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Industrial innovation for competitive sustainability

*Background note to the 8th
European Conference on
Corporate R&D and
Innovation (CONCORDi 2021)*

Diodato, D., Moncada-Paternò-Castello, P.,
Rentocchini, F., Tübke, A.

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Contact information

Name: Pietro Moncada-Paternò-Castello
Address: Joint Research Centre, European Commission (Seville, Spain)
Email: Pietro.Moncada-Paternò-Castello@ec.europa.eu

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Abstract

This background note describes five core global disruptions affecting the world economy. It presents how contributions selected for presentation at CONCORDi 2021 will try to tackle some of these challenges, and concludes by highlighting the policy-relevant issues – resonating with CONCORDi’s objective – from the four conference organisers. The note is addressed to the participants of CONCORDi 2021 as well as to other people interested in the main themes of this conference.

Executive Summary

From 22 to 25 November 2021, the European Commission’s Joint Research Centre (EC-JRC) organises the 8th biennial European Conference on Corporate R&D and Innovation (CONCORDi), in association with the European Association for Research and Technology Organisations (EARTO), the Organisation for Economic Co-operation and Development (OECD) and the United Nations Industrial Development Organization (UNIDO).

The Conference will reflect on the secular disruptions affecting our societies in present times, disruption such as: a once-in-a-century pandemic, the rapid deployment of increasingly sophisticated production technologies that may challenge millions of jobs, the increasingly-visible impact of climate change, the escalation of several societal challenges – such as demographic change and inclusiveness – and the reorganization of global supply chains, challenging the status quo in both the developing and developed world.

CONCORDi 2021 is a unique forum to discuss the role of corporate R&D and innovation in the dealing with these momentous transformations and to identify research, business and policy challenges in the area for decades to come. The discussions at the conference are organised around the following main themes:

- Industrial transition in times of recovery
- Industrial innovation for sustainable transformations
- Industrial strategy in a post pandemic world: Focus on developing countries
- Technology infrastructures to deliver on the digital and green (twin) transition.

The scientific contribution from CONCORDi 2021 comes from the novel scientific work presented in ten parallel sessions. Thirty papers will be presented and discussed during these parallel sessions, with the aim to help reinforcing the research-based evidence needed to address specific aspects of these themes.

CONCORDi 2021 will benefit from the contribution of distinguished professionals representing academia, policy-making, and industry: Kevin O’Connor, Reinhilde Veugelers, Dirk Pilat, Fiona Tregenna, Keun Lee, Bernardo Calzadilla-Sarmiento, and Anna Panagopoulou. The scientific evidence presented in the parallel sessions, the perspective of the keynote sessions, as well as the lively discussions in the panel sessions, they will all contribute to refining the rich innovation policy agendas of the European Commission and the other organizing institutions and beyond.

1. Introduction

From 22 to 25 November 2021, the European Commission's Joint Research Centre (EC-JRC) organises the 8th biennial European Conference on Corporate R&D and Innovation (CONCORDi), in association with the European Association for Research and Technology Organisations (EARTO), the Organisation for Economic Co-operation and Development (OECD) and the United Nations Industrial Development Organization (UNIDO).

The Conference identifies the research, business and policy challenges in the area of corporate R&D and Innovation for the decade to come and is organised around the following main themes:

- Industrial transition (i.e. sustainable change/upgrading/resilience) in recovery times
- Industrial innovation for sustainable transformations
- Industrial strategy in a post pandemic world: Focus on developing countries
- Technology infrastructures to deliver on the digital and green (twin) transition.

CONCORDi 2021 is a unique forum to discuss research, business and policy implications of the recent and future health, economic, technological, and social challenges for the world economy. The present document aims to provide background information and give an overview of the conference and is principally addressed to the targeted audience of CONCORDi 2021, i.e. to scientists, analysts, policy-makers and business.

Some experts believe that evolutionary change in biology moves forward in short windows of rapid transformation: after a long period of stasis, a species may swiftly evolve to reach a new stable morphology.¹ Looking at the state of the world in 2021, one cannot help but wonder if our global economy is experiencing a unique evolutionary burst, whose effects will be felt for decades to come. We are, in fact, observing several disruptive changes taking place at once:

- 1) A once-in-a-century pandemic has compromised our well-being, overwhelmed our health systems, challenged the way we work, and initiated a macroeconomic recession;
- 2) The rapid deployment of increasingly sophisticated production technologies – from IT and machinery to their more advanced modern counterparts: AI and robotics – are part of an ongoing structural transformation that may pose challenges to millions of skilled and unskilled jobs;
- 3) A visible increase in extreme heatwaves and storms lead many to observe that climate change is no longer just a concern for future generations, but a clear and present danger, which requires a speedy decarbonisation of the economy;
- 4) On top of the health and environmental challenges, other relevant societal challenges will need to be addressed in the coming years. Among these, demographic change, a more inclusive society and protection of freedom are increasingly at the centre of the public debate and will need new ideas and solutions to be properly tackled.
- 5) A fragmentation and disruption (i.e., shortening, reshoring, near shoring) of production and industrialisation of emerging countries which are revolutionising the geography of supply chains, challenging the status quo in both the developing and developed world.

The outlook is challenging, and innovation will be a crucial part of it. The biennial international Conference on Corporate R&D and Innovation (CONCORDi), at its 8th edition,

¹ See the theory of punctuated equilibrium (Gould, 2009).

has established itself as a leading forum where scholars and policymakers meet to discuss the latest research findings and the possible policy solutions that innovation might provide in this context. The focus of CONCORDi 2021 is to showcase frontier research results on policy-relevant topics, provide original scientific evidence to support decision-makers in the current conjuncture and condense results and policy debates for civil society and businesses. This includes discussing state-of-the-art academic research and debating policy solutions to aid the post-pandemic recovery, while fostering the achievement of sustainability in its three-fold aspect (economic, social and environmental).

The role of public policy in the present context is more important than ever. While corporate R&D represents a large portion of innovation,² a pillar in the modern theory of economic growth is that the intrinsic characteristics of knowledge (such as non-rivalry and cumulativeness; see Grossman and Helpman, 1991 and Dosi and Nelson, 2009) may render firms' investments in R&D suboptimal, in terms of both volume and direction. The concept of mission oriented STI-policies is increasingly gaining acceptance and implies an even stronger focus on directionality of innovations (Wittmann et al., 2021). The ability of countries and multilateral organisations to stimulate and steer innovation will determine how well we adapt to these momentous transformations. From this perspective, CONCORDi 2021 is well positioned to have an impact: while being an initiative of the JRC – the European Commission's science and knowledge service – this year's edition is co-organised with the European Association for Research and Technology Organisations (EARTO), the Organisation for Economic Co-operation and Development (OECD), and the United Nations Industrial Development Organization (UNIDO), thus ensuring a shared approach on the issues at stake. Building upon the long-lasting collaboration between the European Commission's JRC, EARTO, OECD and UNIDO, the EC-JRC took an active role in involving them in the organisation of this year's CONCORDi. Their expertise on industrial and innovation policies for a sustainable and just transition in the face of the global challenges highlighted above will contribute to make CONCORDi 2021 an even more enriching forum for emerging scientific ideas, practices and policy options in the areas of industrial innovation and sustainability.

