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Industrial Innovation for Open Strategic Autonomy - leaving no one and no place behind: Science-to-policy evidence from the 9th European Conference on Corporate R&D and Innovation

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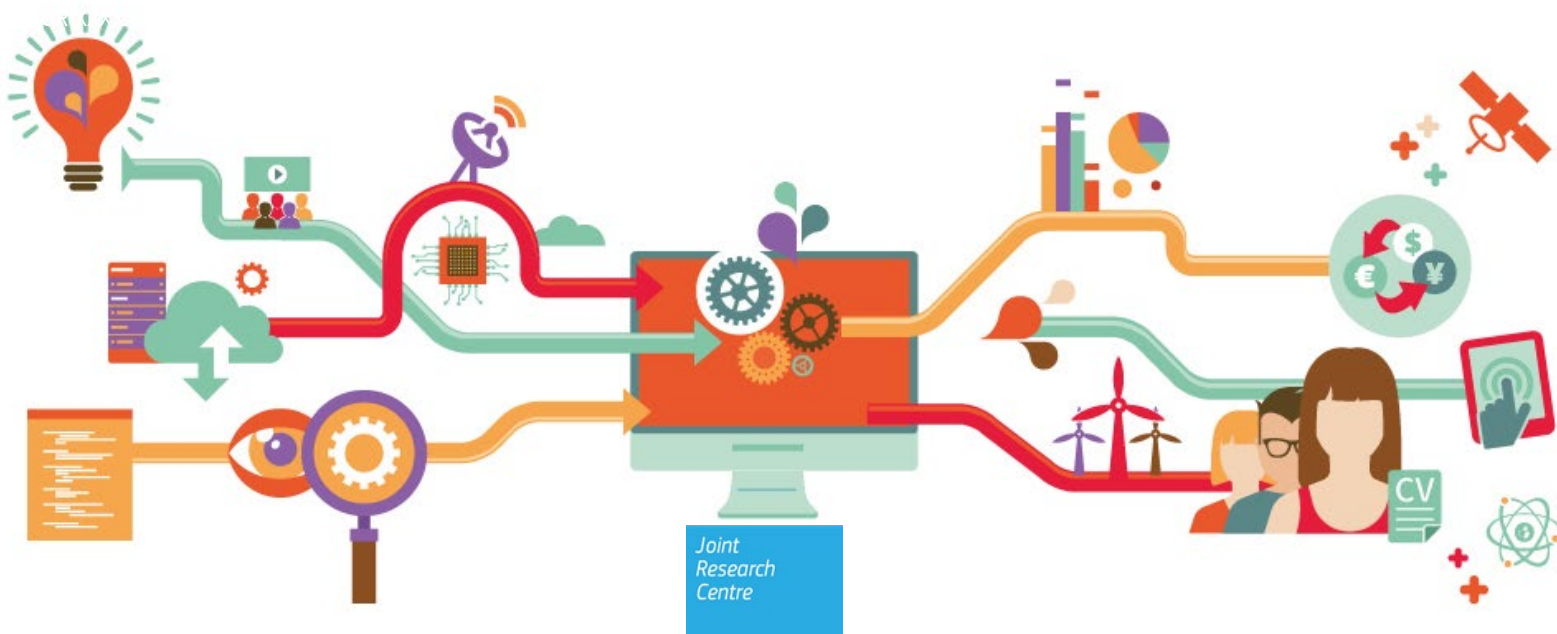
Industrial Innovation for Open Strategic Autonomy - leaving no one and no place behind

*Science-to-policy evidence from the 9th European Conference on Corporate
R&D and Innovation*

Amaral-Garcia, S., Confraria, H., Domnick, C., Hervás, F., Moncada-Paternò-Castello, P., Rentocchini, F., Zaurino, E.

*JRC Working Papers on Corporate R&D and
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Abstract

This document sets the scene and provides background information on 'Industrial Innovation for Open Strategic Autonomy', the main focus of the 9th edition of the European Conference on Corporate R&D and Innovation (CONCORDi 2023), as well as introduces scientific contributions that will be presented at the conference. It thus aims to stimulate fruitful discussions between academia, experts and policy-makers at the conference, identifying potential policy initiatives and areas where additional research and evidence are needed.

Executive Summary

CONCORDi 2023 aims to contribute to the scientific and evidence-based underpinning of the open strategic autonomy (OSA) concept in order to support its operationalization as a central objective of the new EU industrial policy. In this context, a better understanding of the role of industrial innovation in tackling and reconciling the three dimensions of wellbeing (competitiveness and inclusiveness), transformation (green and digital transitions) and open strategic autonomy (technological sovereignty, de-risking and fair trade) is essential. CONCORDi 2023 offers a privileged forum for discussion between academics, entrepreneurs, and policy-makers.

This document sets first the scene of the next policy challenges and proposes some critical questions, both of a scientific and policy nature, related to following subjects: *The OSA trilemma concerning industrial economy and policy; Monitoring progress towards OSA; Fostering the rapid structural economic (sectoral) changes needed for the EU to achieve OSA; Encouraging industrial innovation in space and defence applications; Balancing Trade Policies: Inspiring International Cooperation; Challenges to Market Integrity.*

The concept of OSA is frequently invoked as an important guiding principle. While "Strategic Autonomy" refers to the capacity of the EU to act autonomously in strategically important policy areas, the addition of "Open" stresses the fact that the EU aims for multilateral cooperation wherever possible and appropriate. In this context, is argued that *Industrial innovation* is essential for the development of critical technologies used in civil, defence and space applications, for promoting a circular economy, and for reducing strategic technology and supply

chain dependencies. Moreover, to realize OSA, a comprehensive analysis of industrial innovation ecosystems can be instrumental. Industrial production and technological capabilities at global, national, and regional levels are important dimensions of such analysis (*leave no place behind*). Furthermore achieving OSA should also be compatible with the EU's goals for economic competitiveness and social inclusiveness (*leave no one behind*).

The scientific contributions presented at CONCORDI 2023 in the *Scientific Forum* are distributed in parallel sessions related to four main broad thematic tracks: i) Industrial innovation to alleviate vulnerability and reinforce technological sovereignty in strategic sectors; ii) Industrial innovation in critical technologies and for the reduction of key dependencies; iii) Identification of territorial opportunities linked to industrial innovation for competitiveness, regional cohesion and social inclusion; and iv) Creation and growth of firms in prominent technological fields. A discussion of the scientific background to these tracks and open research questions are offered in this part of the document.

