SCIENCE & AUTOMATION TECHNOLOGIES

NSaRC

https://nsandrc.org/

National Security and Resilience Consortium Cluster

Robotics | Enabling Biotech | Clinical Research | Lab Operations | Automation



ROBOTIC AUTOMATION IN THE BALKANS

CE UK CA ISO



HOW CAN AUTOMATION AND DATA INTEGRITY HELP YOUR SCIENTIFIC INDUSTRIES?

An in-depth look

MODERN RESEARCH INFRASTRUCTURE

Contents

A Foreword from David Reed, Lead of the NSARC Science & Automation Technologies Cluster 4

The NSaRC 5

Benefits of Automation 6

Staged Adoption 9

On Data Integrity - Dr Daniel Thomas, The Semantic Scientist 11

Giving the Service Industry an Upgrade - Robert McKelvey 18

It's time to talk 22

Welcome to this brochure, which serves as your guide to the transformative power of automation in the Balkans.

The nations of the Balkans have a long recognised history of resilience and innovation. This spirit has propelled the region's recent economic growth, establishing it as a dynamic hub of activity. Now, to secure continued prosperity and a competitive edge in the global marketplace, the time has come to embrace the next frontier: automation.

Automation is much more than just a buzzword; it's a fundamental shift in how we work and create value. It's about leveraging technology to optimise processes, boost efficiency, and develop our most valuable asset: human talent.

The opportunity to quickly build new technological sectors in areas previously dominated by long established countries or regions has never been greater. Automation can unlock unprecedented gains in productivity and profitability, but the real benefits are experienced in the downstream industries.

The instant impact of artificial intelligence in the analysis of large scale research data sets, allows those that recognise and adopt new technologies to move quickly and can propel research from routine to cutting edge in a very short timeframe.



NSaRC
National Security and Resilience Consortium
S.A.T. NSARC CLUSTER

The financial benefits of automation within research are clear and compelling. **The initial and more easily recognised impact is acknowledged in reduced operational costs, fewer errors, and a significant increase in output.** By far the less understood and greater potential, is the ability to quickly advance research operations within global recognised industry standards and practices. The adoption of machine and software operations accelerates productivity in the first phase, but more importantly provides a much quicker route to adopting a role in the cutting-edge research and self sufficiency in complex diagnosis and analytical methods. Removing the need for significant numbers of high skill individuals to be sourced and retained, within a particular geographic region prior to commencement, overcomes one of the largest obstacles faced within industry and creates a fully sustainable and scalable business model.

Furthermore, this technological shift is a catalyst for high skill job creation, fostering new roles in areas like data analytics, robotics engineering, and systems management, thereby building a more skilled and high-value economy.

At the **NSARC Science & Automation Technologies Cluster**, we are dedicated to helping the Balkan region navigate this transition. We believe that by fostering strong collaboration between industry, academia, and government, we can accelerate the adoption of scientific automation and ensure its benefits are widespread. Our mission is to provide the resources, expertise, and support needed to help companies of all sizes succeed in this new era.

This brochure is designed to be your starting point. Inside, you'll find **insights from leading experts**, examples of successful automation projects, and practical steps on how to begin your own journey. We hope it inspires you to see automation not as a challenge, but as an incredible opportunity for growth and positive change.

The future of the Balkans is one of *immense potential*. By embracing automation, we can build a more efficient, innovative, and prosperous region for generations to come.

A Foreword from David Reed

Lead of the NSARC Science & Automation Technologies Cluster

Managing Director, Flexible Lab Solutions



NATIONAL SECURITY & RESILIENCE CONSORTIUM



"Operating in over 54 countries the UK's National Security & Resilience Consortium ('NS&RC') is a sophisticated, technically advanced consortium, comprised of some of the most creative minds in the United Kingdom."

NS&RC Head of Global Operations

The NS&RC is a group of **UK Centric companies** who work collaboratively and cooperatively to provide unique **world class security and resilience solutions** in the face of **increasing natural and man made risks** and threats to Governments, commercial organisations, major events, transportation systems and **critical national infrastructure**.

