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Commission

JRC CONFERENCE AND WORKSHOP REPORT

Final review by external experts and workshop
results of the GLORIA 2020-21 project

Summary report

A. Tübke and E. Evgeniev

2022

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This Final review by external experts and workshop results of the GLORIA 2020-21 project has been published within the context of the Global Industrial Research & Innovation Analyses (GLORIA) project that is jointly carried out by the European Commission's Joint Research Centre —Directorate B, Innovation and Growth— and the Directorate General for Research and Innovation —Directorate E, Prosperity. GLORIA has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 101015509. The main expected impact of GLORIA is the better understanding of corporate Research & Development (R&D) efforts in relation to the green deal and sustainability objectives, starting from the top R&D investors in their global competitiveness perspective.

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Contact information

European Commission - Joint Research Centre
Directorate Growth and Innovation - Knowledge for Finance, Innovation & Growth Unit
Edificio Expo; c/ Inca Garcilaso, N° 3
E-41092 Seville (Spain)

Name: Alexander Tübke

Email: Alexander.Tuebke@ec.europa.eu

Any comments can be sent to: jrc-b7-iid@ec.europa.eu

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1 Abstract

The EU policy agenda highlights industrial innovation as key for competitive sustainability, together with the importance of monitoring and analysing innovation activity in Europe as a basis for research, innovation and industrial policy-making.

Since 2004, the Directorate-General Research and Innovation (DG-R&I) and the Joint Research Centre (JRC) jointly produce the EU Industrial R&D Investment Scoreboards as main deliverables of the GLORIA (GLObal Industrial Research & Innovation Analyses) projects. An annual survey of top EU-1000 R&D investors complements the findings. These are implemented by the JRC through an internal Commission contract (Administrative Arrangement) administered by DG Research & Innovation (R&I), in which the JRC is responsible for the evidence and DG-R&I for the policy side.

This report summarises key results from a hybrid workshop, held on 6 October 2022 in Brussels, which focused on the outcome of the peer review by a group of four external experts to the GLORIA project -Prof. Roberta Rabellotti (University of Pavia), Prof. Hanna Hottenrott (University of Munich), Prof. Gary Gereffi (Duke University) and Alex Nussem (European Industrial Research Management Association – EIRMA). Staff from Commission services and external experts participated in the workshop as well. They validated findings of the peer review and provided valuable comments and suggestions, which are highlighted in this document.

2 Background

The main expected impact of the GLORIA 2020-21 (GLObal Industrial Research & Innovation Analyses) project is the better understanding of corporate Research & Development (R&D) efforts in relation to the Green Deal and sustainability objectives, starting from the top R&D investors in their global competitiveness perspective. For this, the EU Industrial R&D Investment Scoreboards are developed to provide a meaningful tool regarding the directionality of corporate Research & Innovation (R&I), and systematically include additional indicators, triggering change of its use and change in industry, becoming complementary to the Sustainable Finance taxonomy. A key aspect here is to add relevant and more specific information regarding key sectors for the Green Deal policy priorities.

The Work Packages (WPs) of GLORIA 2020-21 project are:

WP1: Monitoring and analyses of R&I competitiveness via the top R&D investors;

WP2: Analyses on R&I issues for competitiveness and sustainability;

WP3: Piloting additional tools for R&I towards competitiveness and sustainability;

WP4: Dissemination, discussion and validation of results;

WP5: Management, coordination and quality.

The work plan of the project capitalises on the experience with its predecessors. The Scoreboard produced in WP1 is the only tool for assessing the industrial dynamics of large global innovators worldwide and better understanding their behaviour to harness globalisation. High potential impact stems from the Scoreboard as the core of this project to provide information and analysis on the basis of up-to-date data on main global corporate 2500 R&D investors, collected on an annual basis. Much more than being sizeable direct employers, producers and innovators, the main corporate R&D investors have a huge indirect market and innovation power. They control global value chains, help smaller firms grow and internationalise, participate as shareholders in start-ups, provide work experience for future entrepreneurs, spin-off technologies, and collaborate with universities and research institutions for research and transfer of knowledge, among other. While the analyses of corporate accounts in the Scoreboard is backward looking, the Survey of the EU-1000 Scoreboard companies in WP1 allows a forward-looking dimension and flexibility to address policy-relevant topics to these large players.

WP2 contains additional analyses incorporating the R&I and sustainability dimensions, based on a jointly defined and agreed upon, together with DG R&I, science-to-policy agenda to prioritise topics. Beyond inclusion of additional Scoreboard indicators, Sustainable Development Goals (SDGs) and sustainability-related topics, Environmental Social and Governance (ESG) criteria, R&I competitiveness and employment are candidates to be further tackled.

WP3 pilots additional tools expanding the Commission capacities regarding monitoring R&I for competitive sustainability: a Sustainable Technology Product Space and a Survey tool to monitor R&I for sustainability and competitiveness in companies.