The current note is addressed to actual and potential participants of CONCORDi 2021 as well as to other people from academia, business, and policy-making who are interested in the main focus of this conference.

This background note is organised around three main chapters. Chapter 2 briefly describes the five core global disruptions affecting the world economy. Chapter 3 presents how contributions selected for presentation at CONCORDi 2021 will try to tackle some of these challenges. Chapter 3 concludes by highlighting the policy-relevant issues – resonating with CONCORDi's objective – from the four conference organisers.

2. Global disruptions and challenges

We identify here five main disruptions, which are affecting the global economy, each with many cumulative effects that often present unique challenges, while sometimes exacerbating existing issues.

² About two-thirds of total R&D, for the EU. See https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Europe_2020_indicators_-_R%26D_and_innovation&oldid=345979#cite_note-2

2.1 A once-in-a-century pandemic

Even with vaccinations underway in many countries and the IMF projecting growth throughout the world for 2021 and 2022,³ the disruptive effects of the pandemic are unlikely to vanish soon. First, the rosy economic projections of the IMF rest on the assumption that the COVID-19 pandemic is indeed phasing out. While there are reasons to be optimistic, there are still short-term risks linked, for instance, to new infection waves during the winter. Second, even when the pandemic would be over, some of the impacts it already had are likely to last long. Among them we highlight the continued physical and psychological strain from those affected by the disease or the lockdowns,^{4,5} the learning gap for students and the experience gap for workers (Engzell et al, 2021), the transition to teleworking for an important section of the labour force (del Rio-Chanona et al, 2020).

Meanwhile the pandemic accelerated the impulse towards digitalisation – to the point that many pundits are claiming that our work and lifestyle have been irreversibly altered.

2.2 Scientific and technological disruptions

Scientific and technological progress is undoubtedly a major force behind societal change. The rollout of new digital technologies – such as 5G, autonomous driving, virtual and augmented reality, edge computing, and artificial intelligence – promises to significantly improve our lifestyle.

However, with new technologies often come economic disruptions, especially to the labour market, with the skills of some workers becoming obsolete. This is not a new phenomenon: a deep transformation of production technologies has been in motion for a long time. Automation of tasks performed by humans is as old as the industrial revolution: for instance, mechanisation is believed to have been behind the decline in demand of routine manual tasks performed by agricultural and industrial workers in the 19th and 20th century (Nedelkoska et al, 2018). However, the rapid progress in information technologies in the past 40 years may be causing disruption in the labour market unlike any in the past. First, the adoption of digital technologies at the end of the 20th century extended the set of tasks that can be automated by a machine: technology not only threatens routine manual tasks, but also routine cognitive ones (Autor et al., 2001). The advancements in AI and robotics of the past decade are extending the menace of automation to non-routine cognitive tasks and non-routine manual tasks, respectively (Brynjolfsson and Mitchell, 2017).

While it is hard to predict precisely which job will be automated (Frey and Osborne, 2017; Brynjolfsson et al., 2018), AI, robotics and automation are only a few of the possible technology disruptions with potentially substantial impact. Examples from Horizon Scanning exercises show a wide range of possible applications of technologies in many low-technology sectors, such as agriculture and farming.⁶ Policymakers need to be placing the issue front and centre, guiding industry leaders in the digital transition, as well as dealing with its social consequences. They should also look beyond technological change and acknowledge the relevance of scientific disruptions in dealing with present and future

³ <https://www.imf.org/en/Publications/WEO/Issues/2021/07/27/world-economic-outlook-update-july-2021#Projections>

⁴ [https://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736\(20\)32662-3.pdf](https://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(20)32662-3.pdf)

⁵ <https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/returning-to-resilience-the-impact-of-covid-19-on-behavioral-health>

⁶ See: https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/shaping-eu-research-and-innovation-policy/foresight/activities/horizon-scanning-study-future-radical-innovation-breakthroughs_en

challenges, particularly in the field of health and biotech (leading to, for instance, pandemic prevention, cancer treatment, and new healthy foods).

2.3 Environmental disruptions

Climate change is already having a direct impact on the well-being of citizens around the world.⁷ Tackling this will require bold and radical policy actions, with the EU and the US, for instance, pledging to become climate neutral by 2050. This is set to revolutionise our modes of production in a relatively short time, and it will have vast economic and social consequences. Industrial innovation will arguably be the leading factor in the success of this epochal transformation. It will be key that national governments and multilateral organisations will be able to stimulate innovation in the right direction, ensuring the decarbonisation of the economy without leaving anyone behind. As the demand side of environmental innovations poses additional regulatory challenges for innovation policy (Rennings, 2000) this also calls for integration of traditional supply-side STI policies with more sectoral policy measurements, which are expected to influence the demand side.

2.4 Social disruption (socio-economic innovation)

Mobilising science, technology and innovation is pivotal not only to generate economic benefits, but also to anticipate and respond to societal problems. The transformation of EU industry requires innovation and employment policies to be reconciled with environmental and social challenges. Europe's global position in science is helping shift industrial frontiers and can place EU industry at the cutting edge of technological development. However, there is a pressing need to improve the understanding of the changing dynamics of science relevant to industry, its direction, performance, and impact on the workforce. This points to the need for a better coordination and experimentation with policies supporting innovation. Not only, innovation aiming at addressing social challenges must deal with barriers that cause under-investment and hinder their development and diffusion. Given the limited resources and increasing pressure on a quick, inclusive and sustainable recovery, it is crucial to deploy and develop new knowledge and talent as efficiently as possible. From this perspective, the supply of new skills through the education system and on- and off-the-job skill provision are not always perfectly aligned with the needs coming from industry and the transition to more sustainable production processes.

2.5 A shift in global supply chains

Another long-term macro transformation, whose impact on the global economy has been intensifying in recent times, is the industrialisation of emerging economies. Improvements in transportation and digital communication technologies have increased the fragmentation of global supply chains, allowing for further shifts in production (Antràs, 2016). This has clearly been having disruptive effects: many manufacturing jobs in the developed world (already challenged by automation) have been off-shored to emerging economies, while in emerging countries, industrialisation brings its own challenges: regulatory, social, environmental. Moreover, economic growth in industrializing countries is likely to increase international migration further, at least in a first phase (Clemens, 2020), with all the social and economic consequence it entails.