NS&RC members commit to a common charter based around cultural respect, honesty, trust, integrity, loyalty and the delivery of outstanding service to each other, clients and their associates.

The NS&RC is divided in to fully integrated capability clusters which are chaired by an Executive member of the NS&RC Consortium, of which the **Science & Automation Technologies Cluster** is the latest.

Partner with UK world leading experts to transform specific growth sectors.



Robert McKelvey, Director at
Vortex Containment Technologies

An engineer with a background in industrial filtration and power generation. He has extensive experience solving complex challenges where efficiency, safety, and reliability are crucial. Now in the life sciences sector, he applies his expertise to technologies that enhance safety and cleanliness at a microscopic level, shaping better environments for research and innovation. His engineering perspective informs innovative approaches to containment, air purity, and system design in laboratories and healthcare.



David Reed, Managing Director at
Flexible Lab Solutions

Bringing over three decades of experience to his role as Managing Director and co-founder of Flexible Lab Solutions, David's career began as an engineer in pharmaceutical production and evolved into automation within life sciences research. David's forward-thinking approach focuses on creating innovative, modular solutions that serve the evolving needs of modern laboratories. He also acts as a trusted advisor on laboratory automation for the UK Government.



Dan Thomas, Managing Director at
Twenty24 Consulting

With over 25 years in pharma and biotech, Twenty24 Consulting accelerates drug discovery by uniting scientific expertise with digital transformation. Through precision automation and proven experience in molecular profiling, enzyme kinetics, and fully automated platforms, we deliver reproducible data, streamline workflows, and enable smarter decisions that drive the future of healthcare innovation.

THE BENEFITS

Data integrity is the foundation of accuracy, consistency, and reliability throughout the data lifecycle.

Precision engineering plays a pivotal role in ensuring this integrity and is essential for informed decision-making across all industries, but never more so than in novel scientific research.

By **minimising error bandwidth** and **achieving high accuracy**, **precision engineering** delivers robust methods for data collection, calibration, and analysis of measurement uncertainty, ensuring that source data remains correct, complete, and untampered.

Investing in robotics and automation in the Balkans offers substantial business benefits.

For the Balkan economies, embracing global standards in robotics and automation is not just an aspiration but a necessity for robust economic growth and integration into the **broader European community**. With initiatives like the Common Regional Market (CRM) agenda aligning policies with the **EU Digital Single Market**, the Western Balkans are well positioned to harness these advancements to drive innovation, strengthen resilience, and **secure a lasting competitive edge**.



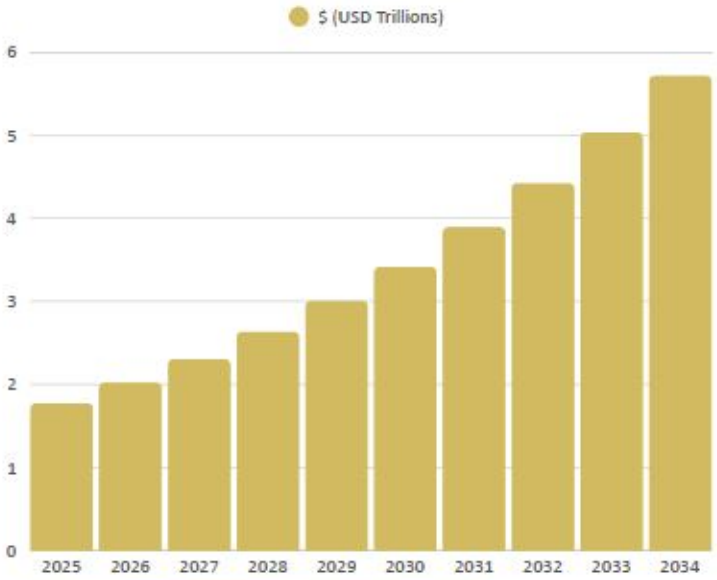
While some countries like Slovenia and the Slovak Republic show higher adoption rates of industrial robots, others such as Moldova and Serbia have significantly fewer, highlighting a growth opportunity. Investing in robotics and automation in the Balkans offers substantial business benefits.