Against the backdrop of scientific insights from academic papers, the *Policy Forum* of the conference delves into the crucial policy perspectives that align seamlessly with CONCORDI's core objectives. This last part of the paper aims to both steer future scientific investigations and raise awareness among businesses and society at large about the current trajectory of policy development. In policy efforts to strengthen the EU economic and geopolitical position OSA has recently come to be an integral part of EU's vision. On the other hand, while industrial policy and industrial innovation is central to the realisation of OSA. The Policy Forum in its plenaries addresses first the central focus of the event, "Industrial innovation for Open Strategic Autonomy, leaving no one and no place behind". It will follow the contributions of distinguished keynotes on crucial aspects of OSA, such as Governance and international organizations, Trade and Innovation & industrial policies", Competition policy, Industrial investment, Next generation health cures, and Digital & Green transition. The concluding session will offer a summary of the science-for-policy results from the Scientific Forum as well as the areas where additional research and evidence is needed, and a lecture on the development of the growth diagnostics and economic complexity methodologies. The conference will be closed by pointing out the possible policy-mixes and practical initiatives identified across the entire event for the full realization of OSA.

Introduction

From 24 to 26 October 2023, the European Commission's Joint Research Centre (EC-JRC) hosts the 9th biennial European Conference on Corporate R&D and Innovation (CONCORDi) in Seville, Spain, in cooperation with the Organisation for Economic Co-operation and Development (OECD) and the Spanish Government as an event of the Spanish Presidency of the Council of the European Union¹.

The 2023 edition of CONCORDi is entitled "*Industrial Innovation for Open Strategic Autonomy - leaving no one and no place behind*" and has the intention of exploring numerous links between "Open Strategic Autonomy"² and Industrial Innovation³.

This document provides background information and an overview of CONCORDi 2023, primarily targeting the conference audience, which includes scientists, analysts, policymakers and business professionals.

Setting the scene for the next policy challenges

The European Conference on Corporate R&D and Innovation (CONCORDi) has traditionally explored the pivotal role of industrial innovation in catalysing sustainable socio-economic progress and its policy implications.

CONCORDi 2021 focused on the role of industrial innovation in fostering competitive sustainability, creating synergy between industrial policy, structural dynamics, the *twin*

¹ Full information of the conference is available here: <https://iri.jrc.ec.europa.eu/concordi-2023>

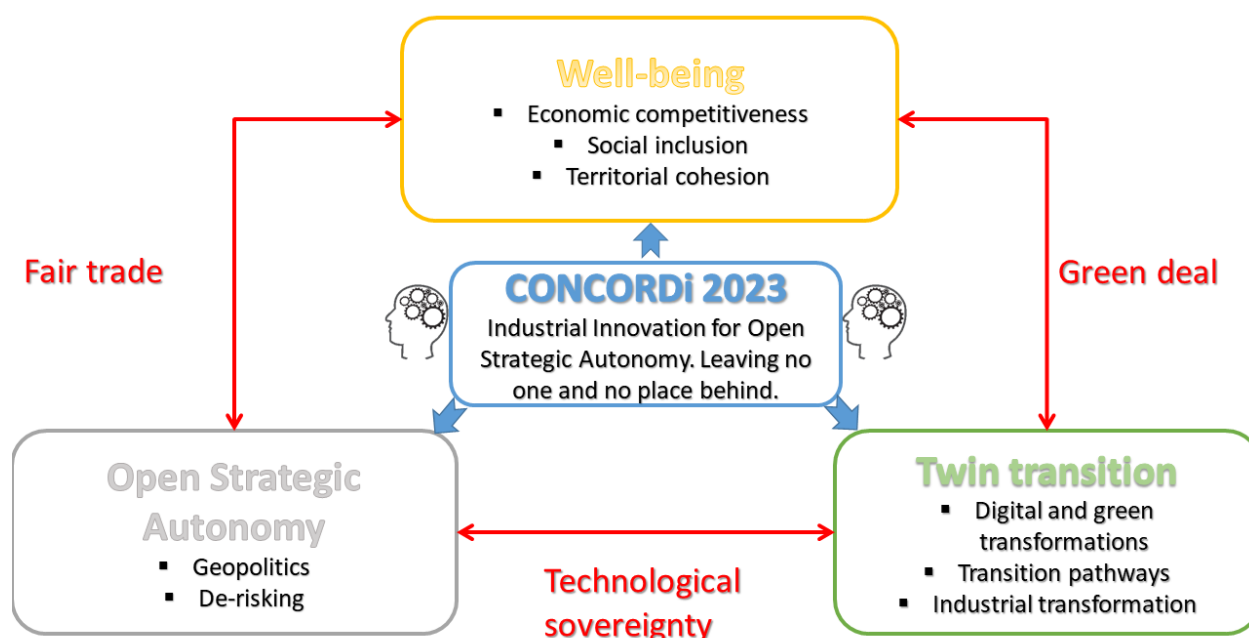
² Please consult the dedicated OSA page by the Spanish Presidency here: <https://futuros.gob.es/en/our-work/OSA> (last access on September 6, 2023).

³ For more detailed information, please refer to the "Concept Note" available at the following link: <https://iri.jrc.ec.europa.eu/node/5834>. This document provides a comprehensive overview of the topics and ideas pertaining to the conference.

transition, and the broad industrial competitiveness objectives of the European Union.⁴ This facilitated a holistic exploration of social, technological and territorial dimensions of industrial policy, deriving insights relevant to policy reforms.

The main focus of CONCORDi 2023, “Industrial innovation for open strategic autonomy - leaving no one and no place behind”, is on Open Strategic Autonomy (OSA) which is currently central to the EU's industrial policy agenda. Figure 1 traces links between OSA and the main topics for discussion at CONCORDi 2023 – geopolitics, de-risking strategies, the twin digital and green transitions, economic competitiveness, social inclusion, and territorial cohesion.

Figure 1: Industrial innovation for open strategic autonomy - leaving no one and no place behind



Source: Own elaboration

The conference will engage with a series of critical scientific and policy issues. These include for example:

1. The OSA trilemma concerning industrial economy and policy. This consists of reconciling and preventing divergences between "well-being" (i.e., eco-competitiveness, social and territorial cohesion, while upholding European values), "transformation" (encompassing twin transition

⁴ <https://iri.jrc.ec.europa.eu/concordi-2021>

and industrial dynamics), and "technological sovereignty" (which also covers aspects of fair trade as well as economic and national security). For this policy makers require a combination of strategic planning, stakeholder engagement, and continuous adaptation to the evolving industrial economy landscape.