⁷ <https://www.un.org/sg/en/content/sg/statement/2018-09-10/secretary-generals-remarks-climate-change-delivered>

3. Background information on science-to-policy contributions from CONCORDi 2021

The first section in this chapter discusses the broad thematic areas of CONCORDi 2021 and introduces the scientific background from the contributions provided by the papers selected by the Conference scientific committee. Section 3.2 presents the invited keynote speakers and provides a brief description of their contribution. The abstracts of the papers accepted for presentation in the parallel sessions are provided in Annex A.1 at the end of the document.

3.1 Main themes of the Conference and contributions from scientists and research analysts

The scientific contribution from CONCORDi 2021 comes from the novel scientific work presented in ten parallel sessions. The thirty papers that will be presented and discussed during these parallel sessions will help to reinforce the research-based evidence needed to address specific aspects of these policy-relevant topics.

3.1.1 Industrial transition in times of recovery

Current health and economic emergencies hit EU member states badly (Tesche, 2020) and are expected to exacerbate inequalities in the EU (Busch, 2020). Paradigmatic changes in industry are expected to play a major role in the post-COVID recovery, thanks also to the important resources invested by the European Commission through the next generation EU funds.⁸ It is then central to understand the different innovation and competitive dynamics characterising firms worldwide, so that the effort made will not be wasted and that will grant a sustainable competitive advantage for the years to come.

The academic and policy discourse has recently focused on two transitions which are expected to contribute to economic recovery. On the one side, the focus has been on the role that digital (ICT and more lately AI, Industry 4.0, platforms) technologies have for growth, productivity and labour (Heyman et al., 2021). On the other side, investment into environmental technologies and products seems essential to facilitate the transition into a low carbon economy (Dean and McMullen 2007), which has the potential to restore the competitiveness of advanced economies (Costantini and Mazzanti 2012).

Digital disruption is a broad term which encompasses several technologies (e.g., industrial robots, AI, augmented reality) and different forms of implementation (e.g., platforms, sharing economy, blockchain) for which we still lack a clear understanding of antecedents and economic consequences. Existing works have investigated the potential for technological disruption from Industry 4.0 technologies (Martinelli et al., 2021) and its consequences on the future of work (e.g., Frey and Osborne, 2017, Graetz and Michaels, 2018; Acemoglu et al., 2021). Other works have focussed on an analysis of specific Industry 4.0 technologies such as artificial intelligence and robotics (e.g., Cockburn et al., 2018, Dernis et al., 2019, Kromann et al., 2020). From a company perspective, available evidence has shown a positive contribution of the adoption and developments of industry 4.0 technologies on productivity and profitability of (established) firms (Benassi et al., 2021; Beherens et al., 2021; Cirillo et al., 2021; Peters and Trunschke, 2021).

⁸ https://ec.europa.eu/info/strategy/recovery-plan-europe_en

Similarly, we still lack relevant evidence on several aspects relating to the development and implementation of green technologies for a transition towards a climate neutral economy. Recent contributions show that green technologies are more complex and novel compared to non-green technologies (Barbier and Burgess, 2020) and that follow a path-dependent process in their development at the country level (Barbier and Burgess, 2020; Perruchas et al., 2020). However, we lack a clear understanding of how these technologies can be effectively funded as traditional funding sources seem to be problematic (Gaddy et al., 2017). Also, there is an important role to be played by young companies in the green domain: green start-ups follow an entrepreneurial path that provides practical and innovative solutions for environmental concerns, which are eminently different from the logics applied by the established firms “going green” (Demirel et al., 2017). Nevertheless, we miss evidence on this topic due to a lack of reliable data.

Despite these recent advancements, there is still little understanding on several issues relating to the development and adoption of digital and environmental technologies and how these impact corporate strategy and investments (particularly in R&D and innovation), the internal organisation of labour, industrial competitiveness and productivity. Furthermore, we still lack appropriate frameworks and policy instruments to effectively steer industrial transitions and foster recovery. Finally, we lack relevant evidence on whether and how the digital and green transitions can be efficiently coupled together into a “twin” transition, as recently advocated by policy makers.

This theme is covered by the scientific papers that will be presented in four parallel sessions at the Conference (A.I, A.II, A.III and A.IV – in the afternoon of 22 November 2021).⁹

3.1.2 Industrial Innovation for sustainable transformations

The post-pandemic recovery period should be characterised by a fair and just transformation. Industrial innovation is central to this, but it can also induce profound disparities. For example, academic and policy circles have only recently started to scratch the surface of the “dark side” of innovation which may have profound consequences for public health, environmental degradation, harms to society and economy (Coad et al., 2021; Biggi et al., 2020). Therefore, assuring a cohesive industrial recovery might be challenging, unless relevant aspects are taken into consideration.

First, the role of gender in industrial research and innovation must be considered. Although there is a general agreement on the need for a gender-aware understanding of antecedents and consequences of innovation, there is still an excessive focus on gender diversity in innovation and research teams compared to other equally relevant topics of discussion such as other gender biases – e.g., in research methods and questions (Nielsen et al., 2018; Xie et al., 2020) – or how gender policies affect industrial innovation and performance (Foss et al., 2021; Dezsö and Ross, 2012; Lyngsie and Foss, 2017).

A second stream of research in sustainability specifically look at environmental sustainability. Whereas recent work has improved our understanding of sustainability practices (Eccles et al., 2014) and environmental technologies (Nesta et al., 2014) for corporate innovation and performance, comparatively less evidence supporting policy makers is available regarding the implementation of transition to climate neutral production processes. Notably, policy makers lack support about which new skills and jobs will be demanded in the future to accommodate the green transition (Vona et al., 2019),

⁹ See also Appendix of this document and the Programme (<https://iri.jrc.ec.europa.eu/concordi-2021/programme>)

the sources of funding needed (Gaddy et al., 2017); relevant undertakings to deal with the sustainable development goals from large corporates; the role of young and high-growth companies (Demirel et al., 2019); existing and new policy instruments needed to steer the transition and to grant technological sovereignty.

This theme is covered by the scientific papers that will be presented in four parallel sessions at the Conference (B.I, B.II, B.III, and B.IV - in the afternoon of 23 November 2021).¹⁰

3.1.3 The future of industrialization in a post pandemic world: Focus on developing countries

Although the COVID-19 pandemic has hit hard also developing countries, there is a paucity of evidence on the economic consequences that middle- and low-income countries will need to face in the coming years. Gerard et al. (2020) propose a wide set of measures that governments from developing countries can implement to shield the most vulnerable groups of the population. Despite these short-term countermeasures, post-pandemic recovery is expected to arrive later due to the slower distribution of vaccines in developing countries (Hitt et al., 2021).