These technologies drive higher efficiency, increased productivity, and improved product quality by minimising human error and enabling continuous operation. Automation not only frees skilled staff for higher-value tasks but also amplifies resources—enhancing data accuracy through **integrated systems**, **extending workforce capacity**, and contributing to **sustainability** by optimising the use of **high-level expertise**.

The region's strong focus on digital transformation, supported by initiatives like the EU's Economic and Investment Plan and the Digital Europe Programme, creates fertile ground for such investments. Combined with a skilled workforce and the potential for higher earnings from digital platform work, the Western Balkans are increasingly attractive for businesses expanding into advanced manufacturing and services.

Ongoing efforts to align with EU digital legislation, including the AI Act and cybersecurity directives, further strengthen this case, offering a secure, stable, and competitive landscape for global investment.

10-year Global Biotechnology Market Size & Forecast



* https://www.precedenceresearch.com/biotechnology-market (2023)



Technology: transfer & collaboration

Access UK Export Finance to catalyse regional transformation

Enhance project ratings to secure UKEF Sovereign grants and boost investor confidence

STAGED ADOPTION

GROWING A WORLD LEADING SCIENTIFIC INDUSTRY

STAGE 1

IDENTIFY PRIORITY RESEARCH AREAS

- Target fields with high impact potential.
- Align with emerging technologies and societal needs.
- Focus where automation adds maximum value.

STAGE 2

ASSESS CAPABILITIES & GAPS

- Review infrastructure, skills, and technology adoption.
- Spot gaps in processes and expertise.
- Benchmark against global best practices.

STAGE 3

INTRODUCE SCALABLE AUTOMATION

- Deploy modular, adaptable automation platforms.
- Reduce human error, free skilled staff for high-value work.
- Ensure solutions grow with research demands.

STAGE 4

ENABLE REGIONAL COLLABORATION

- Build networks across academia, industry, and government.
- Promote open data and shared research platforms.
- Encourage cross-border projects to leverage strengths.

STAGE 5

BUILD SUSTAINABLE INNOVATION PLATFORMS

- Develop funding models and long-term incentives.
- Foster continuous training and upskilling.
- Monitor, adapt, and scale successful initiatives.

“Without data you're just another person with an opinion.”

W. Edwards Deming



"Drug discovery is a uniquely challenging process, fraught with challenges and risks, taking **10–15 years** to navigate and costing, on average, more than **$1 billion to secure clinical approval** for each new drug (Hinkson I.V., et al. (2020) Front Pharmacol. 11, 770)."

The Semantic Scientist

Quality, Integrity, and Validity

"Quality, Confidence, (Communication) and compliance - Ensuring Data Integrity is critical for achieving success in drug discovery" *Dr. Daniel Thomas, MD Twenty24 Consulting*

Drug discovery is a uniquely challenging process, fraught with challenges and risks, taking 10–15 years to navigate and costing, on average, more than **$1 billion** to secure clinical approval **for each new drug** *(Hinkson I.V., et al. (2020) Front Pharmacol. 11, 770)*.

While preclinical stage failure rates are relatively low, analyses of clinical trial data reveal that nine out of ten drug candidates fail after entering clinical studies (between Phase I and drug approval), with lack of efficacy (40%–50%), unmanageable toxicity (30%), poor drug-like properties (10%–15%), and limited commercial demand and poor strategic planning (10%) cited as the leading reasons *(Dowden H. and Munro J. (2019) Nat Rev Drug Discov. 18, 495; Takebe T., et al. (2018) Clin. Transl. Sci. 11, 597; Harrison R.K. (2016) Nat. Rev. Drug. Discov. 15, 817)*.

"Consequently, this poses a conundrum: how do we manage the slow pace of organisational change in a rapidly evolving technological environment to achieve success?"