2. *Monitoring progress towards OSA:* The challenge is to develop and implement methodological approaches (the “what” and the “how”) to monitoring progress towards the primary policy, economic, and social objectives encapsulated within OSA, coupled with identifying the appropriate actors capable of undertaking the complex and multifaceted analytical and monitoring tasks this initiative necessitates.

3. *Fostering the rapid structural economic (sectoral) changes needed for the EU to achieve OSA:* In many economic sectors there is a conspicuous absence of European companies among the top R&D spenders globally (Moncada-Paternò-Castello, 2022; Grassano et al., 2022). While the acknowledgment of pivotal roles played by start-ups and other actors is valuable, the significant concentration of corporate R&D activities in key strategic sectors outside Europe cannot be overlooked. Considerable effort should be made in the EU to accelerate industrial innovation and firm creation and growth to drive the needed structural economic (sectoral) changes towards strategic sectors. This can reduce external dependency in these strategic sectors and increase the representation of innovative EU companies in the global arena.

4. *Addressing the implications of OSA for the EU workforce.* The impacts on employment and of skills and job arising from the shift of considerable resources towards key sectors and technologies in different locations could have undesired socio-economic consequences. For example, the skills shortage can hinder the transformation of firms and can constrain the full exploitation of the return from various investments in digitalization, innovation or associated to the green transition. Indeed, there is increasing evidence on the potential job creation effect brought about by technology providers, in contrast to the potential job destruction observed among technology users (Dosi et al., 2021; Montobbio et al., 2022).

5. *Encouraging industrial innovation in space and defence applications.* A key dimension of industrial innovation for OSA relates to the defence and space sectors. Developing a true innovation economy in these sectors has been historically difficult due to "anti-business"

institutional structures marked by monopsony/oligopoly market dynamics. While the US successfully transitioned towards a more innovative economy in these sectors with notable players like SpaceX and a reinvigorated NASA supporting startups, Europe lagged behind, significantly trailing in space access—a critical strategic asset. However, to what extent institutional and value shifts are needed to encourage industrial innovation in space and defence applications? Given the geographical concentration of the key players in these sectors, how should the universal applicability of the "leave no place behind" principle across different industries best be managed?

6. *Balancing Trade Policies:* Against the backdrop of emerging policies tailored towards OSA, the EU appears to be at a crucial juncture in its trade policy dynamics. This brings to the fore critical questions about whether the shift towards OSA will reshape EU's historical stance on trade openness, liberalisation, and international cooperation, possibly tipping the scales towards a more autonomous policy framework. In this context, an important aspect to consider for the EU is "fairness in the global economy". Furthermore, the concept of strategic autonomy implies maintaining interdependencies and collaborations, including with "less needed" countries which, for instance, might not be as crucial in achieving technological sovereignty but are vitally important to address global concerns such as climate change and security.

7. *Inspiring International Cooperation:* While the trade strategy heavily emphasises the centrality of international cooperation to OSA, it demands a deeper understanding of how such collaborations can enhance resilience to geo-economic shocks and spearhead a sustainable economy. An important aspect is the set of criteria used to select partners for such international cooperation. These could include: 1) strategic alignment in multilateral agreements (shared objectives, complementary strengths); 2) economic considerations (trade balance, economic political, market potential); 3) technological synergy (technological expertise, R&D collaboration potential); 4) environmental commitment, and 5) political and cultural synergy.

8. *Challenges to Market Integrity:* The heightened focus on industrial policy within the OSA framework presents a significant challenge to maintaining the integrity of the internal market. A critical area of discussion, therefore, revolves around assessment of the potential ramifications for competition policy. Competition Commissioner Margrethe Vestager has articulated a

willingness to embrace the concept of "open strategic autonomy" as a guiding principle that could shape the future direction of competition policy and help to defend EU's strategic interests and security. This raises crucial questions regarding the role of merger control, the regulation of member states and foreign subsidies, relevant regulatory exemptions, and other aspects of competition policy in reinforcing the European Union's strategic autonomy while simultaneously preserving competition within the internal market. It is necessary to find an appropriate EU approach to balance OSA objectives with territorial cohesion.

Context and background: Open Strategic Autonomy and Industrial Innovation – leaving no place and no one behind

The world has recently experienced a series of sudden crises and disruptions, notably the outbreak of COVID-19 and the Russian invasion of Ukraine, leading to an increasing level of geopolitical fragmentation. These crises have brought to the fore existing vulnerabilities in the EU that include critical shortages of products, supply chain disruptions and technological dependencies that make the EU socio-economically and geopolitically weaker and ultimately limit the capacity of European policy makers to act according to their strategic goals. At the same time, this complex and changing environment complicates responses to long-term challenges including the increasing effects of climate change and the on-going digital transition (Diodato *et al.* 2023).

Governments worldwide are grappling with the question of how to effectively address challenges arising in this age of 'polycrisis'. One possible response lies in the use of industrial policy, as illustrated for example by the "chips and science act" or the "inflation reduction act" in the United States, or the "Made in China 2025" policy in China. In Europe, the concept of Open Strategic Autonomy (OSA) is frequently invoked as an important guiding principle⁵. While "Strategic Autonomy" refers to the capacity of the EU to act autonomously in strategically important policy areas, the addition of "Open" stresses the fact that the EU aims for multilateral cooperation

⁵ For a brief overview of OSA see, *e.g.*, EPRS (2022) [https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/733589/EPRS_BRI\(2022\)733589_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/733589/EPRS_BRI(2022)733589_EN.pdf)

wherever possible and appropriate⁶. By developing capabilities that allow for more independent action, the EU aims to bolster its geopolitical and economic capacity, addressing both strategic dependencies and vulnerabilities.

In the economic sphere, this concept has wide ranging implications that include enhancing internal production capacities in strategic industrial ecosystems and sectors, establishing technological sovereignty in critical technologies, fostering efficiency in the use of resources (as a source of higher productivity), smart consumption and circular economy. As a result, acting on OSA enables EU resilience to future crises and realization of its vision for sustainable growth.

Important policy objectives related to OSA are intimately linked to various recent EU policy initiatives undertaken under the umbrella of the EU's new Industrial Policy Strategy published in 2020 and updated the following year. Notable initiatives include the Chips Act, the Net Zero Industrial Act and the Raw Materials Act.⁷

Industrial innovation for Open Strategic Autonomy

Industrial innovation is essential for the development of critical technologies used in civil, defence⁸ and space applications, for promoting a circular economy, and for reducing strategic technology and supply chain dependencies⁹. Such innovation supports the EU's *technological leadership* as well as objectives related to *EU policies on Industry, Innovation, the Single Market, Trade and Competition*. The goal of the EU is to foster strategic industrial ecosystems to enhance innovation and production capabilities within its borders, thereby reducing dependency on foreign suppliers. The use of foresight techniques helps to identify threats and ensures resilience by anticipating the required responses.