Drivers of economic recovery in middle- and low-income countries will necessarily build upon the ability of these countries and international organisations to turn back on industrial capacity after the recent slowdown. Fostering digitalisation and the transition towards industry 4.0 is one such way, nevertheless this process is different from the one in developed countries and is characterised by its own challenges in terms of institutional and financial barriers (Bogoviz et al., 2019; Raj et al., 2020). Green transformation of developing countries' industrial structure is another way post-pandemic recovery can materialise in the form of increased productivity and high income. To achieve that, a central role will be played by industrial innovation (Hansen et al., 2018) and adherence to sustainable development goals. This will depend to a great extent by the capacity of R&D investments by companies to address issues such as the exploitation of natural resources (Barbier, 2020), waste management (Lauridsen and Jørgensen, 2010), decarbonisation (Okeleke, 2019), as well as the ability of firms to adopt sustainable management practices.

The above-mentioned transformation in developing countries' industry towards a more digital and green content is likely to see a central role played by innovative companies and multinational enterprises via foreign direct investments (FDI). These companies are expected to provide important contributions to developing countries' productivity, industry diversification and servitisation but, at the same time, important investments in innovation and human resources are needed to realise these potential benefits (Miyamoto, 2008; Fu et al., 2021). This is also because, the contribution of FDI to economic growth for low- and middle-income countries has been shown to be highly heterogeneous and heavily depend upon contextual factors, such as FDI volatility, primary export dependence and business freedom (Herzer, 2012).

Taking stock of the above themes is the purpose of the scientific papers presented in two parallel sessions at the Conference (C.I and C.II -in the afternoon of 24 November 2021).¹¹

¹⁰ See also Appendix of this document and the Programme (<https://iri.jrc.ec.europa.eu/concordi-2021/programme>).

¹¹ See also Appendix of this document and the Programme (<https://iri.jrc.ec.europa.eu/concordi-2021/programme>).

3.2. Contributions from Keynote Speakers

CONCORDi 2021 will benefit from the contribution by distinguished professionals representing academia, policy-making, and industry. A short abstract of their keynote presentations is presented below according to the order of appearance in the Conference programme.

Kevin O'Connor, Co-Founder of Biplastech Ltd. and Professor at University College Dublin will speak about “Biodegradable plastics innovation for sustainability: an Entrepreneurial experience”. Biodegradable plastics offer society an opportunity to move from recalcitrant materials to those that can be managed through natural processes. The presentation will address the challenges of starting a business based on sustainability and addressing an immature rapidly evolving market.

Reinhilde Veugelers full professor at KULeuven (BEL) and Senior Fellow at Bruegel, will speak about “How to do green industrial policy?”. Following the recent commitments, the EU needs to develop a strong green industrial policy: this contribution is about what should Europe's green industrial policy look like and how it can be achieved in practice.

Dirk Pilat, Deputy Director - Directorate for Science, Technology, and Innovation at the OECD) will deliver a speech about “World Corporate Top R&D investors: Paving the way to climate neutrality”. During the speech, the joint JRC-OECD report on the Intellectual Property portfolios of the world's top 2000 R&D investors will be presented. The report explores the important role played by top R&D investors in the development and commercialisation of new technologies, as reflected in their patenting and trademark filing activity. The focus of this year's report is on the contribution of the world's top R&D investors to innovation in climate change mitigation and adaptation technologies as a response to the new climate neutrality objectives.

Fiona Tregenna, Professor of Economics at the University of Johannesburg, will speak about “The impact of the COVID-19 pandemic on manufacturing firms in developing and emerging countries”

Keun Lee, Professor of Economics at the Seoul National University, will speak about “Digitalization and greening as windows of opportunity for leapfrogging in the post-pandemic world”. Whether digitalization in the Fourth Industrial Revolution can be a new window of opportunity for leapfrogging or a source for further risk for the latecomers depends on each country's responses and readiness, including industrial policy, digital literacy, skills and educational level (relative to wage rates), domestic market size and position in GVCs.

Bernardo Calzadilla-Sarmiento, Managing Director of the Directorate of Digitalization, Technology and Agri-Business, and Director of the Department of Digitalization, Technology and Innovation, at the United Nations Industrial Development Organization, UNIDO, will speak about: “UNIDO Strategic approach: Making the Fourth Industrial Revolution work for all”. The speech will focus on how the COVID-19 pandemic has become an unforeseen accelerator for the digital transformation. To this respect, the speaker will briefly introduce and share thoughts on how the Fourth Industrial Revolution can promote a strong, inclusive, and green recovery for countries in a post-COVID world.

Anna Panagopoulou, Director of European Research Area & Innovation at the Research and Innovation Directorate General of European Commission, will speak about “Towards an integrated European technology infrastructure landscape”. Technology infrastructures are important enablers and accelerators of technology co-creation, scale-up, and diffusion

across Europe. As they are an essential element of the new European Research Area for R&I, the speech will revolve around the development of an integrated European technology infrastructure landscape and how this can favour the European Union.

4. Policy views about industrial innovation at CONCORDi 2021

Following the global disruptions highlighted in Chapter 2 and the scientific contributions from Chapter 3 which were selected for presentation at CONCORDi 2021 and aimed at providing solid scientific evidence on how to tackle some of these challenges, Chapter 4 presents the different policy views from the main conference organisers (EC-JRC, EARTO, OECD and UNIDO) which resonates well with CONCORDi's main objectives.

Based on its traditional open and fruitful science-to-policy discussions, CONCORDi 2021 aims to support decision-makers with the novel scientific-based outcomes addressing the role of industrial innovation in achieving competitive sustainability in the EU, in the context of the recovery plan and the implementation of the twin green and digital transitions and the global sustainability agenda.¹²

Evidently, industrial and innovation-policy making cannot escape the disruptions highlighted in previous chapters: solid scientific evidence should inform policy solutions aimed at tackling the contributions that industry should provide in the next decade. At the same time, industrial innovation will trigger change and transformation towards the green policy objectives, where Europe is comparatively stronger. The political ambitions of a more resilient, greener and digital EU, with the objectives of becoming the world's first climate-neutral continent while boosting Europe's recovery, can in fact only be met by a boost to industrial innovation as a driver for change and by innovation towards sustainability and inclusivity goals.

The following sections touch upon the relevant industrial and innovation policy views aimed at tackling the global challenges we face and will draw on the contributions from the four main organisations contributing to the CONCORDi's plenary sessions (EC-JRC, EARTO, OECD and UNIDO). The aim is to bring at the forefront the policy-relevant work conducted by each organisation in order to inform future scientific research and make civil society and businesses aware of where policy-making development currently stands.

4.1 A view on CONCORDi 2021 from the EU policy agenda

The relevance of industrial innovation to contribute to the multiple transitions mentioned above and sustainability objectives are reflected in recent key EU policy documents, such as the September 2020 renewed European Research Area (ERA) Communication,¹³ the May 2021 updated Industrial Strategy for Europe,¹⁴ and the 2030 Digital Compass.¹⁵ The updated Industrial Strategy raises EU industrial and technological vulnerabilities, and implements transition pathways for some of the 14 identified industrial ecosystems.¹⁶ The renewed European Research Area (ERA) strategy implements common industrial technology roadmaps to transfer R&I results into the economy through investment agendas developed

¹² The European Green Deal Communication (Dec. 2019) set out the path for the initial priority actions to be undertaken during the next years. These are moving targets and constitute an integral part of the Commission's strategy to implement the United Nations 2030 Agenda and the Sustainable Development Goals.