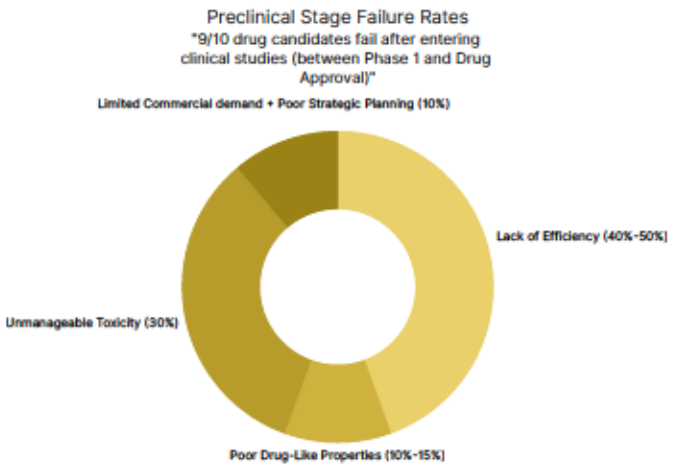
The last decade has seen a substantial broadening in types of therapeutics being developed, from proven entities such as small molecules and biologics, to more nascent

modalities such as protein degraders, PROteolysis TArgeting Chimeras (PROTACs), molecular glues, antisense oligonucleotides, small interfering RNA, antibody-drug conjugates, and oncolytic viruses *(Blanco, MJ. (2023). New Therapeutic Modalities: Transforming Drug Discovery and Development. In: Hock, F.J., Gralinski, M.R., Pugsley, M.K. (eds) Drug Discovery and Evaluation: Safety and Pharmacokinetic Assays. Springer, Cham. https://doi.org/10.1007/978-3-030-73317-9_135-1)*.

Interestingly, these newer modalities have experienced similar rates of attrition across clinical phases over the five-year period from 2019 to 2023, indicating **a risk profile which is comparable with more conventional therapeutics** (bcg.com/publications/2023/).

The pressure on scientists to deliver results is constant, leaving little time for implementing new technologies.

With success so difficult to achieve despite the implementation of many successful strategies over the last 30 years or so, our focus must now shift towards developing a better understanding of why.



The industry faces considerable challenges to successfully bring safe and effective medicines to market, in part due to the rising scale and complexity of data which must be generated across the research and development process.

Data is one of the most valuable assets a company possesses, directly impacting the accuracy and reliability of information used in making decisions. However, confidence in the accuracy of research findings continues to suffer, with the number of published papers being retracted, corroborating recent studies by pharma companies indicating that over 70% of research findings cannot be reproduced by independent third parties.

Nature **533**, 452–454 (2016). https://doi.org/10.1038/533452a

The reasons behind this highlight growing concerns around the **lack of appropriate standardisation**, use of poorly validated reagents and inconsistency in the capture and reporting of experimental methods and workflows.

With scientific innovation rapidly expanding the scale, dimensionality and resolution of data being generated, interrogated, and stored, the pace of adoption of transformative digital technologies required to address future data quality, validity and integrity challenges has remained interminably slow, with cultural resistance frequently cited as a major hurdle to be overcome.

Furthermore, we accept the paradoxical juxtaposition of researchers continuing to push the boundaries of scientific discovery while perpetuating experimental irreproducibility at an untenable level.

The pressure on scientists to deliver results is constant, leaving little time for implementing new technologies. However, the limited number of changes in people, processes, and technology that organisations can effectively absorb without significant disruption, results in a fundamentally slower, logarithmic rate of adaptive change when compared with the exponential trajectory of technological change observed throughout history (ref. Moore's Law, Kurzweil's Law of Accelerating Returns). Consequently, this poses a conundrum: how do we manage the slow pace of organisational change in a **rapidly evolving technological environment** to achieve success?

As one of our most valuable assets, industry attitudes regarding data, in terms of its quality, validity and integrity, are surprisingly diverse. We possess huge volumes of data, collected from a diverse array of sources and stored in large repositories, referred to as data lakes, which are subsequently used to drive our drug discovery and development pipelines.

However, our ability to effectively understand and interpret these data using conventional methods is increasingly being called into question given the levels of pollution observed. Whether it is a single string in a **malicious data** file or more fundamental inconsistencies in a data process workflow, corrupted data contributes to uncertainty, significantly undermining AI models and prediction results, increasing the risks of incorrect decisions and costly errors, and rendering AI and ML workflows inaccurate and unreliable.