⁶ For example, the ability to develop the technologies the EU deems critical for its welfare and competitiveness in cooperation with other economic areas “without one-sided structural dependency” (Edler *et al.*, 2023).

⁷ European Commission (2022) A Chips Act for Europe. Commission staff working document. SWD(2022) 147 final. Brussels, 11.5.2022; European Commission (2023). Proposal for a regulation of the European Parliament and of the Council on establishing a framework of measures for strengthening Europe’s net-zero technology products manufacturing ecosystem (Net Zero Industry Act). COM(2023) 161; European Commission (2023). Proposal for a regulation of the European Parliament and of the Council establishing a framework for ensuring a secure and sustainable supply of critical raw materials ‘COM(2023) 160 Brussels, 13 March 2023.

⁸ [COM 2022 61 1 en act roadmap security and defence.pdf \(europa.eu\)](#).

⁹ Products in sensitive ecosystems for which the EU is heavily dependent on foreign suppliers ([link](#))

EU OSA¹⁰ policy aims to alleviate vulnerabilities and reinforce the technological sovereignty of the EU in strategic sectors of the economy, such as energy, mobility, health, food supply, digital technologies, and space-defence-security. Therefore, industrial innovation is central to OSA, and, vice versa, OSA is at the core of the EU's industrial and innovation policy agenda. Achieving OSA requires transformative changes rather than incremental innovation and business-as-usual strategies (Amoroso *et al.*, 2023).

Leave No Place Behind

To realize European OSA, a comprehensive analysis of industrial innovation ecosystems can be instrumental. Industrial production and technological capabilities at global, national, and regional levels are important dimensions of such analysis. It is vital to engage stakeholders at various territorial levels to pinpoint areas for industrial innovation investments that align with open strategic autonomy and technological sovereignty considerations, with direct implications for regional innovation strategies for sustainability.

In this respect, the Partnerships for Regional Innovation¹¹ initiative, a new approach to place-based innovation policy which builds on positive experiences with smart specialisation strategies, offer a good forum to mobilise relevant actors. One key objective is to strengthen interconnection of regional and local innovation ecosystems and to reinforce European sustainable value chains and deep-tech sectors, integrating initiatives and investment at EU and national levels.

Leave No One Behind

Achieving OSA should also be compatible with the EU's goals for economic competitiveness and social inclusivity. Recently enacted policy packages, like the “Inflation Reduction Act” in the US and the “New Green Deal” in the EU, have integrated resources for a just transition, as these

¹⁰ For a definition of Open Strategic Autonomy please refer to "Europe's moment: Repair and Prepare for the Next Generation, May 2020 – Commission Communication, COM(2020) 456 final, 27 May 2020". This concept is also well endorsed in recent documents such as the following: "European Commission (2022). "A New European Agenda". Brussels, European Commission COM(2022) 332, 5 July".

¹¹ This is an initiative promoted by the European Commission in cooperation with the Committee of Regions, as part of the EU's climate, cohesion and innovation agendas:
https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3008. For more information, see Pontikakis *et al.* (2022).

initiatives can have unintended effects on equity and inclusiveness while combatting climate change and promote economic stability. It is imperative that the design and implementation of new policy packages encompass equity and justice to ensure that the benefits and burdens are distributed fairly among all communities, particularly the marginalised and vulnerable ones. This comprises the creation of high-quality jobs within the EU, facilitating transitions to new employment opportunities, and equipping workers with the skills needed for future "green jobs" and bridging the "digital divide" both within and across EU regions and member states. In this context, a labour-intensive twin transition may be conceptualised as a means to counterbalance the potential labour-saving impact of AI applications, robot adoption, and other automation technologies (Acemoglu and Restrepo, 2020; Montobbio et al., 2022; Diodato et al, 2023).

Overall, analysis of the concept of OSA across various dimensions is relevant for policy-making. However, given the fast-pace of geopolitics in combination with the relatively recent emergence of the OSA framework implies that the academic literature on this topic remains scarce and the intersection of OSA with issues such as industrial innovation is still underexplored. As such, public policy incorporating OSA considerations needs *more and better scientific evidence to support appropriate new initiatives*. The challenge is to provide relevant and action-oriented evidence supporting coherence across different EU policies.

Scientific forum - Science-to-policy contributions from CONCORDi 2023

The keynote speakers of plenary sessions of the Scientific Forum will elaborate on key aspects related to the main focus of the conference.

In the Opening plenary of the Scientific Forum chaired by Salla Saastamoinen (Deputy Director-General, Joint Research Centre - European Commission), Sandrine Dixon-Declève (Vice-president Club of Rome and Chair of the European Commission's Economic & Societal Impacts from Research & Innovation Expert Group - ESIR) will deliver the keynote speech. This will focus on the following topic: Today's poly crisis and complex wicked problems require systemic solutions that go beyond business as usual (BAU) and enable open strategic autonomy. Transformation in times of crisis is only feasible if we adopt an ambitious research and innovation programme that simultaneously serves the needs of people and the planet, promotes prosperity, and targets economical and societal well-being.

The second Plenary of the Scientific Forum, entitled "Academic contribution to innovation and entrepreneurship", will be chaired by Román Arjona (Chief Economist, Directorate-General for Internal Market, Industry, Entrepreneurship and SME, European Commission). The keynote speaker, Natacha Valla (Dean of the Sciences Po School of Management and Innovation at Sciences Po, Paris University FRA), will speak about "Academics, Entrepreneurs and Innovation: How to build an efficient ecosystem". The different components of academia will be described with the aim to explain under which circumstances academic research does lead to innovation. The difficulties to provide « entrepreneurship » curricula will be then discussed, with a view to identify practicable solutions. Finally, the crucial issue of knowledge transfer, both domestically and internationally, will be analysed to highlight its impact on both growth and well-being.

"Research, innovation, and technology policy in times of geopolitical competition" is the title of the third plenary that will be chaired by Alexandr Hobza (Chief Economist, Directorate-General Research & Innovation, European Commission). The keynote speaker of this plenary will be Stres Špela (Director of Innovation and Technology Transfer Center for Jožef Stefan Institute, Board Member of the European Innovation Council, and lecturer at University of Ljubljana, SLV). She will provide an overview of the challenges in the European innovation ecosystem and how to make it more coherent and professional.