¹³ COM (2020) 628 final.

¹⁴ COM (2020) 102 final.

¹⁵ COM (2021) 118 final.

¹⁶ These 14 industrial ecosystems are: aerospace and defence, agri-food, construction, cultural and creative industries, digital, electronics, energy intensive industries, energy-renewables, health, mobility – transport – automotive, proximity, social economy and civil security, retail, textile and tourism (see https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en).

among the stakeholders, supports industrial alliances to mobilise industrial capacities in key areas, as well as Horizon Europe¹⁷ partnerships with industry. Similarly, innovative start-ups and scale-ups with break-through potential are supported by the European Innovation Council and InvestEU. This should lead to the emergence and growth of companies and investments in strategic and R&D intensive sectors.

Further, industrial innovation is at the heart of the EU recovery process, supported by mobilising in total €1.8 trillion for the NextGen Recovery and Resilience Facility and the 2021-27 long-term budget combined.¹⁸

From a global perspective, there is sometimes a tension between globalisation dynamics and EU strategic autonomy. Thus, balance between the need to promote growth on the one hand, and the security of supplies, on the other hand, is necessary. The Industrial Strategy identifies and monitors strategic dependencies¹⁹ and technology-related risks systematically in technologies such as raw materials, batteries, active pharmaceutical ingredients, hydrogen, semiconductors, cloud and edge technologies. In addition, in space, defence, and associated civil domains, the Commission's Observatory on Critical Technologies has been set-up to monitor and analyse potential applications, value chains, needed research and testing infrastructure, desired level of EU control over them, and existing gaps and dependencies.²⁰ Industrial innovation for competitive sustainability and the EU policy context will be the focus of the first day (22 November 2021) and of the afternoon of the last day (25 November 2021) of the Conference.

4.2 EARTO contribution to CONCORDi 2021: Research and technology organisations for industrial innovation ecosystems²¹

In the light of the global challenges highlighted in previous chapters, EARTO sees an important role to be played by Research and Technology Organisations (RTOs). RTOs are non-profit organisations with the public mission to translate basic research into innovation, tackling our global challenges and enabling technology uptake by industry. RTOs are also essential components of European industrial innovation ecosystems, and key actors to fulfil the objectives of the Green Deal and of the EU Digital Decade. The Technology Infrastructures (TIs) managed by RTOs are essential for the development, maturation, testing, demonstration and upscaling of technology,²² and key enablers for the transition to a sustainable and digital industry. However, TIs require a lot of resources and skills to build, manage, operate and maintain. Most companies cannot afford to have their own, and they depend on the access to RTOs' TIs to strengthen their innovation capacity and stay ahead of global competition. In addition, RTOs play an essential role in the RD&I policy mix: delivering impact is deeply rooted in their service-delivery models and stated in their public missions. Finally, RTOs have an impact on many different aspects of the economy and society: advancements in knowledge, technological development, competitiveness, sustainability, and well-being.

¹⁷ Horizon Europe will strengthen the EU's scientific and technological bases and the European Research Area, will boost Europe's innovation capacity, competitiveness and jobs, and will deliver on citizens' priorities and sustain the EU socioeconomic model and values (see https://ec.europa.eu/info/horizon-europe_en).

¹⁸ See <https://www.consilium.europa.eu/en/policies/the-eu-budget/long-term-eu-budget-2021-2027/>

¹⁹ The monitoring report identifies 137 products in sensitive ecosystems for which the EU is highly dependent on foreign sources (see: https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy/depth-reviews-strategic-areas-europes-interests_en)

²⁰ COM (2021) 70 final. Action Plan on synergies between civil, defence and space industries.

²¹ This sub-chapter is largely based on the contribution received by Ms Sophie Viscido and her colleagues from EARTO.

²² See "Setting-up a European Strategy for Technology Infrastructures". EARTO Paper Brussels, 31 July 2020.

EARTO organised a CONCORDi 2021's session in order to take stock of the progresses in the above domains. The session will discuss (i) the elements of a dedicated policy on TIs at EU level, towards an Integrated European TI landscape, which is currently being designed in the context of the new European Research Area's Policy Agenda; (ii) present core results from a joint OECD-EARTO project focusing on how RTOs contribute to supporting the transitions towards a more sustainable socio-economic system, which will be presented during the session and (iii) introduce different tools and methodologies which are key to foster evidenced-based policy making for STI and ensure that RTOs are used to their full potential to foster Europe's competitiveness and sustainability.

The EARTO dedicated session at CONCORDi 2021 conference on the 25th of November will further expand on the above themes.

4.3 OECD contribution to CONCORDi 2021: The effort of top R&D performers to achieve carbon neutrality objectives and innovating for climate neutrality²³

The current decade is crucial to achieve carbon emission reductions at the levels needed to reach long-term goals for climate action. Evidently, major innovation efforts are needed so that the technologies necessary for net-zero emissions reach markets as soon as possible. However, technology and innovation are not only major building blocks in achieving the deep cuts in carbon emissions that are needed in enabling the transition to a net-zero carbon world, but they are also essential pillars of resilient economic growth (OECD, 2021).

Therefore, at a time when countries are seeking to re-ignite economic growth in the post-COVID era by designing and implementing recovery packages, integrating low-carbon innovation support into these and making policy reforms to support innovation will be of the utmost importance. This requires a comprehensive set of policy instruments – a “green industrial and innovation strategy” – including ambitious technology support, infrastructure planning, carbon pricing, regulatory standards and public procurement. The results of the joint OECD – European Commission's JRC analysis²⁴ that will be released at CONCORDi 2021 provide evidence that the world's top R&D investors are key contributors to global climate-related innovation. They are responsible for the vast majority of global climate change mitigation or adaptation patent applications and for a significant share of global climate-related trademarks. Thus, the report highlights the key role that top R&D investors can play in reaching climate neutrality objectives. However, the report also suggests that while large corporate R&D investors produce large amounts of climate-related innovation, other inventors – such as young firms – develop more radical innovations and are therefore more likely to generate the breakthrough discoveries needed to achieve net-zero emissions. Therefore, public policies have a critical role to play to ensure that the right incentives are in place to further enhance the necessary investments in low-carbon technologies among large R&D investors, but also to trigger more innovation among smaller companies, including SMEs and technology-based start-ups.

A discussion on these topics will take place on the second day of the CONCORDi 2021 conference, on the 23rd of November. On this occasion, the joint OECD-JRC report on “Innovating for climate neutrality: Large corporations, start-ups, and the broader industrial ecosystem” will be officially presented.

