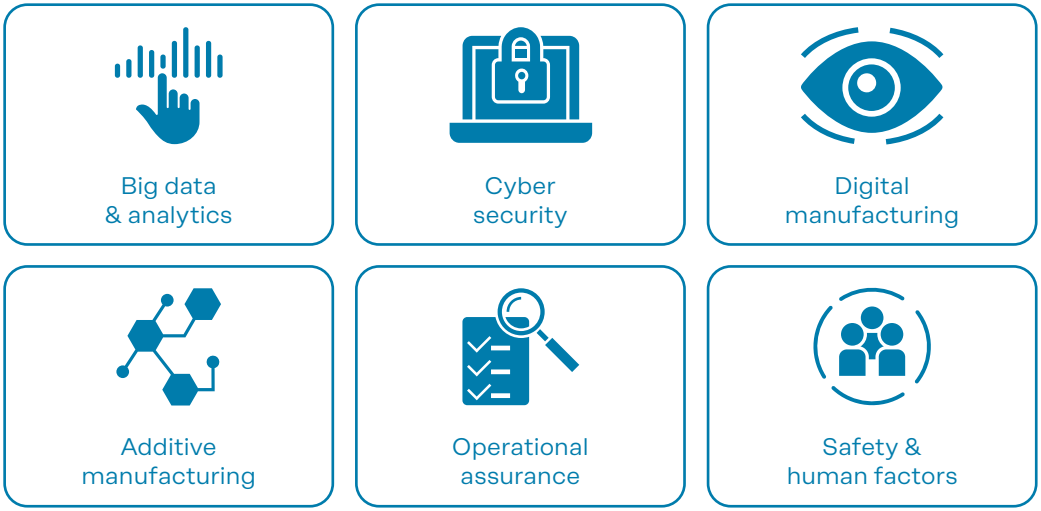
Industry 4.0

Our experience. Your growth.

We develop an integrated approach consisting of two main steps: feasibility and implementation. This ensures competitiveness in terms of:

- Speed: reducing time-to-market through shorter innovation cycles
- Quality: improving quality and reducing waste by means of real-time production monitoring and real-time prediction of the expected product evolution during production
- Flexibility: enhancing flexibility by means of mass-customisation production
- Security: increasing security to avoid downtime and cyber attacks
- Safety: the machines and even single critical components can advise of corrupt performance in advance, thereby avoiding critical and unsafe situations
- Efficiency: increasing efficiency through smarter products and services
- Know-How: data allow us to master production and help correct rates (costs for each product, expected time to market, etc.)
- New technology: introduction across the entire supply chain, internally or in partnership
- Environment: predicting and managing the impact of production through a wide set of data from sensors and the digitalisation and modelling of plants and processes

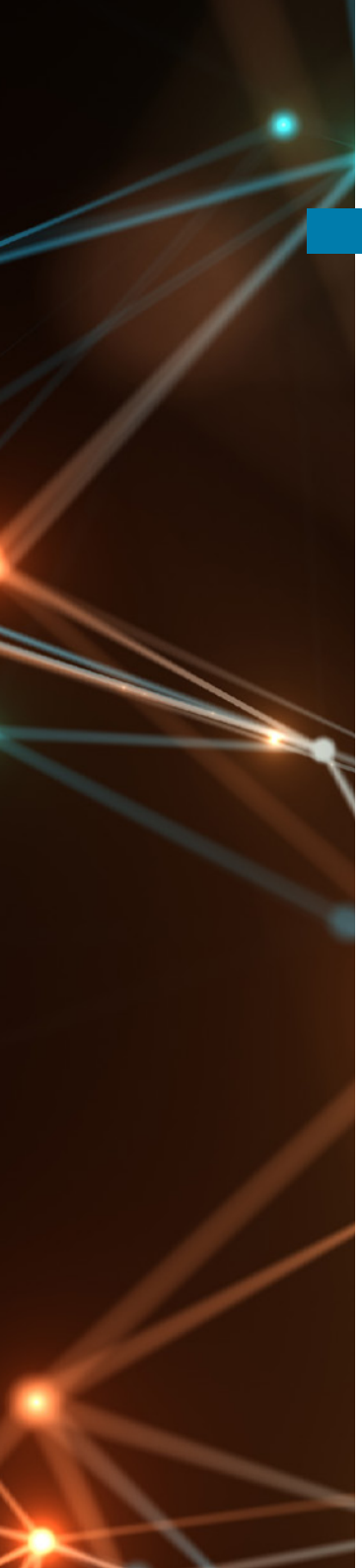
Business cannot move forward without measuring performance. In the feasibility phase, we assess the hotspots for improvements, in order to maximise impact and define the roadmap for the transition from a strategic to a technological approach. Identifying targets through the company assessment allows us to customise strategies for the most efficient development. The implementation of cyber-physical production systems combining communications, IT, data and physical elements requires a step-by-step analysis of the production chain to identify strengths and weaknesses. Industry 4.0 integrates the enabling technologies providing specific solutions, products, and benefits creating a digital image of entire value chains.



