras and communications channels are unavailable (testing is scheduled for 2025)
- optical identification of nickel cathode quality was commissioned in the nickel tankhouse at a metals and mining enterprise of the Kola site, enabling the automated sorting of saleable nickel by grade, ensuring appropriate quality premiums, and reducing commercial losses caused by human error
- development continued on a solution for monitoring mining machinery operation via video streams from onboard recorders: modules were created for recognising the actions of roof bolters, boom drills, and fan drills, which enables tracking machinery and equipment utilisation rates, improves oversight of work order completion, and enhances dispatch efficiency in mines.

Engagement with universities

Nornickel, jointly with Central University, launched the AI in Industry partnership master's programme. As of 1 September 2024, ten individuals enrolled in the Data Science and Data Engineering courses. Over two years of full-time study, they will acquire the necessary skills to work on projects implementing artificial intelligence solutions. The programme is taught by experts from Central University and Nornickel employees. Training is delivered in person at Central University's Moscow campus during evening hours.

The programme curriculum teaches students the fundamentals of programming, provides a solid foundation in Machine Learning, Deep Learning, Data Engineering, and MLOps, and explores business process automation, basic automation principles, and the application of artificial intelligence to workshop and production management.

First semester, Start level

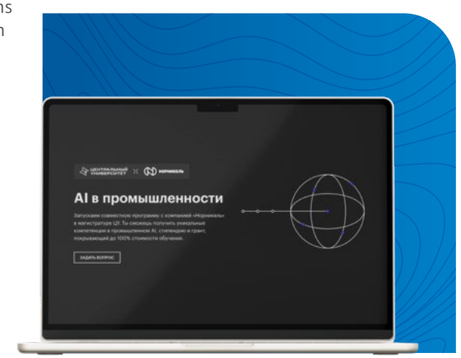
A training grant from Central University, with a RUB 30,000 stipend

Second semester, Medium level

An opportunity to take a paid internship at Nornickel and receive an additional grant equal to 50% of the one awarded by Central University

Pro level

A job offer from Nornickel and a 100% training grant funded by the Company



Information security

Nornickel's contribution to the Data Economy and Digital Transformation of the State national project and the Digital Transformation of State and Municipal Administration, the Economy, and Social Sphere national goal

Targets and objectives under the national goal

m) Ensure network sovereignty and information security on the internet

The Company's approach to information security (IS)

Nornickel considers the prevention of information security threats a critical responsibility. This priority arises from the substantial impact of potential information security risks across all areas of life, the need to protect critical information infrastructure, and the emerging challenges of cyber resilience in the modern era.

Relevant UN SDGs

Related federal projects

- Domestic Solutions
- Cybersecurity Infrastructure

Nornickel's key initiatives and focus areas

- Protecting the Company's information systems and infrastructure
- Supporting import substitution and domestic solutions
- Contributing to market development by establishing and strengthening strategic partnerships
- Contributing to policymaking and best practices
- Fostering an information security culture among employees

Going forward, the Company plans to continue along its defined strategic paths, with a focus on strengthening partnerships, fostering dialogue between customers and contractors to minimise third-party risks, and promoting an information security culture, including beyond the Company, as a contribution to the overall security of broader Russian society

Nornickel's information security objectives in the context of the sustainable development agenda

- Protecting host regions by ensuring uninterrupted production processes, pursuing sustainable business growth, and preventing environmental accidents
- Driving positive societal impact by fostering an information security culture, building partnerships, and contributing to legislative development
- Managing information security risks to enhance the security of the Company and the state, contributing to the development of the information security market and policymaking

The operation of the Company's information security management system is governed by internal documents. MMC Norilsk Nickel's Information Security Policy applies to all employees and sets forth the goals, principles, rules, requirements, and restrictions pertaining to information security activities, including the respective roles and responsibilities of the Board of Directors and the Management Board. Top management, specifically the First Vice President – Chief Financial Officer, is responsible for identifying and updating the prioritisation of strategic information security areas, reviewing information security risks, and overseeing budgets for information security programmes and projects. Information security risks are monitored on a regular basis through relevant committees and corporate reporting. The Information Protection and IT Infrastructure Department is a dedicated unit responsible for Nornickel's information security.

In 2024, Nornickel improved its existing approaches to information security management. To ensure consistent development, the information security function strives to enhance its service model by aligning its approaches with best practices in the market. One of the function's key goals for 2025 is to boost the effectiveness of existing information security processes.