²³ This sub-chapter is largely based on the contribution received by Mr Antoine Dechezleprete and his colleagues from OECD.

²⁴ European Commission – JRC and OECD (2021) “World Corporate Top R&D investors: Paving the way to climate neutrality” JRC Technical Report (upcoming, November 2021).

4.4 UNIDO contribution to CONCORDi 2021: Sustainable industrial recovery through digital transformation and the greening of the economy²⁵

The COVID 19 pandemic has triggered the worst social and economic crises the world has experienced in decades. The dramatic loss of lives and negative impacts on livelihoods and incomes across the world threatens to jeopardize progress made to date towards achieving the goals of the 2030 Agenda for Sustainable Development. Both developed and developing countries struggle to recover from the crisis and set out along a new path of prosperity. Some key questions have emerged on the long-term effects of the pandemic, and on new challenges and opportunities likely to emerge for industrialization and industrial innovation in the future.

While the international community has largely focused on combatting the negative effects of this pandemic, there is scope also to identify new windows of opportunity for technological change, and for transitioning towards industrial models that enhance productivity and generate economic growth. Digitalization and economic greening stand out as promising strategies to serve this purpose. Both strategies require the accumulation of industrial capabilities, including the ability to innovate and adapt to new technologies, to avoid the risk of widening the development gap.

UNIDO has been at the forefront of global manufacturing recovery efforts, inter alia through its tailor-made COVID-19 Industrial Recovery Strategy for MSMEs; the deployment of advanced technologies to assist global recovery efforts; the provision of industrial policy advice, and contributions to global debates around industrialization and resilience, including through production of the forthcoming Industrial Development Report 2022: “The future of industrialization in a post-pandemic world”. Moving forward there is a unique window of opportunity to collectively reflect and draw lessons from the pandemic to build a better future for all, and to be better prepared for similar emergencies in the future. Industrial innovation will be fundamental to explore new sources of competitiveness and sustainability, while enhancing inclusion and resilience. By investing in the accumulation of production capabilities countries will be able to ready themselves to cope with and take advantage of new technologies that are green, circular, scalable and customizable. UNIDO encourages efforts to foster policy dialogues and knowledge sharing around pathways towards smooth digital and green economy transitions through developing country lenses.

The above key themes will be addressed during the UNIDO dedicated session at CONCORDi 2021, on the 24th of November.

More information can be found in CONCORDi 2021 dedicated webpage: <https://iri.jrc.ec.europa.eu/concordi-2021/programme>

²⁵ This sub-chapter is largely based on the contribution received by Mr Fernando Santiago and his colleagues from UNIDO.

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ANNEX

Annex A.1 Content of the scientific papers presented at the conference

The 30 papers accepted at CONCORDi 2021 will be presented and discussed in ten specific parallel sessions grouped in 3 main sessions (A, B and C). The following is a brief description of the papers to be presented in each of the parallel sessions.

Session A.1

Chair: Maria Savona (University of Sussex, GBR, and Luiss University, ITA)

Monday, 22/15h00 – 15h55

- » International Patent Protection and Trade: Transaction-Level Evidence
(D. Moschella, G. de Rassenfosse, M. Grazzi and G. Pellegrino)

This work provides evidence on the causal effect of patenting on exports at the firm level. As patent protection gives the right to exclude others from making, using, and selling the patented technology in the markets covered by the patent, markets in which a firm manages to secure patent protection become more attractive to the firm and, in all logic, it should export more to such markets. The authors leverage unique data on the international patenting activity of French firms at the product-country level. Results show that patent protection in a product-country destination increases total exports in that product-country destination by up to six percent. Furthermore, exporting firms export larger quantities in countries with patent protection, but they do not seem to charge higher prices.

- » Intangible assets, industry performance and finance during crises
(P. Bauer, C. Altomonte, A. M. Gilardi and C. Soriolo)

This study focuses on the development and the role of intangible investment during crises with a special attention to the financing of intangibles. The findings give insights into several aspects of intangible investment, like the general trend of adoption of intangible assets, differences in financing of intangible versus tangible assets, the impact of demand and financial shocks, and into the implications of crisis periods like the Global Financial Crisis (GFC) and the COVID-19 crisis.

- » Market Selection in Global Value Chains
(P. Mundt, U. Cantner, H. Inoue, I. Savin and S. Vannuccini)

The work explores the market selection in a competitive environment (selection hypothesis) extended to value chains. The complexity of value chains can make individual producer fitness less relevant compared to the fitness of the value chain the producer belongs to. Results show that the productivity of entire value chains is a more thorough performance indicator than idiosyncratic productivity when it comes to testing the market selection hypothesis, which carries additional information on the nexus between productivity and growth. This suggests that effective supply-chain management, e.g. careful selection of new suppliers or joint efforts with existing partners to improve productivity, has a crucial influence on the market success of individual producers.

Session A.II

Chair: Gaétan de Rassenfosse (École Polytechnique Fédérale de Lausanne, CHE)

Monday, 22/15h00 – 15h55

- » Developing governance capacity for transformative policy: Insights from a comparative case study (M. Janssen, I. Wanzenböck, L. Fünfschilling and D. Pontikakis)

This work provides a comparative study of twelve transformative policy initiatives (TPIs) currently implemented at the regional or national levels across Europe. The initiatives were selected based on their ambitions to achieve system-wide innovation. The authors in this way assess on what accounts the initiatives have a potential for bringing about transformations and provide insights on how and why transformative policy designs and organizational structures could emerge in practice. The results can inform the further uptake of transformative innovation policies.

- » Technology policy evaluation: The interaction between the financial constraint of firms and level of impact in term of financial additionality

(J. Heijs, D. Sancho and A. J. Guerrero)

Firms with less access to internal or external financial funds for R&D and innovation may be more dependent of public support. This study focusses on the financial and economic situation of the firm as determinant of both the participation probability and the differentiated effect of the public support for R&D and innovation (RDI) at the firm level (both subsidies and fiscal advantages). The authors draw some policy-relevant insights by showing that the more indebted firms have less access to the support programs though their financial additionality is above average. In other words, the public administration discriminates the firms with financial problems but the aid in such firms has higher positive impact.

- » Regional technological capabilities and the access to H2020 funds

(D. Archibugi, R. Evangelista and A. Vezzani)

The work explores the rationale behind the regional allocation of H2020 funds, focussing on the role played by the pre-existing technological capabilities of regions, along with other possible factors, in facilitating (or hampering) their participation to the EU S&T programme. Due to the lack of evidence on the impact of the H2020, the authors suggest that the evidence presented in their work will allow drawing some indications on the potential role that this policy scheme might play in the future (e.g. in its updated version, the Horizon Europe 2021-27) with respect to the target of building a cohesive S&T European system.