WP4 is dedicated to dissemination, stakeholder involvement and communication, identifying key events, organising GLORIA project workshops and digital communication.

WP5 describes management and coordination, processes for (expert) subcontracting, quality control, reporting and the final review.

3 Review Process and Panel

A peer review by a group of experts external to the project takes place every two years. This review focuses on the period going from 2020 to the summer of 2022 (due to administrative overlap with the successor project).

The panel consists of the following reviewers (see Annex for more info):

- **Prof. Roberta Rabelotti**, University of Pavia (IT), coordinator and reviewer to cover green R&D, green patents, and environmental firm upgrading.
- **Prof. Gary Gereffi**, Duke University (US), reviewer to cover global value chains, global competitiveness, financing of R&D and firm dynamics in specific sectors where R&D is strong.
- **Prof. Hanna Hottenrott**, Technical University Munich (DE), reviewer to cover industrial R&D & Innovation, monitoring of private R&D, and technology policies.
- **Mr. Alex Nussem**, Secretary General, EU Industrial Research Management Association - EIRMA (BE), reviewer to cover the industry view.

The review panel centred on main science-to-policy lessons for the future. This comprised suggestions based on each reviewers' main expertise, including further strengthening the Green Deal and Industrial Innovation Policy topics in the outputs, further areas to increase contextualisation and possible actionable policy messages.

A virtual kick-off meeting between the Commission and the review panel was held on 26 July 2022, after which the expert group reviewed the outputs of the GLORIA 2020-21 project, and each member of the panel prepared a draft review report. The review panel has met virtually twice to agree on the division of labor and discuss the structure and the focus of the individual reviews.

The individual reports were discussed at a hybrid workshop on 6 October 2022, in Brussels, with 35 participants in total. A final report was elaborated accounting for the comments received during the workshop. The main results are summarised below.

4 Summary of the review findings

4.1 Main strengths of the GLORIA project

GLORIA offers a comprehensive global benchmarking of R&D investments by the top 2500 industrial companies and it documents the developments over time since 2004, based on detailed analyses of R&D expenditures and patenting activities.

The project offers macro-level and structural explanations for the major gaps in R&D investments across selected sectors and countries/regions. A key overall finding that emerges from the Scoreboard reports, the Surveys, and other related materials, is **a persistent gap in R&D investments and innovation capacity in the EU vs. the US and its top Asian competitors, especially China.**

Overall, GLORIA delivers useful, quantitative, qualitative, and longitudinally continuous empirical evidence to globally benchmark the EU R&D industrial investment capacity and innovation outputs. Its flagship publication – the Scoreboard – has good visibility and is based on a reliable methodology of data collection and analysis. Data are publicly available to researchers and practitioners, used in scientific articles, and published in well recognized journals. The database also represents an opportunity for collaborations with other institutions, such as the Organisation for Economic Cooperation and Development (OECD) the European Investment Bank (EIB), the World Bank, among other.

The panel agrees on the **good quality of the research outputs and recognizes the substantial value of the project.** It also acknowledges the significant improvements introduced in the project outputs in the most recent cycle, including design and readability, incorporating some of the recommendations from the previous external review.

Although continuing with the established indicator set is very desirable for tracking R&D developments over time, several improvements as well as additional, complementary areas of research are identified. The scope of the review suggests how GLORIA can offer a more comprehensive and updated understanding, useful for all the different target audiences -- academia and research institutions, policymakers, companies, and investors -- of the technology and innovation gaps between the EU and its major global competitors.

4.2. Recommendations to streamline GLORIA's research agenda and policy impact

The main aspects of the existing empirical analysis in the GLORIA project which could be improved are discussed below.

Longitudinal analysis

This is a clear asset of the project, which provides a longitudinal assessment of the R&D investments of the top 2500 global industrial firms in terms of R&D growth, net sales growth, and profitability since 2004. Therefore, as indicated above, continuing with the established indicator set is very desirable for the purpose of tracking developments over time. A useful addition would be the introduction of a periodization scheme to account for the impact of key disruptions like the Brexit, the COVID-19 pandemic, the Ukraine conflict, the energy crisis, and the onset of Industry 4.0. The analysis of recent disruptive events could address how they might affect global R&D and whether crises have different impacts depending on the country or sector.

Territorial analysis

The current empirical analysis in the GLORIA project is limited by its **much aggregated spatial perspective**. Most of the GLORIA outputs, including the Scoreboards, adopt an aggregated approach at the EU or country levels, which, given the focus on the leading R&D investors, implies that the analysis is limited to a minority of EU countries. Thus, a large part of the EU (i.e., all the Central and Eastern European Member States) is not directly accounted for.

Because GLORIA aggregates its results to the EU level, its policy recommendations tend to be overly broad and abstract, and the lessons from best-case country experiences within the EU are glossed over. National economies vary significantly in size, sectoral composition, and institutional features such as education, labor markets, and innovation systems, and these characteristics shape both economic performance and policy.