Moreover, the scientific contributions presented at CONCORDI 2023 are distributed across 26 Parallel sessions and a poster session related to the following four main broad thematic tracks: i) Industrial innovation to alleviate vulnerability and reinforce technological sovereignty in strategic sectors; ii) Industrial innovation in critical technologies and for the reduction of key dependencies; iii) Identification of territorial opportunities linked to industrial innovation for competitiveness, regional cohesion and social inclusion; and iv) Creation and growth of firms in prominent technological fields. What follows below is a discussion of the scientific background to these tracks and open research questions.

Industrial innovation to alleviate vulnerability and reinforce technological sovereignty in strategic sectors

Only well designed industrial policies will contribute to the long-term competitiveness of the EU. The design of industrial policy is challenging for many reasons. In particular, there is a lack of agreement with respect to which combination of policy instruments might be more effective (Criscuolo et al., 2022). The New Industrial Strategy for Europe focuses on the twin transition for EU industry, but adds the dimension of resilience after the COVID-19 pandemic and the disruptions in supply chains. More recently, geopolitical tensions amplified awareness of strategic autonomy and dependency in key strategic areas. Industrial innovation is key to alleviating vulnerabilities and reinforcing technological sovereignty of the EU in strategic sectors of the economy. In this context in particular, there is the need to properly define technological sovereignty and consider its corresponding implications (see, *e.g.*, Lavery, 2023). Edler et al. (2023) define technology sovereignty as *“the ability of a state or a federation of states to provide the technologies it deems critical for its welfare, competitiveness, and ability to act, and to be able to develop these or source them from other economic areas without one-sided structural dependency”*.

In this setting, disruptive innovation is needed to achieve not only the twin transition but also to reduce technological vulnerabilities and create capabilities. Startups, deep tech and high-growth firms, in particular in strategic sectors such as energy, clean-tech, digital, advanced materials, advanced manufacturing, artificial intelligence, biotechnology, blockchain, robotics, photonics, electronics, and quantum computing, play an important role. How can innovation policy foster the development, creation, and adoption of technologies that reinforce technological sovereignty? What are the implications of these technologies in terms of environmental sustainability, growth, innovation, employment, and potential regional inequalities? Recent evidence shows that the creation and adoption of technologies such as digital, automation, robotics, or artificial intelligence might have vast implications at different levels, not only in terms of productivity (Graetz and Michaels, 2018), but also employment, skill polarization and wages (Acemoglu and Restrepo, 2020; Aghion et al. 2019, Dauth et al. 2021), income inequality (Acemoglu and Restrepo, 2022) and even competition (Calvano et al., 2020). Some of the papers presented at the conference shed light on which types of companies are more prone to adopt new technologies; how companies are adopting disruptive technologies including artificial intelligence, digital technologies and clean technologies; and what are the outcomes of adopting disruptive technologies. Evidence at the EU level is still limited, and some of the papers contribute to filling this gap.

Firms exploiting scientific and technological innovation, and cooperating domestically and internationally with universities and other organisations, can enable innovation opportunities as well (Mulligan et al., 2022). For instance, public research institutions were key drivers of innovation in the development of COVID-19 vaccines (Agrawal and P. Gaule. 2022; Dewatripont, 2022).

Industrial innovation in critical technologies and for the reduction of key dependencies

Rising environmental and geopolitical instabilities increase the chance of extreme events with disruptive economic effects. In this context, given how technological capacities are distributed in the world, the European Commission has identified several critical technologies as potential “strategic vulnerabilities” should adequate technological not be developed/ sustained in the

EU.¹² The conference papers dealing with this theme help to shed light on recent developments in key technological fields, firm dynamics, global value chains and other relevant policy questions.

Several papers in this conference track focus on technologies related to the digital and green (twin) transition (Muench et al., 2022). This transition is often discussed in terms of environmental challenges (Barbieri et al., 2016; Colombelli et al., 2020; Horbach et al., 2012) and the integration of digital technologies and data-driven approaches into various societal and economic contexts (Acemoglu and Restrepo, 2018; Agrawal et al., 2019; Berger et al., 2021). Firms play a leading role in this transition by investing in digital technologies and in pursuing environmental sustainability strategies. However, several questions remain on how this transition will unfold. Some of the issues discussed at the conference include the determinants of green and digital transformations, the effect of green innovations on firm performance or sustainability, mapping green technological development across European regions, the relationship between green innovation and corporate acquisitions, the role of venture capital and foreign direct investment in the funding and growth of clean energy and digital tech ventures, how the green and digital transition will affect employment, how automation affects exports, and complementarities between digitalization and sustainability strategies.

Digitalization and environmental transitions also imply transformations in our societies related to global value chains. These structural transformations revolve around a growing dependence on specific raw materials such as rare metals (Schrijvers et al., 2020). For instance, almost all key green technologies, such as solar power, wind energy, fuel cells, hydrogen production and storage, electric vehicles, and energy-efficient lighting, depend significantly on various rare metals (Grandell et al., 2016; Valero et al., 2018). Similarly, advances in ICTs and artificial intelligence have greatly increased the intricacy and sophistication of electronic devices, leading to a heightened demand for certain rare metals as vital inputs in advanced electronic

¹² Technological fields recently identified as critical by the EU include: 1) deep and digital technologies (such as microelectronics, high-performance computing, quantum computing, cloud computing, artificial intelligence, cybersecurity, and robotics); 2) clean technologies (such as renewable energy; electricity and heat storage, heat pumps, electricity grid, energy efficiency, advanced materials, and technologies for the sustainable extraction and processing of critical raw materials), and 3) biotechnologies (such as biomolecules and its applications, pharmaceuticals, medical technologies, and crop biotechnology).

components (Eggert, 2010). Extensive studies (*e.g.* Bobba et al., 2020; European Commission, 2018; European Commission, 2021b; Kowalski and Legendre, 2023) have been carried out by the EU and other organizations to identify critical raw materials and the vulnerable, critical supply chains that depend upon them. Yet some research gaps remain. Some of the research questions explored in this conference include how the dependence on rare metals influences the R&D strategies of firms, how vulnerabilities in critical supply chains can be assessed, and how to identify future strategic raw materials needs for critical technologies.

As political concerns around these themes increase, so too does the demand for policy evaluation. Some of the contributions in this conference look specifically at the impact of environmental policies on global value chains, the effects of monetary and green policies on emissions of CO₂ and green investments, the determinants of energy efficiency policy adoption and implications for firm competitiveness.