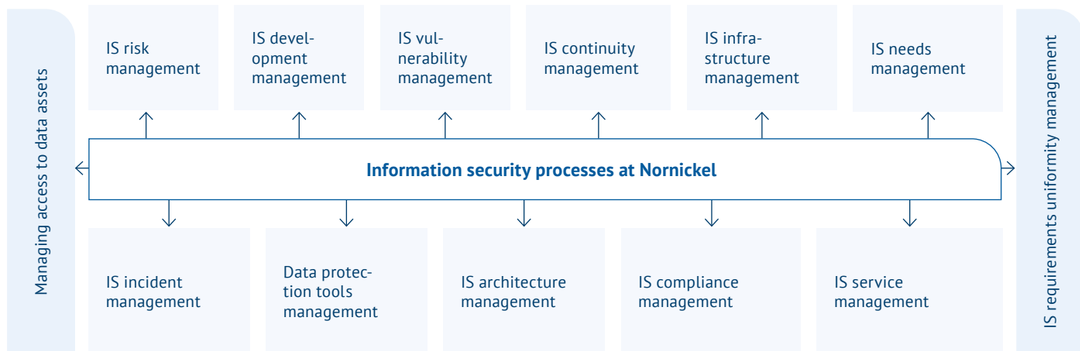
The Company's information protection strategy is built with consideration for both an increase in information security risks and the government's ongoing drive to promote import substitution of information technologies and IS solutions. Specifically, in 2024, Nornickel completed the import substitution process for data protection tools used in industrial automation systems within the Company's technology infrastructure.

The Company shares its expertise with IS product developers and takes part in refining solutions that are subsequently scaled across the market, thereby ultimately influencing the Russian IS industry's development.

The Company is taking some extra steps to protect the technology infrastructure perimeters of its enterprises and mitigate the risks of production process disruption or shutdown.

With the Company still offering hybrid work schedules for office staff, the first stage of introducing two-factor authentication for employees was completed to minimise the risks associated with unauthorised remote access to corporate resources. The Company is continuously monitoring the security of its corporate systems to promptly identify and address vulnerabilities as well as prevent cyber intrusions.

To enhance the information security management system, in 2024, the Company developed and approved a model of corporate IS processes and implemented an IS process management system to aggregate information on key performance metrics and ensure high availability of IS services for internal customers within the service model, including through additional steps to boost protection against external cyber threats.



Certification

Nornickel's information security management system (ISMS) was built in line with ISO/IEC 27001. Five Group enterprises have been certified to ISO/IEC 27001.

In 2024, activities aimed at transitioning site-level ISMS to ISO/IEC 27001:2022 were implemented to maintain cyber-defence processes at a high maturity level. The effectiveness of information security management processes across production sites was confirmed by audits. The independent auditor noted strong management engagement in ISMS processes and the preparedness of Group enterprises to respond to external threats and challenges. ISMS teams showed a high level of information security knowledge.

Security and vulnerability management

The Company has completed all activities planned for 2024 to boost the overall security of its automated process control systems (APCSs) and to implement audit recommendations from 2023.

The Energy Division's production enterprises completed their activities under the plan to implement basic process safeguards, facilitating the mitigation of IS risks at enterprises critical for the energy security of Group enterprises as well as cities and towns in the Far North.

In close collaboration with key information security market partners, the Company has refined a number of domestic solutions offered by leading manufacturers of technological and production process automation systems and aligned them with Nornickel's information security requirements.

In the reporting year, the Company enhanced its approaches to managing vulnerabilities and conducting vulnerability analysis of corporate systems, with a special focus on APCS testing. Vulnerabilities in operational systems were identified and promptly addressed, strengthening information security. Regular security analysis measures and drills to improve coordination with the response centre team also help identify and address weaknesses in security systems.

The Company is focused on improving IS processes throughout the software development lifecycle. Deploying the DevSecOps platform helps automate key security controls by integrating them directly into software development. The Company has bolstered its resilience against supply chain attacks by implementing a corporate software repository for all third-party software installations and updates.

[1] Risks related to cybercrimes against the Company's processes and systems as well as data privacy compliance risks are listed in the corporate risk management system. The Information Protection and IT Infrastructure Department is the owner of these risks. Information security risk factors, their assessment, and Nornickel's mitigation measures are presented in the Company's 2023 Sustainability Report and Nornickel's 2024 Annual Report.

>20 ths
IS events handled by the Centre's employees in 2024 (>18 thousand in 2023)

>1 ths
cyber incidents analysed by the Centre's employees in 2024

0
computer security incidents recorded across Nornickel's critical infrastructure facilities in 2024

6 ths
investigations into Nornickel employees' reports conducted in 2024

Cyber incident response system

Nornickel has in place a Cyber Incident Monitoring and Response Centre, which employs advanced technical solutions and best practices in managing cyber defence. The Centre's employees consistently demonstrate a high level of proficiency, as evidenced by the Nornickel team's exceptional knowledge and unique skills demonstrated in three competitions held in 2024.

Continuous monitoring of the IS landscape and sharing best practices with colleagues from other companies and market partners enable the Centre to implement proactive measures to block malicious activity.

Despite a significant growth in cyberattacks, the Company maintained the integrity of Nornickel's infrastructure, successfully repelling all attempts to damage it.