Session A.III

Chair: Pierre-Alex Balland (Utrecht University, NLD)

Monday, 22/16h05 – 17h00

- » The direction of technical change in AI and the trajectory effects of government funding

(M. Iori, A. Mina and A. Martinelli)

The authors analyse all artificial intelligence patents filed at the US Patent and Trademark Office and develop network measures that capture each patent's influence on all possible sequences of follow-on innovation. They make three core contributions: i) they provide novel and original evidence on the influence of government funding on the direction of technical change; ii) they contribute to the

development and application of a novel way to measure the effect of innovation on follow-on technological developments and iii) they contribute to the emergent literature on the economics of artificial intelligence by providing novel quantitative evidence of key financing patterns that have supported the development of these technologies over the last thirty years.

» Productivity and HGEs: resilience and potential recovery from Covid-19 pandemic

(S. Amaral, P. Bauer, A. Coad, C. Domnick, P. Harasztosi, R. Pal and M. Teruel Carrizosa)

This work explores the impact of the Covid-19 crisis on the short and long-term employment adjustments of global frontier and laggard firms. The authors first evaluate the differential impact of the Covid-19 pandemic on leader and laggard firms in the short and long-term and then show how the high-growth enterprises (HGEs), as a particular set of pre-pandemic successful firms (reflected in their fast growth), are affected and able to develop resiliency during the pandemic.

» Choosing Technologies: Benefits of investing into the Development of Fourth Industrial Revolution Technologies

(B. Peters and M. Trunschke)

Fourth Industrial Revolution (4IR) related technologies have been increasingly developed and incorporated in firms' organizational structures and production processes. This work investigates a firm's decision to invest in its own research and development of such technologies and estimates the long-term benefits of developing 4IR related and non-4IR related technologies and their development cost.

Session A.IV

Chair: Elena Huergo (Universidad Complutense Madrid, ESP)

Monday, 22/16h05 – 17h00

» Do the two make a pair? Digital and green transition in European regions and their impact on greenhouse gas emissions

(S. Bianchini, C. Ghisetti and G. Damioli)

At the beginning of 2020, the European Commission launched a new industrial strategy setting explicit directions for a globally competitive, climate-neutral and digitalised industry – i.e., a green and digital transition that soon became popular under the name of twin transition. This work aims to empirically understand whether digital and green technological transitions can be mutually compatible. The authors develop a unique original dataset on digital and green scientific (publications) and technological (patents) knowledge and air emissions of selected pollutants for the period 2000-2017 in the European Union (EU28), Norway and Switzerland at the metro-regions level. Results show that (i) The regional endowment of environmental technologies helps reducing (local) GHG emissions; (ii) The regional endowment of digital technologies has no significant effects on (local) GHG emissions and (iii) Some digital technologies (e.g. robotics and additive manufacturing) hampers the environment.

» Going green and failing: Evidence from propensity score matching on types of eco-innovation and project failure

(B. Becker and E. Kesidou)

The pursuit of eco-innovation strategies poses significant challenges for firms, as eco-innovations often lie outside the firm's core competencies and exhibit greater complexity and uncertainty than other innovations. Consequently, eco-innovation projects can potentially be abandoned more often than other innovation projects. This paper contributes to the literature by empirically testing the causal impact of firms' pursuit of eco-innovation strategies on the 'failure' or abandonment of innovation projects. The results suggest that, depending on the type of eco-innovation strategy, there are significant differences

in the abandonment of innovation projects by eco-innovators compared with other innovators. The policy implications include, first, that further environmental policies are needed to support eco-innovators focused on material efficiency. Second, the results ascribe a role to innovation policy in subsidising new eco-product innovation projects to alleviate the high uncertainty surrounding these projects.

- » International collaborations in green energy technologies: What is the role of distance in environmental policy stringency?

(N. Corrocher and M. L. Mancusi)

This work investigates the intensity of international collaborations in energy-related technologies across OECD and BRICS countries focusing on the role of the distance in the stringency of environmental policy between countries, thus extending the analysis of the role of more traditional measures of geographical, cultural, institutional and technological distance in affecting the existence of different forms of cross-country relationships. The results show that the distance in the stringency of environmental policy – particularly with reference to demand-pull policy instruments such as taxes, standards, and trading schemes – negatively affects the intensity of technological collaborations in energy-related technologies. Conversely, the distance in the stringency of supply-push measures of environmental policy stringency does not seem to play a relevant role.

Session B.1

Chair: Mariagrazia Squicciarini (UNESCO, FRA)

Tuesday, 23/15h00 – 15h55

- » For whom the bell tolls: the firm-level effects of automation on wage and gender inequality.

(G. Domini, M. Grazzi, D. Moschella, and T. Treibich)

This paper investigates the impact the current advent of new technologies belonging to the so-called 'Fourth Industrial Revolution', notably including robots and AI, on wage inequality and gender wage gap, using French data to run the empirical analysis.

- » Corporate Social Responsibility, Board Gender Diversity, and Firm Innovation.

(S. Sui and D. Ruth)

This paper studies the impact on firm innovation of both CSR and board gender diversity. The study expands CSR-Performance research by moving beyond financial performance, it uses the three components of ESG performance separately, and provides evidence that the CSR-Innovation relationship is contingent on Board Gender Diversity.

- » Gender diversity in R&D teams and firms' environmental innovation strategies.

(P. Vahter and B. Becker)

This study analyses the effect of gender diversity within R&D teams on firms' innovation, specifically the relationship between gender diversity in R&D teams on environmental innovation, finding a positive relationship between increase in share of women in a firm's R&D team and environmental innovation at these firms.

Session B.II

Chair: Andreas Pyka (University of Hohenheim, DEU)

Tuesday, 23/15h00 – 15h55

» Venture Capital Financing and Green Patenting.

(A. Bellucci, S. Fatiga, A. Georgakaki, G. Gucciardi, S. Letout and F. Pasimeni)

The paper uses a modelling-based quantitative analysis of the impacts of carbon pricing on industry's competitiveness together in-depth policy review of Dutch policies. The analysis is used to provide actionable policy recommendations to adjust existing instruments and to implement additional measures, in particular innovation incentives focused on some emerging technologies.

» Knowing brown and inventing green? Incremental and radical innovative activities in the automotive sector between persistency and transition.

(J. Mazzei, T. Rughi and M.E. Virgillito)

This paper focuses on the automotive industry to analyse patterns of complementarities among the existing knowledge at the firm level, identified by brown patents, and opportunity of innovation in both incremental and radical innovative trajectories in patents.

» A Patent Analysis of Digitalization in Climate Change-Related Technologies: Innovation, Corporate Strategies, and Policy Implications

(K. Chandra and M. Yarime)

This study analyses the extent of digitalization in climate change mitigation and adaptation technologies over the past years. It identifies the development trends of digitalization across different types of technology and provide empirical evidence on the types of organizations that are most likely to pioneer the creation of digitalized climate change-related technologies.