Establishing performance criteria that identify missing or incomplete values or flag data outside specific tolerance thresholds will reduce the risk of errors **when developing and training accurate AI models**. (www.contractpharma.com/issues/big data) Data quality, validity and integrity represent distinct but interconnected data management concepts, providing structured frameworks for assessing and improving the value of data repositories, central to the success of data-driven organisations.

Data quality measures data health across various dimensions (accuracy, completeness, consistency, relevance, and timeliness), data validity describes the extent to which data is accurate, relevant, and conforms to predefined rules or standards and data integrity focuses on how data is collected, stored, accessed, and used, maintaining the accuracy, consistency, and security throughout its lifecycle. Ensuring each one involves the implementation of reference standards and process controls capable of **detecting discrepancies** and, where appropriate, **correcting errors, maintaining data quality and validity, and preserving trust** in the data. By upholding data integrity, organisations can make informed decisions, improve operational efficiency, and build a foundation of trust with all stakeholders (numerous online references).

"With success so difficult to achieve despite the implementation of many successful strategies over the last 30 years or so, our focus must now shift towards developing a better understanding of why."

iAcceleration in the development and implementation of artificial intelligence (AI) and machine learning (ML) capabilities across drug discovery is placing an increasing emphasis on the requirements for consistent, high-quality data, intensifying the pressure for existential change. The value promised by end-to-end generative AI-enabled drug discovery (AIDD) is linked to the speed, cost, novelty and quality of the molecule and target hypothesis, as well as a projected higher probability of success.

Ensuring data integrity will be critical in realising the potential of AIDD as it directly impacts the predictive performance, accuracy, and reliability of the AI models used. From data collection and annotation through to data storage and use, the availability of high-quality data enables these models to make better predictions and deliver superior outcomes.

The **"garbage in, garbage out" (GIGO)** analogy clearly illustrates the fundamental importance of high-quality data, reinforcing the case that the input of flawed, biased, or poor-quality information directly results in an output of equivalently poor quality.

The integration of automation, referred to as digitalisation, is an integral component required to successfully deliver this change.

Automated systems offer numerous benefits that can greatly improve the efficiency, flexibility, and productivity of laboratory processes, eliminating the need for repetitive and time-consuming tasks, allowing scientists to focus on more important, value-adding activities.

In addition, the use of automation minimises the risk of process errors and improves accuracy, significantly reducing variance profiles, and limiting the need for excessive replication.

Finally, integration with contemporary data management systems will ensure fidelity in the capture of all data and associated metadata, significantly improving our ability to find, access, interoperate, and reuse it with little or no human intervention.

Embracing automation and digital transformation is no longer a choice but a necessity to address the drug discovery challenges of tomorrow.

“ - the use of automation minimises the risk of process errors and improves accuracy, significantly reducing variance profiles, and limiting the need for excessive replication.”

Building a resilient industry for the future requires us to integrate technologies that ensure consistency, support the ability to deconvolute complex biology, better predict target–therapeutic interactions while accelerating and augmenting the decision-making process.



Dr Daniel Thomas

Founding Consultant, CEO
Twenty24 Consulting.