Any Nornickel employee detecting any suspicious content or activity on company devices can send an alert to the information security team for investigation. Experts assess the possible negative impact on the Company's information systems and take measures to prevent and eliminate the consequences of incidents.

Requirements for counterparties

In 2024, cases of compromised IT infrastructure were identified for several contractors, with response measures taken to block relevant contractors' access to Nornickel's infrastructure and prevent possible negative consequences.

The Company developed a contract section outlining information security requirements and liability for non-compliance by counterparties getting access to Nornickel's data assets under relevant contracts. In 2024, this section was already added to the general terms and conditions for Company contracts. In addition, the Company amended its standard confidentiality agreement / NDA to include the counterparty's obligation to ensure information security measures are implemented and to provide relevant details upon the Company's request. Mandatory two-factor authentication was also implemented for all third-party employees, along with a series of restrictive measures governing access for counterparties with privileged rights within information systems.

A methodology for evaluating the information security status of Nornickel's counterparties is currently under development. This will enable the Company to implement additional safeguards for its corporate data assets.

Personal data protection

Nornickel implements a set of legal, organisational, and technical measures to ensure the security of personal data (PD). Technical protection of PD involves anti-virus protection, leak prevention, monitoring of removable devices, analysis of security incidents, etc.

The Company places particular emphasis on maintaining legal compliance of its personal data processing. As part of this commitment, a relevant department at Nornickel developed and implemented corporate guidelines in 2024.

A methodology for lean PD processing was developed at the Company to reduce the risk of PD leaks by minimising PD processing within business processes.

8 Group enterprises brought their personal data processing procedures into full compliance with legal requirements and internal regulations

11 Group enterprises assessed their websites for compliance with legal requirements to PD processing

Information security training and communication

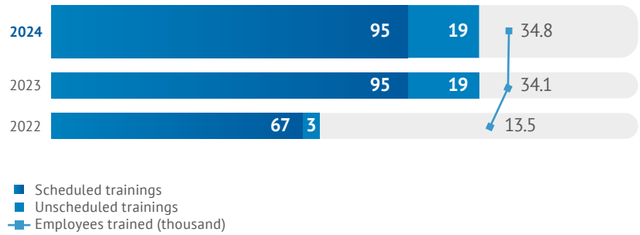
In line with its objective to foster an information security culture across the Group and reduce the impact of human error in IS incidents, Nornickel places particular emphasis on raising awareness among all employee categories about IS requirements and digital hygiene practices.

Information security issues are covered during mass corporate events and strategic sessions. Employees are updated via internal communication channels: publications on the intranet portal, mailings, corporate messenger, postings on bulletin boards, and videos on screens in common areas.

Employees receive regular training on relevant IS topics, including online courses and training sessions updated to reflect the evolving threat landscape and legislation.

To enhance employees' vigilance and practice the sequence of actions in case of an information security incident, the Company runs regular drills, including simulations of phishing attacks and other current unlawful practices that affect users. Following the drills, instructions for employees are updated.

Nornickel also prioritises the personal information security of employees and their families, implementing initiatives for employees' children (such as cybersecurity games, meetings with experts, and educational videos on IS fundamentals).



Cybersecurity culture is an integral part of Nornickel's cultural DNA – one that extends beyond the Company and contributes to both business resilience and national cybersecurity efforts.

Partnerships and best practice sharing in information security

Established at Nornickel's initiative, the Information Security in Industry Club (BIP-Club) brings together chief information security officers and IS experts to share expertise, engage in public-private dialogue, develop universal information security requirements, explore innovative solutions, and foster mutually beneficial partnerships.

In 2024, BIP-Club continued its activities and, as part of a public meeting for market participants, brought together for the first time vendors, integrators, customers, and market regulators to discuss their approaches, requirements, and expectations for partners, as well as outlooks for productive collaboration under the import substitution programme.

In addition, the Company used BIP-Club to propose to the information security community a Code of Ethics for the Information Security Market, containing a set of principles that will help improve the maturity of the market and foster better cooperation between customers and contractors.

Nornickel engages in strategic collaborations with leading market players to develop and introduce cybersecurity solutions designed to bolster the cyber resilience of the metals and mining industry.

Nornickel also collaborates with a number of leading Russian universities on joint projects, encouraging and recruiting young talent to pursue careers in industrial information security.

> **The agreement with Nornickel is aimed at the continuation and expansion of our cooperation, consolidation of expertise, efforts, and resources to ensure information security in the metals and mining sector. Our experts note the increased focus of attackers on critical information infrastructure and predict a rise in destructive attacks on Russian companies. Together with Nornickel, we will be able to make a significant contribution to the industry's cyber resilience to be prepared for growing threats and challenges.**
>
> **Mikhail Oseevsky,**
> President of Rostelecom