An integrated approach based on

Feasibility

Implementation



Big data & analytics

Industrial production has always processed a large amount of data, typically in databases made available from time to time for automation, for decision support systems and for overall quality. Gradually, the internet became integrated into the factory and the amount of data available increased accordingly, but the management architecture essentially remained the same.

Now, the IoT (Internet of Things) and intelligent sensors make better quality data available and bigger quantities, both structured and unstructured. These data are collected and analysed with tools which transform them into information capable of driving decisions - making things faster, more flexible and more efficient through the use of frontier innovations such as cognitive systems.

The detection, analysis and exploitation of this volume of data by companies has already been done. In the future, the data will be used more and more, not only during production, but also for business strategies. The Big Data & Analytics Revolution refers to algorithms capable of handling multiple variables in a short time, and to (not necessarily large) computational resources.

Big Data provides new possibilities to combine information and to provide a visual approach to data, suggesting paths and interpretation models that are difficult to predict in advance. The real goal of analytics is therefore to extract hidden meaning from data that are not normally used or are even considered unnecessary. Big Data is characterised by the rule of the three Vs: Volume of data, their Variety and their Velocity. There is talk of Big Data when the values of all three characteristics are extremely high, and it therefore requires special technical skills together with specific and non-conventional methods to extract information and value from this mass of data.

Volume of data

Variety of data

Velocity of data

Main **projects**

TECHNOLOGICAL PLATFORM
Sector: Heavy industry
Location: Italy / Argentina / Mexico / Canada

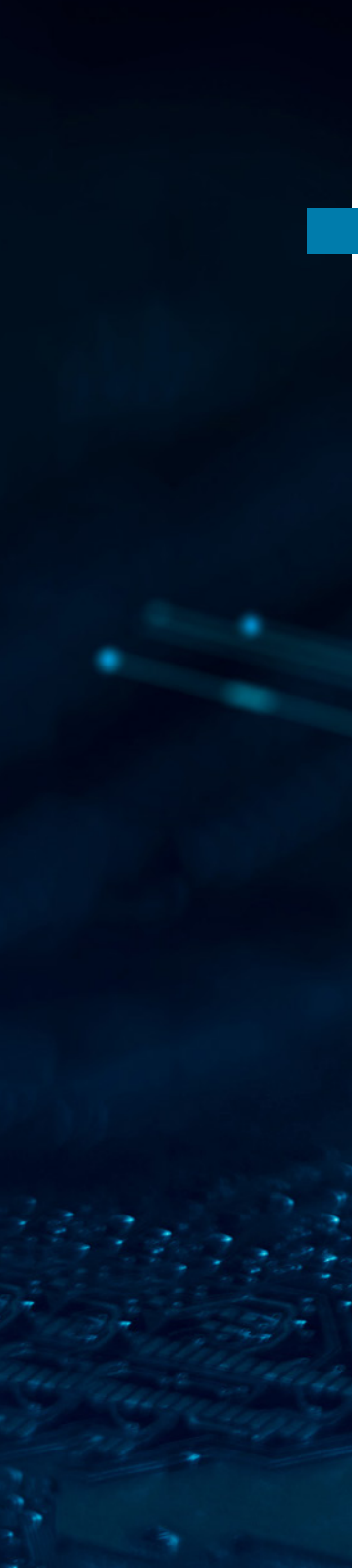
The platform is an online system dedicated to the production of metallic components. Its primary objective is to reduce process variability by generating additional technological information through mathematical process models and algorithms. The online expert system is applied to the process based on deterministic rules for the diagnosis of anomalous and non-standard rolling conditions and alarm generation and moves the production towards a process control closed loop system.