Another relevant perspective on key technological areas relates to the “complexity” of technologies. Not all technological outputs have the same value. Technologies which can be relatively easily copied and replicated by many potential producers in many countries, generate lower margins in the long-run (Hidalgo and Hausmann, 2009). On the contrary, skills in complex technologies are more difficult to acquire and, as such, confer a competitive advantage to the countries or regions in which they are located (Balland et al., 2019a). The study of how the structure of economic activities shapes the dynamics of growth and development has recently intensified through the growing emphasis that is placed on the notion of economic complexity (Balland et al., 2022; Pugliese and Tübke, 2019), and strategies for technological diversification (Frenken et al., 2007; Morrison et al., 2008; Neffke et al., 2011). At the conference, key open research questions explored include the extent to which the EU specializes in complex technologies, the effects that technological relatedness and technological unconventionality have on the performance of European regions, the role of global value chain participation in technological diversification, and the effect of knowledge diversity in high-skilled migrants on green innovation.

Identification of territorial opportunities linked to industrial innovation for competitiveness, regional cohesion and social inclusion

The pursuit of regional development linked to industrial innovation is an increasingly important objective for governments and policymakers. Therefore, understanding how and why certain regions or countries develop particular industries and patterns of economic activity is crucial. Although this emphasis on regional development holds significance for economic growth, it also poses significant challenges to inclusivity because the clustering of industries and economic activities in certain regions often leaves others marginalized, leading to geographical imbalances. By identifying and capitalizing on territorial opportunities tied to industrial innovation, governments can foster regional cohesion, mitigating inequalities and fostering collaborative endeavours.

In the realm of regional development, the framework of regional (or national) innovation systems (Cooke et al., 1997; Lundvall, 1992) is pivotal, encapsulating the web of interactions across public and private entities that drive technological advancement (Freeman, 1995). This framework focuses on learning processes and capability enhancement within a region, accentuating the significance of network interactions among system actors (Broekel et al., 2014). In this context, public policies have tended to encourage research and innovation partnerships to promote new knowledge recombination, synergies and potential multiplicative effects of projects that operate in a multidisciplinary environment (Balland et al., 2019b). In the conference, some of the research questions related to this theme include how to evaluate the performance of an innovation system, how to promote better interactions within a network of actors in order to increase knowledge diffusion and inventive activity, and how innovation policy contributes to regional economic rebalancing and convergence.

A parallel framework central to EU regional development is Smart Specialisation, aimed at fortifying competitiveness through the identification and promotion of new economic avenues within a region. It seeks to leverage existing strengths, identify hidden diversification opportunities, and generate novel platforms upon which regions can build competitive advantage in new activities (Foray, 2015). Yet, concerns have been raised that smart specialization strategies might work better for the more advanced regions in the EU, because

they have many capabilities from which they can diversify, while more peripheral regions may grapple with limited diversification opportunities (Pinheiro et al., 2022). This makes it difficult to bring smart specialization policy in line with cohesion policy, which is geared towards reducing EU regional disparities (McCann and Ortega-Argilés, 2015). In the conference, some of the papers presented will expand our understanding of the impact of smart specialization policy on territorial development, the development of new industries, and convergence dynamics between peripheral and advanced regions.

The identification of territorial opportunities linked to industrial innovation has direct policy implications. Policymakers can use insights from this research to design targeted interventions, incentives, and supportive frameworks that encourage innovation in specific regions or sectors. Such policies can, for example, stimulate private sector investment, attract talent, direct innovation towards eco-friendly technologies, and create an environment that allows the benefits of innovation to be widely shared across different segments of society. Within this broad context of policy evaluation, some papers in this conference examine the effect of better governance of innovation funds on policy outcomes, the role of green public procurement in driving the circular economy, and the role of policy coordination in stimulating green innovation for the decarbonization of European economies.

Creation and growth of firms in prominent technological fields

Investing in innovation today is crucial to achieve enhanced competitiveness tomorrow. Several policy efforts are continuously being made with the aim of improving EU's innovation-based performance (*e.g.*, New European Innovation Agenda). Access to finance is crucial for EU firms to accelerate their pace of innovation in order to remain competitive as well as building or maintaining leadership positions. Financial constraints are important barriers to innovation (Arrow, 1962; Hall et al., 2016), and evidence shows that younger and smaller firms (*e.g.*, Cincera et al. 2016), namely in high-tech sectors, might be more financially constrained than other firms (Himmelberg and Peterson, 1994; Czarnitzki and Hottenrott, 2011). From a comparative perspective, the finance gap is more pronounced for European innovative firms than for US firms (Cincera et al., 2016). Financial frictions help explain, for instance, why firms underinvest in novel drugs: even though they are more valuable than derivative drugs, they are also riskier (Krieger et

al., 2022). To what extent do small innovative firms suffer from financing constraints? Are there particular types of technologies, such as green technologies, more prone to suffer from financial constraints? Papers presented at the conference aim to provide evidence for this discussion.

R&D is crucial for innovation and growth and young and innovative firms try to finance their R&D activities in different ways, including with public funding or grants, or with private means such as venture capital. Venture capitalists tend to have an important role in identifying innovative firms and bringing new technologies to the market quickly (Hellmann and Puri, 2000). Concomitantly, R&D grants to private firms are also regularly used by governments around the globe and, in spite of theoretical arguments that R&D grants might not allocate funds efficiently (Lerner, 2009), evidence shows that R&D grants can have a significant effect on innovation (Howell, 2017). It is still unclear how R&D resources should be allocated optimally across economic sectors or technological fields, or how it should differ across countries (Liu and Ma, 2023). EU initiatives such as EC Horizon 2020 SME Instrument are attracting more manufacturing and high-tech firms (Mina et al., 2021). What is the role of private and public initiatives in financing innovation and growth? Does public support enable the adoption of critical and risky technologies (including filing unconventional, novel or green patents)? Empirical evidence on the comparison between private and public forms of financing is still lacking. Moreover, and considering the different types of instruments that can be used (e.g., grants, tax incentives), and as highlighted by Lenihan et al. (2023), what are the most effective ones and what mix of instruments work best and for which types of firms? Additionally, we still lack knowledge of Governmental Venture Capital (GVC) initiatives in Europe. The papers presented at the conference help quantify the impacts of different financial instruments, including public vs. private funding, identifying potential spillover effects, and can enhance the design of innovation policy.