ESTABLISH REGIONAL INNOVATION CLUSTERS

Invest in advanced research and learning ecosystems



Increase GDP

Retain and grow domestic talent pool



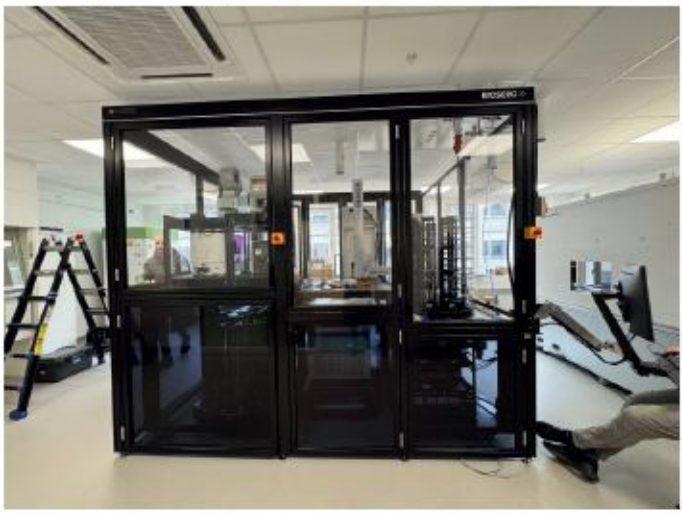
BECOME THE SCIENTIFIC RESEARCH HUB WHERE EUROPE MEETS THE MENA REGION

Giving the Service Industry an Upgrade

For governments seeking sustainable growth, investing in high-skill scientific industries is one of the most strategic choices available. The benefits extend far beyond the labs and research facilities themselves: **they catalyse a wide ecosystem of high-value, high-skill jobs in the support services that make scientific enterprise possible**.

When a country develops advanced industries - whether in biotechnology, aerospace, energy, or





artificial intelligence - it triggers demand for a network of supporting expertise.

Engineering talent is needed to design specialist infrastructure and manufacturing systems. Safety and regulatory services expand to ensure rigorous standards are met, safeguarding both workers and the public.

At the same time, information technology services - particularly in cybersecurity, data management, and AI systems - **become indispensable to protect sensitive research and optimise operations**.

These support services are not peripheral. They are central to the functioning and success of scientific industries. Once established, they create spill-over benefits: raising the national skills base, attracting further private investment, and fostering local clusters of excellence.

Over time, the ecosystem becomes self-reinforcing, embedding resilience and global competitiveness into the economy.

For policymakers, the message is clear: funding high-skill science is not a narrow bet on research outputs. **It is a nation-building strategy**. By anchoring scientific excellence, governments simultaneously create the conditions for the growth of engineering firms, safety specialists, and IT innovators.

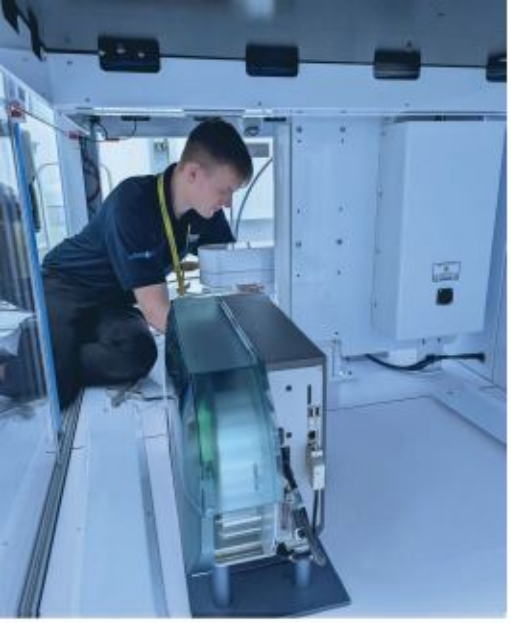


Each layer of this ecosystem delivers secure, well-paid employment and strengthens national technological sovereignty.

In a global economy where competitive advantage increasingly rests on knowledge and skills, the decision to prioritise investment in scientific industries is not just good policy - it is an essential step in shaping a prosperous, future-ready nation.

Robert Mckelvey
Managing Director,
Vortex Containment









SCIENCE & AUTOMATION TECHNOLOGIES CLUSTER



Leverage innovation to access new markets







SCIENCE & AUTOMATION TECHNOLOGIES CLUSTER

READY TO TAKE THE FIRST STEP?

BOOK A MEETING WITH OUR NSARC CLUSTER. IT'S TIME TO TALK.

STEP 1 Fill out our form

STEP 2 Meet with our team

STEP 3 Let us help you

STEP 4 Build a stronger future



SCIENCE & AUTOMATION TECHNOLOGIES NSARC CLUSTER

National Security and Resilience Consortium

Robotics | Enabling Biotech | Clinical Research | Lab Operations | Automation