MONITORING QUALITY AND PROCESS PARAMETERS IN METAL PRODUCTION
Sector: Heavy industry
Location: Italy

RINA designed, developed and installed a data acquisition and monitoring system for process variables and quality of metallic products, including the creation of a centralised product repository along the treatment lines of two different plants. Process variables of each production step are associated with the position together with quality measures (reflectivity, roughness and the presence of defects) for quality reports and a Graphical User Interface allows for the generation of statistical analysis.

NEURAL NETWORK ONLINE PREDICTION OF MECHANICAL PROPERTIES
Sector: Heavy industry / Automation
Location: Belgium / Italy / Russia

mechView is a software tool which complements RINA's metallurgical knowledge through the huge amount of data collected by automation systems and the features of an artificial neural network. It is used to predict the mechanical properties of a metallic product during its production, and is based on five specific modules: patternView, ausView, phaseView, preciView and Neural.



Cyber **security**

The 4th Industrial Revolution, driven by the Internet of Things, is creating intelligent networks that can autonomously exchange information, trigger actions and control each other independently. The complexity of managing production and supplier networks across the value chain therefore grows enormously, and any industrial monitoring and control system that interacts with the physical world must be secure.

The potential risks - including loss of intellectual property, brand damage, financial loss, customer grievances following late deliveries or batch inconsistencies, the safety of production personnel and even the safety of manufactured products (to name but a few) - go far beyond the perceived threats in everyday personal computing and online banking.

These are challenges that cyber criminals are exploiting, so tackling the threat of attacks is of paramount importance. Achieving cyber resilience involves diligence, standards, good practice and risk management that is supported by the right security strategy and technologies.

Mitigation strategies to counteract cyber threats are developed through the analysis and testing of embedded and mobile systems and complex service-orientated applications following international best practices (ISO27001, NIST, OWASP, CEH).

Information security involves safeguarding sensitive information from illegitimate access, usage, revelation, disruption, alteration, reading, inspection, damage or recording

Network security refers to comprehensive security policies and provisions adopted in an adaptive and proactive manner for thwarting and monitoring network threats

End user education This is the weakest link in cyber security, so users must be trained to sufficiently high levels

Main **projects**

STOCKHOLM METRO RED LINE SECURITY ENGINEERING SERVICES
Sector: Local institutions
Location: Sweden

RINA provided system engineering services for the upgrading of the Red Line signalling system. IT security was one of the main issues, covering verification of the security requirements for the design of the system, vulnerability analysis of the system blueprint in accordance with worldwide recognised IT security threats and best practices, specification of additional requirements to fill security gaps and compliance verification of the signalling system.

SECURE SMART GRIDS
Sector: International institutions
Location: Italy / Belgium

The projects covered risk analysis related to the management of micro-energy plants and the realisation of a distributed energy production system. This included the development of self-configuring smart grids able to balance the energy offering, the evaluation and implementation of a minimum set of security requirements to increase grid resilience, and ensuring an increased resilience of the networks against cyber-attacks and physical outages.

CYBER SECURITY RISK ASSESSMENT
Sector: National institutions
Location: Italy

The project was aimed at the identification and evaluation of potential cyber security risks in view of the Italian Civil Aviation National Authority's information system being certified ISO 15408/27001. The main activities covered system architecture and functional analysis, risk analysis and mitigation of the information system security, testing, inspection and security countermeasures and requirements.