In order to develop stronger industrial innovation and production capabilities in the EU, key technologies can help achieve higher growth, enable and accelerate the achievement of the European Green Deal, and the Digital Transition. Therefore, it is important to have a good understanding of how firms are investing in these technologies, how these technologies are being adopted, the barriers and challenges faced by companies when trying to implement them, and their corresponding impacts, namely on firms' performance and growth. Intellectual property rights are helpful to quantify firms' innovation outcomes.

Policy forum - Industrial Policy and Innovation for Open Strategic Autonomy: A European policy imperative

Against the backdrop established in previous sections including scientific insights from academic papers, this section delves into the crucial policy perspectives that align seamlessly with CONCORDi's core objectives. In keeping with its well-established tradition of bridging science and policy, CONCORDi 2023 aspires to offer policymakers fresh scientific insights to address the pressing challenges at hand. These outcomes are particularly pertinent in navigating industrial innovation's role in attaining an open strategic autonomy for the European Union. By showcasing the policy-centric work undertaken within the European Commission, this part of the background note aims to both steer future scientific investigations and raise awareness among businesses and society at large about the current trajectory of policy development.

Open Strategic Autonomy as integral part of EU's vision

The concept of OSA has recently come to the fore as a priority of EU policy efforts to strengthen its economic and geopolitical position.¹³ This section draws on a number of academic and policy contributions to provide some preliminary discussion points and material for CONCORDi's policy-focused plenary sessions.

The role of Industrial policy and Industrial Innovation

Industrial innovation is central to the realisation of OSA.¹⁴ By fostering academic and corporate R&D, coupled with a rejuvenated industrial strategy, the EU aspires to cultivate industrial ecosystems. These ecosystems are envisioned to spur innovation within the EU, diminishing our reliance on external suppliers. Such an approach not only enhances economic robustness but also ensures that no region or individual is left behind in this transformative journey.¹⁵

The EU's previous industrial policy did not sufficiently account for the great power rivalry and the strategic moves of other nations, hence the need for the EU to recalibrate its strategy, focusing on key industries, essential supplies, and infrastructure, as the introduction of new policies such

¹³ EU Strategic Autonomy Monitor - July 2022. EPRS | European Parliamentary Research Service Available at [https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/733589/EPRS_BRI\(2022\)733589_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/733589/EPRS_BRI(2022)733589_EN.pdf)

¹⁴ COM(2020) 102 final "A New Industrial Strategy for Europe" Brussels, 10.3.2020

¹⁵ <https://s3platform.jrc.ec.europa.eu/pri>

as the Recovery and Resilience Facility, the EU Chips Act or the Critical Raw Materials Act testify. The aim should not be mere self-sufficiency but rather to maintain production capability.¹⁶ The future efforts of the EU should be directed towards enhancing internal production of goods in which it already holds a competitive advantage, has the potential to establish itself as a leader, or requires sufficient capacity to ensure its future economic security.¹⁷ This involves targeting new technologies, bolstering competition, and supporting productive companies.¹⁸ Industries such as semiconductors, renewable energies, and e-mobility have significant spillover effects and are pivotal for growth and development. Infrastructure, encompassing energy networks, transport, and digital platforms, is integral to a robust industrial policy.¹⁹ The emphasis on a robust industrial policy that aligns with the green transition and the development of new technical standards and regulations further underscores the importance of industrial innovation in achieving OSA.²⁰

Policy forum at CONCORDi 2023

The Policy Forum during the CONCORDi 2023 conference is devoted to policy discussions with the main stakeholders (policy makers, industrialists, experts) based on the relevant implications for policy that emerge from the scientific presentations and discussions taking place at the conference. Key areas of focus include:

Opening Plenary 1. “Industrial innovation for Open Strategic Autonomy, leaving no one and no place behind”. The implementation of OSA is testament to the close collaboration between the European Institutions and the Member States, at national, regional and local levels. This includes the attainment of a unified market to underpin the EU's economic prowess. The Spanish presidency semester of the EU has been instrumental in championing OSA.²¹ Further details on

¹⁶ https://ec.europa.eu/commission/presscorner/detail/en/IP_22_1124

¹⁷ Resilient EU 2030 – Spanish Presidency of the Council of the EU. <https://spanish-presidency.consilium.europa.eu/en/news/the-spanish-presidency-presents-resilient-eu2030-roadmap-to-boost-european-union-open-strategic-autonomy/>

¹⁸ COM(2022) 332 final “A New European Innovation Agenda” Brussels, 5.7.2022

¹⁹ Dullien, Sebastian, and Jonathan Hackenbroich. "European industrial policy: A crucial element of strategic autonomy." IMK Policy Brief, No. 130.

²⁰ Van den Abeele, Éric. "Towards a new paradigm in open strategic autonomy?" ETUI, Brussels, 2021. Available at: <https://ssrn.com/abstract=3873798>

²¹ <https://futuros.gob.es/en/our-work/OSA>

the ongoing initiatives relating to OSA during the Spanish Presidency semester of the European Union set out below in Box 1.

Box 1 “RESILIENT EU2030: A future-oriented approach to reinforce the EU’s Open Strategic Autonomy and Global Leadership”

Nine lines of action are proposed by the Spanish EU Presidency in a recent “non-paper” document entitled “Resilient EU2030”²² to tackle the vulnerabilities identified in a systemic and realistic way, aligned with the European principles of competitiveness and cohesion as well as with the EU’s main economic, social and environmental goals and values.

A CHANGING GEOPOLITICAL LANDSCAPE

Aiming for the best: a renewed, open, rules-based international order. Preparing for the worst: managing dependency in a fragmented economy. The EU’s response: Open Strategic Autonomy.

BOLSTERING AND SECURING INTERNAL PRODUCTION CAPACITIES

1. Fostering domestic production of key goods, services and raw materials. 2. Monitoring foreign ownership and control over strategic sectors. 3. Setting contingency plans to respond to future shortages.

ENHANCING CIRCULARITY AND SMART CONSUMPTION

4. Increasing resource efficiency. 5. Fostering circularity in the economy and society. 6. Replacing raw materials and components by more accessible alternatives.

REINVIGORATING GLOBAL TRADE AND THE MULTILATERAL SYSTEM

7. Launching a new trade expansion. 8. Rebalancing economic relations with China. 9. Leading the renovation of the multilateral architecture.