Session B.III

Chair: Martin Srholec (CERGE-EI, Prague, CZE)

Tuesday, 23/16h05 – 17h00

» On the road to a 'Competitive Sustainability': How can European funds support regions in the transition?

(A. Santos, D. Pontikakis, J. Barbero Jimenez)

To understand how European funding instruments have supported employment across different sectors in EU regions over the last years, the paper develops an indicator to measure structural change and carries an analysis to understand the determinants of such transitions. EU structural funds are found positively correlated with structural change, however, such relationship seems to be only significant in more developed regions.

» Impact of Climate Change Mitigation Technologies on Sustainable Development Transition

(A.Hajikhani, A. Suominen)

This paper aims to capture climate change mitigation technologies (CCMT) patents in accordance with a broader scope of global challenges formulated under UN SDGs. The research uses Natural Language Processing (NLP) techniques to compile a language model representing the SDG related textual artefacts. The model is then further applied on EPO patent documents and is able to detect the interrelation of distinct category of SDGs within patent's textual content, revealing the linkage between CCMT patents

and SDGs.

- » Policies for a climate-neutral industry: Lessons from the Netherlands
(A. Dechezlepret, G. Lalanne, L. Dressler, N. Gonne, E. Cammeraat, B. Anderson, J. Martins Guilhoto, K. Theodoropoulos)

The paper uses a modelling-based quantitative analysis of the impacts of carbon pricing on industry's competitiveness together in-depth policy review of Dutch policies. The analysis is used to provide actionable policy recommendations to adjust existing instruments and to implement additional measures, in particular innovation incentives focused on some emerging technologies.

Session B.IV

Chair: Bram Timmermans (Norwegian School of Economics, NOR)

Tuesday, 23/16h05 – 17h00

- » Do Consumers Shift from Private to Shared Ownership?
(F. Pasimeni, T. Ciarli)

This paper asks under what conditions consumers might shift from individual consumption and ownership of goods, which often are under-utilised, to a consumption model based on shared consumption and shared ownership. Using a model, it finds that, under most parameterisations, shared purchase is a very unlikely option: consumers prefer either to use the public to purchase their own individual good. Only a small customer niche opts for shared purchase.

- » Building an OECD infrastructure for timely monitoring business R&D investment
(F. Verger, F. Galindo-Rueda)

This work entails a monitoring exercise, with the manual inspection of quarterly, semi-annual and annual reports published by selected companies identified as large R&D investors. Company reports of R&D expense need not coincide with R&D expenditures as covered in official R&D statistics. The OECD analysis implements a series of adjustments aimed at enhancing comparability, whenever the necessary information is available. Results arising from this exercise have been published in the OECD Science, Technology and Innovation Outlook and in the OECD Main Science and Technology Indicators (MSTI) Highlights on R&D expenditure.

- » Collaborative ecosystems between research organizations and companies from web scraped data: a vantage point to proximity of collaboration
(A. Hajikhani, A. Suominen, L. Pukelis)

Measuring industrial ecosystems has relied on publications, patents, surveys, and qualitative studies. To add on the existing approaches, this study used web scraping to find collaborative networks between medium-high and high-technology companies in the European Union and the United Kingdom. The work demonstrates a methodological procedure for utilizing a novel data source in the form of textual content from companies' website to approximate collaboration.

Session C.I

Chair: Riccardo Savigliano (UNIDO, AUT)

Wednesday, 24/15h00 – 16h00

- » Exploring European oil majors' response to pressures for climate action

(L. Canal Vieira, M. Mura, M. Longo)

International Oil Companies (IOCs) are key to the process of transformation needed in the oil industry to facilitate the reduction in carbon emissions and avoid temperature increase. Some European IOCs have diversified their portfolios in the 2000s to include renewable energy and less carbon-intensive fuels. Recently, a growing number of European IOCs has also developed decarbonisation strategies to respond to climate policy pledges of net-zero emission by 2050. The work analyses the dynamics between external socio-political and economic pressures and the oil industry response from 2005 to 2019. Results from the study on the relationship between the external environment and European IOCs investments contributes to understanding the limitations of climate policy and how it can be advanced to encourage companies' transition from mineral oil successfully.

- » The potential of European Industry regarding Europe's Green Deal

(N. Malanowski, L. Potters, J. Steinbach, E. VandeVelde)

The paper provides theoretical as well as case-study based evidence for the potential of European industries to become carbon neutral and provide job security and growth in the EU. The study identifies, maps, and analyses Global Innovation Networks, between industry and other actors that make the European Green Deal a success. The study also presents the main current policy context in place in the EU, China and the U.S., and identifies the main drivers and barriers for investing in technologies relevant for Europe's Green Deal. In addition, a concise policy toolbox for Research & Development & Innovation (R&D&I) policies supporting technologies relevant for Europe's Green Deal is discussed.

- » Iberdrola Green Transformation

(C. De Inza Pujadas)

This study presents an analysis of the new business models in the utilities sector that are able to combine digital technologies and decarbonization for the implementation of an efficient green energy transition. The author(s) present the case of Iberdrola which has been able to pursue sustainable solutions by means of digital transformation and contextually to improve operational efficiency thanks to automation and digitization of businesses and processes. The case covers the Global Smart Grids Innovation Hub, a centre that responds to the challenges of the energy transition by combining the Iberdrola's technological capacity with that of collaborators: suppliers, universities, technology centres and startups.

Session C.II

Chair: Meryem Sghir (UNIDO, AUT)

Wednesday, 24/15h00 – 16h00

- » Countries' research priorities in relation to the Sustainable Development Goals

(T. Ciarli, H. Confraria, E. Noyons)

This paper investigates the misalignment between the investment in research areas and the socio-economic challenges. It finds that, while the vast majority of SDG challenges are worse in lower income countries, only a small fraction of SDG-related research takes place in those regions. This indicates that a

potential reason for misalignment is that lower income countries need to rely on research done elsewhere, which might be focused on areas that are not relevant in their context.

» Duration of universities as participants in the United Nations Global Compact programme

(M. Falk, E. Hagsten)

This study examines why some universities leave the UN Global compact programme. The Cox proportional hazard model is employed to determine the relevance of factors such as university size and quality, environmental performance indicators and quality of institutions. The econometric analysis shows that the risk of leaving the UN Global compact status depends significantly on environmental progress at the country level, regulatory quality of the government, size and quality of the university and the region where the university is located.

» Informal to Formal Industrial Co-Location and Structural Change in Ghana

(Bernardo Caldarola)

Using the case of Ghana, this paper explores the patterns of co-location of informal industries with formal ones. The empirical analysis carried out in the paper unveils that informal activities are diversified as well as unexpectedly more concentrated than formal activities. In exploring the drivers of informal-formal co-location across pairs of industries, the results highlight the positive effect of input-output relationships, indicating that - at least to some extent - informal and formal firms operate in sectors which are part of the same supply chain.

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