Digital **manufacturing**

The availability of Key Enabling Technologies, better known as KET's, is spontaneously evolving automation and control of production to the global integration of the production area, between production areas, and with the typical factors and relevant actors in the territory. In this, the physical barriers are smoothly overcome and tend to react more liquidly. We talk about vertical integration of all automation components and information systems in a single process area. The IoT (Internet of Things) allows each operating unit to communicate with each other and enables the integration of related automation systems. A key role is played by the availability of a network of physical and virtual smart sensors capable of detecting the state of operation of each individual machine or component.

The next step is the horizontal integration, when the level of production control is such to connect all the individual process areas. The exchange of technical, quality and management data allows early intervention in case of deviation from the target. The complete tracking down of all the various production steps allows to build the product genealogy associating all the process information and draw up a "production certificate". Enterprise portals are open to the customers who can check the status of their orders and communicate any change. The connection between areas of the process so allows to implement the best operational practices.

Featured **project**

LADLEHEAT THROUGH-PROCESS CONTROL SYSTEM
Sector: Heavy Industry
Location: Italy, Turkey

Measuring the real-time temperature of liquid steel across the different phases of the production process, from the electric furnace to the converter to the continuous casting machine. Communicating with the plant automation infrastructure, the system highlights anomalies and proposes countermeasures that optimise energy consumption and costs in view of the final target: the arrival of the ladle at the continuous casting phase with the expected quality of the steel.

Main **projects**

ONLINE STRIP FLATNESS MEASURING
Sector: Heavy Industry, Automation
Location: Italy, Russia, Argentina

Designing and building up various industrial optical systems for the dimensional control of the strip and for the measurement of flatness while a steel strip is being processed. The system carries out continuous analysis without contact, allowing for better quality management through a distributed system for consultation of the information produced.

VEDONET
Sector: Heavy industry
Location: Italy

VedoNet is a system that supports production and quality control and can monitor all areas of a manufacturing facility. It provides dedicated services in the LAN to monitor a specific area of the plant, record video through TCP / IP camera devices, communicate with inspection or image processing and exchange information and data with automation levels 1 and 2.

RF SENSOR
Sector: Heavy industry, Automation
Location: Italy

A model-based measuring system that uses radio frequency technologies for mould powder thickness and steel levels in the mould of the continuous casting machine. The system can perform a dynamic measurement of powder thickness with previously impossible levels accuracy and a measurement of steel level with a much greater range and higher speeds, and without the use of radioactive sources. The system is applied industrially for square and rectangular formats and the project is also in an advanced stage for round shapes.

Additive **manufacturing**

RINA provides a full range of services to systematically create growth opportunities through innovation in additive manufacturing technologies. We follow the entire lifecycle of an innovation project spanning from analysis of technological trends, the conceptual design of new solutions, engineering adaptation and design, analysis of funding opportunities and setting up of collaborative partnerships, through to integration, testing and validation.

As innovation is a major concern for public institutions, stakeholder groups and development agencies, we help them in designing, implementing and monitoring the most suitable funding instruments and support programs.

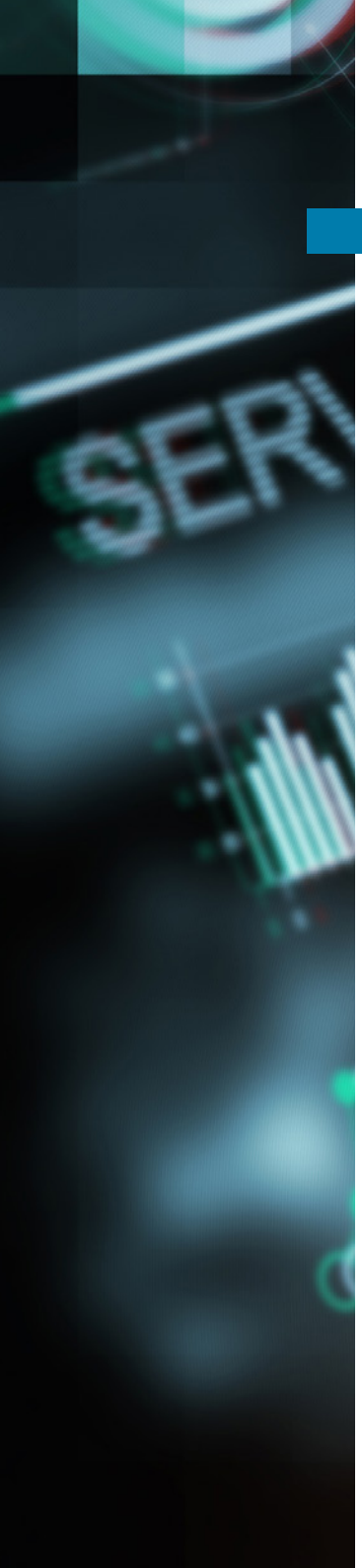
We manage the innovation chain of metallic materials for additive manufacturing by understanding the defects of the current materials and developing specific new ones. RINA can improve material utilisation and increase consistency and product repeatability, achieving similar or superior performance levels to those of cast or wrought materials. The integration of additive manufacturing into the manufacturing process, understanding the metallurgy resulting from a specific additive manufacturing thermal process cycle, and the manufacture of technical prototypes with a complete validation are the main areas in which our capabilities can be implemented. RINA has developed a more specialised business (applying some Industry 4.0 KETs to the additive manufacturing sector) with strong integrated opportunities through the creation of competence centres that work side-by-side with service providers.