CONCLUSIONS: A COMPETITIVE EUROPE FOR A PROSPEROUS WORLD

The concluding section of the “non-paper” document reflects on the real capacity of the EU to adopt all the afore-mentioned measures and overcome the challenges of this time. Building on data, it shows that, despite its many weaknesses and vulnerabilities, the EU remains one of the most socially-advanced regions in the world and one of its economic and geopolitical powerhouses. Accordingly, the authors argue that imagining an EU in 2030 with top-tier technological companies, non-polluting and cheap energy, high quality and affordable services and higher living standards is an empirically-based, reasonable forecast. It states that the future of the EU is not to prevent its decline but to lead a new era of global prosperity.

²² Spain’s National Office of Foresight and Strategy (2023) Resilient EU2030. NIPO: 089-23-024-6. Madrid, 15 September 2023. More information www.futuros.gob.es/e,

These issues, and the strategic vision and objectives to achieve the EU's Open Strategic Autonomy and technological and economic leadership, are highlighted in the Opening Plenary 1. Diego Rubio, Director of the National Office of Foresight & Strategy of the Spanish Government will chair and moderate the opening session. Key policymakers will intervene in this plenary session.

Plenary 2. "Governance and international organizations; Trade and Innovation & industrial policies", chaired by Barbara Kauffmann, Director for employment and social governance, analysis at the European Commission, Directorate General for Employment, Social Affairs and Inclusion.

Governance and international organizations. Open Strategic Autonomy is meant to rely on a repertoire of socio-economic, technological and policy governance. Therefore, the OSA policy agenda addresses a multitude of interrelated areas and is articulated around a broad geopolitical frame (Csernatoni, 2022; Miró, 2023). An overview of the partnership with third countries and of the governance of multi-policy fields with related policy initiatives and instruments is offered from the perspective and experience of the international organizations in this Plenary.

Trade policy. A pivotal aspect of Open Strategic Autonomy is EU trade strategy and policy support. The trade strategy focuses on delivering stronger global trading rules and contributing to the EU's economic recovery. The policy support aims to: i) lead and shape the system of global economic governance; ii) develop mutually beneficial bilateral relations; and iii) strengthen the EU economy, defending it from unfair and abusive practices (European Commission, 2020; 2021a). This subject will be introduced and expanded in Plenary 2.

Industrial innovation policy. Industrial and innovation policies (together with other relevant policies in the policy mix, such as sectoral and environmental policies) play a pivotal role in advancing the objectives of "open strategic autonomy" (OSA). These policies promote the use of industrial innovation as a means to mitigate vulnerabilities and strengthen technological sovereignty in key sectors. Additionally, they underscore the significance of innovation in critical technologies as a way to reduce dependencies on external sources. Excellence in knowledge production, facilitated by international collaborations, and an EU climate conducive to business and investment, stand out as key factors contributing to the success of industrial innovation. There are also challenges in formulating and implementing industrial innovation policies with

multiple goals (productivity, technological sovereignty, circularity, inclusivity) as promoted by the European Commission. A multitude of goals can obscure accountability and hinder the recognition of failures. The session will also discuss how to mitigate these challenges. These and other aspects of industrial and innovation policy related to OSA are introduced in Plenary 2.

Plenary 3. “Competition policy; Industrial investment; Next generation health cures; Digital & Green transition”, chaired by Bernard Magenmann, Deputy Director-General of the Joint Research Centre - European Commission.

Competition policy. Other key aspects to support Open Strategic Autonomy relate to critical infrastructure and supply chains for critical sectors, technologies and raw materials, and to industrial cooperation and supply chain partnerships with allies (Gehrke, 2022). This also marks some important challenges for competition policy and business practices as for example in the context of mergers and acquisitions (Pim and Devroe, 2022). These and other aspects of Competition policy will be introduced in Plenary 3.

Single Market Integration policy. A unified market is the cornerstone of the EU's economic prowess. Ensuring open and seamless trade, commerce, and movement of goods, services, capital, and people within the EU is also of paramount importance for Open Strategic Autonomy. The harmonization and implementation of the Single Market can further help in removing barriers to free movement in the main industrial ecosystems and services. These and other key issues of the EU policy addressing the integration of the Single Market related to OSA will be introduced in Plenary 3.

Industrial investment. Access to and the availability of finance for the EU economy very much determine the speed of the realization of OSA because it addresses critical sectors and implies substantial efforts to face innovation, structural and financial challenges, as in the case of Digital and Green transition. In this Plenary, a very recent firms’ outlook on the investment climate in the EU is released. The analysis is based on a sample of twelve thousand firms across the EU, with a smaller representative sample of firms in the US used to provide a comparator. It shows the financial impacts of the invasion of Ukraine and the energy crisis on firms in Europe, and how firms may react going forward.

Next generation health cures, and Digital & Green transition: The business views. Essential to overall OSA implementation is the role of industrial entrepreneurs. In Plenary 3 presents the experience and views of industrialists operating in critical (strategic) sectors of the EU economy, such as Health and Digital & Green. The competitiveness and leadership of businesses in these broad sectors rely very much on research and innovation. In this context, the full implementation of OSA is expected to create better conditions for accruing business success and social welfare.

Closing plenary 4. “Industrial innovation for Open Strategic Autonomy - Leaving no one and no place behind”, chaired by Mikel Landabaso, Director of Fair and Sustainable Economy Directorate, Joint Research Centre, European Commission.

Science for policy. Fulfilling the objective of translating science into policy, a summary of the main highlights of novel scientific analyses with potential relevance for policy-makers will be provided in the Closing Plenary session 4. This will be based on the scientific contributions offered in the Policy Forum of the conference.

Identification of Territorial Opportunities. Recognising and capitalising on territorial opportunities linked to industrial innovation is pivotal for enhancing competitiveness, ensuring regional cohesion, and fostering social inclusion. By leveraging the unique strengths and capabilities of different regions, the EU can create a synergistic ecosystem that drives growth and innovation. These topics will be introduced and will be central to the discussions in the Closing Plenary session 4.

Closing. A sum-up of the main discussions and key takeaways from CONCORDi 2023 will be offered in the last intervention of the conference. This will include the mission of the JRC and its contribution to OSA as science-for-policy body of the European Commission. Follow-up initiatives arising from this edition of the conference may also be proposed in this Plenary.

CONCORDi 2023 science-to-policy contribution: The way forward

The policy-relevant results of the Conference are expected to be made public in a *policy brief*, and the most salient scientific contributions will be promoted for publication through relevant academic channels²³.

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²³ All information related to CONCORDi 2023, including the mentioned follow-up items, are and will be accessible from <https://iri.jrc.ec.europa.eu/concordi-2023>

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