Featured **project**

FEASIBILITY STUDY FOR METAL POWDER PRODUCTION
Sector: Heavy Industry
Location: Europe

RINA provided detailed analysis of the metal powders market and the opportunities deriving from the installation of industrial plants for powders manufacturing. From these considerations a further technical and economic feasibility analysis of the best layout for a production plant has been carried out.


Analysis of technological trends
Conceptual design of new solutions
Engineering adaptation and design
Funding opportunities & collaborative partnerships
Integration, testing and validation



Operational **assurance**

Predictive maintenance is performed in order to avoid any failure in the critical components of production systems. It is based on identifying one or more service parameters that are measured and that make predictions over time using appropriate mathematical models. The key point is to predict the residual lifespan of one or more components before they fail in an irreparable way, causing the system to grind to a halt.

To achieve this, the most common detection methods used are vibration measurement, thermography and absorbed current analysis. The detection of an unexpected change to the expected value of the parameters being monitored will indicate the start of a continuous condition of degradation. Based on a specific model, it will be possible to predict the residual useful life of that component, before the occurrence of a catastrophic failure.

With the availability of enabling technologies and in particular of intelligent built-in onboard sensors, integrated predictive maintenance has become one of the industry leading applications of Industry 4.0. Thanks to the presence of onboard sensors that send data to more sophisticated forecasting models, the need to shut down is now decided by the machine itself. Large infrastructures, both civil and industrial, can be subject to predictive maintenance, for example with monitoring drones. Intelligent 'flying' sensors are able to detect abnormal corrosion conditions, gas leaks, the formation of cracks, and to call for human intervention in real time.

Finally, it must also be underlined that in order to overcome the problem of unpredicted failure of a critical component, technical staff are currently forced to directly monitor the behaviour of a machine. Such 'de visu' monitoring can sometimes include activities that are hazardous for the technical staff. Thanks to the application of such predictive tools, the frequency of these unsafe activities can be drastically reduced.

Vibration measurement

Absorbed current thermography

Absorbed current analysis

Main **projects**

DROMOSPLAN
Sector: Heavy industry
Location: Italy, Germany

RINA designed and implemented cooperative Unmanned Aerial Vehicles for industrial use in monitoring critical areas, including confined indoor spaces. These drones, specialising in suitable sensors, autonomously carry out maintenance-related missions such as periodic infrastructure inspections, safety (anti-intrusion in hazardous areas), and environmental monitoring.

IDENTIFICATION AND TRACKING OF ROLLING CYLINDERS FOR PREDICTIVE MAINTENANCE
Sector: Heavy industry
Location: Italy

Two technical feasibility studies were carried out for the use of UHF RFID technology in the identification and tracking of rolling cylinders. The first, in 2013, demonstrated the validity of the proposed solution (UHF RFID tag + Impinj Speedway Revolution tag) for the rolling cylinders of a complex rolling mill. In 2016, a similar solution highlighted the feasibility of identifying the workpiece cylinders in the outputs at a specific processing line of the client.

PRELIMINARY INSPECTION, MAINTENANCE AND DIAGNOSTICS IN RENEWABLE SOURCES
Sector: National, Regional institutions
Location: Italy

The competitiveness of renewable energy sources is significantly related to the maintenance and management of failures. In this context, the application of specific methodologies and competences in the field of online and real-time inspection and control, advanced diagnostics and prognostic systems is of critical importance.

Safety & human factors

Technology based on extensive connectivity is changing the role of employees, technicians and managers, and the concept of a work environment as a physical place in which activities are carried out will also undergo an evolution. Manufacturing companies are increasingly looking for trained staff who know how to handle data, monitor production processes and operate systems to correct deviations from the target. In a globally connected company, these staff will be required to make use of the same digital skills at work as they use in their private lives. In order to understand, drive, and ultimately exploit this change, it will be crucial to identify suitable solutions for both training and workplace safety.

Total safety and security, together with comfortable work environments with high technology systems will increase employee satisfaction and will attract young talents in production environments and a new generation of skilled and knowledgeable operators. We can count on solid experience in managing high-level training programs including Steel Master, EuroSteel Master, Master on Additive Manufacturing and Master on Industry 4.0. Safety is an area that will receive tremendous impetus through the application, in particular, of wearables and augmented reality solutions. We have launched important development projects in this field to offer our clients tailormade solutions. We have developed and installed complete solutions based on software and hardware packages, including dynamic production line scheduling systems and, thanks to our long-standing experience in the steel industry, we can offer skills and solutions that have been tried and tested in the field.

Featured **project**

INTEGRATED INTELLIGENT MANUFACTURING
Sector: Heavy Industry
Location: Spain, France

I2MSteel is a collaborative system based on agent technology, service-orientated architecture and a semantic engine. The system has been released and validated in a multisite company to find alternatives for off-spec products in any of the production steps. The potential final product characteristics are matched to alternative customer orders and the system reallocated off-spec products by up to 60%, improving automatic reallocation.

Main **projects**

PLANNING AND SCHEDULING OF PRODUCTION
Client: Automation
Location: Egypt, Russia, Ukraine, Saudi Arabia, India, Italy

Planning and scheduling the production of steel mills integrated into the customer system. The system allows you to create and manage production campaigns, generate internal orders for steel mills, manage park material, generate and send the program on each level 2 machine, tracking the production.

MONITORING OF INDUSTRIAL WATERS TREATMENT PLANT
Sector: Heavy industry
Location: Italy

Development of a system for monitoring the industrial water treatment and distribution facilities in a manufacturing plant. The system was developed using a 3D interface reproducing the elements of the systems in a realistic way whilst taking into account access to web applications. The main variables (flow rate, temperature, pressure, machine status) are acquired at automation level 1 and proposed to the operator in real-time.

RFID FIRE CONTROL SYSTEM
Sector: Heavy industry
Location: Italy

The use of RFID technology based on the remote reading of information contained in a tag makes fire detection and control procedures more secure and effective. All fire extinguishers are uniquely identified and registered in a database together with data from periodic checks and inspections. For fire extinguisher control, a mobile terminal such as a smartphone with an RFID transceiver is used.

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DISCOVER
our web page

RINA consists of the parent company RINA S.p.A., the holding which controls the main sub-holdings RINA Services S.p.A., RINA Consulting S.p.A. and RINA Prime Value Services S.p.A. In order to ensure compliance with the applicable recognition, authorization, notification and accreditation rules, including those relevant to the management of impartiality, RINA has adopted a governance and organizational model. According to this model, the sub-holdings are subject to direction and co-ordination by the holding in the finance, administration, strategic, organizational, managerial and business continuity fields, while technical and operational decisions remain under the exclusive responsibility of the sub-holdings and their controlled companies. The strict separation of duties in the governing bodies and the impartiality risk assessment, which identifies and manages the impartiality and conflict of interest threats coming from the company relations, ensure compliance with the applicable impartiality rules.

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