The introduction of a more **disaggregated territorial analysis** within the EU with increased attention to thriving regions and clusters and including some comparative case studies about leading regions and innovative hubs in the EU, the US and China would be a useful direction in the GLORIA project. In this regard, EIRMA also suggests extending the

analysis beyond the EU, including the UK and other European countries, such as Switzerland. The objective of the analysis should not be the EU as a political entity but rather Europe as an integrated innovation area.

Sectoral analysis

Both the EU Scoreboard and Survey results are presented for broad industrial sectors, with little attention given to divergent strategies among leading multinational enterprises (MNEs) and lower-tier suppliers within key global industries. **Technologies and industries differ in complexity and opportunities.** R&D-intensive sectors, like ICT hardware and services, pharmaceuticals, and aerospace, have very different growth dynamics and innovation paths than medium-tech sectors, like automotive, chemicals, energy, and construction, where the EU opportunities in green and sustainable development are greatest.

Adding highly R&D-intensive industries, such as the aerospace, the agri-food and the new materials, could be useful. According to EIRMA, the defense industry is also a driver in the tech race among China, Russia, and the US, while the EU currently seems unable to play a key role.

In the GLORIA 20-21 project, special attention is devoted to **green (i.e., environmentally sustainable) industry**. Green innovation is investigated in several GLORIA outputs, using a rather disaggregated sectoral approach. The 2021 Scoreboard provides a detailed analysis of green patenting in energy-intensive industries with some interesting findings about EU regions characterized by a high concentration of green patents in sectors, such as cement or ceramics. A more thorough analysis of these **green innovative hubs** could be worthwhile, investigating the main R&D players, their local and external knowledge connections, and the regional technological specialization.

A crucial dimension in green innovation that is overlooked in the GLORIA project and certainly requires more attention is the role of **policy**. The core green technologies are public goods, meaning that their direct benefits are non-excludable. The level of public policy interventions, regulations, and public financing in green sectors far exceeds those typical of other industries. Research on the innovative performance in green industries cannot leave aside the role played by policy, and more granular and systematic attention to the different policy measures adopted would be a useful addition to the GLORIA project.

R&D measures

The adoption of *patents and R&D expenditures* as the main indicators of innovation activity and performance has long been a challenge in economic research. The limitations of relying on R&D investments and patents are well acknowledged in the Scoreboards. Patents can be used solely to impede innovation by competitors, many innovation outputs are not patentable, and patent innovation propensity differs considerably by sector and country. Furthermore, caution is needed to compare domestic patent applications from different patent systems, particularly with China.

Regarding R&D investments, it would be insightful not only to focus on growth in absolute terms but also to consider relative growth with respect to firm size (R&D per employee, for instance) or market size. It seems also worthwhile to explore alternative measures for innovation that are more output related. Low(er) investments in Europe could also reflect higher R&D efficiency of the companies and higher spending is not necessarily more desirable. Since wages are a large fraction of R&D expenditures, higher spending could reflect higher wages for R&D employees. For instance, extremely high salaries (relative to European standards) in California and Massachusetts likely affect US R&D investments.

Examining R&D performance is highly valuable and it addresses key questions such as: Are R&D-intensive companies more robust (in terms of performance) to crises? Are there sector differences? What are the employment dynamics in these companies? Are increases in R&D expenditures mainly related to higher wages? It is also important to investigate the impact of R&D expenditures in terms of their economic and social outcomes: Are green R&D investments leading to positive biophysical outputs (i.e., decrease in CO₂ emissions, less toxic inputs, reduced biodiversity loss)? Are more R&D investments in the pharmaceutical industry improving population's health?

EU R&D Surveys

Qualitative evidence complementing the Scoreboard information is worthwhile because it addresses important issues, such as R&D collaboration between companies and other

public/private institutions and the location of R&D. Nevertheless, the surveys have an extremely low response rate (around 11%), which makes it hard to interpret their findings.¹

The low response rate could be due to the overlap with the CIS and the OECD R&D surveys. Most topics are also covered in these other two major company surveys. Therefore, coordination of the EU R&D survey effort with other large-scale company surveys is recommended to reduce redundancies and the burden on companies in filling out very similar questionnaires.

Companies may not want to engage with yet another survey that captures very similar information. The cost/benefit ratio of the surveys is therefore somewhat questionable. The question is whether better participation can be encouraged or not. If not, it will be hard to use the collected data, and resources may be better devoted to introducing new research areas and/or a deeper analysis of non-survey data and additional data sources (company websites, social media accounts, press releases, data on R&D joint ventures, financial transactions).

¹ During the workshop meeting on October 6, 2022, in Brussels, it was noted that in the most recent survey the response rate has increased. It was also proposed that the survey could possibly be reduced to a biennial frequency.

4.3. Recommendations to improve the existing analysis

The existing analysis could be broadened in two main directions: 1) overcoming the predominant focus on the top R&D spenders by incorporating Global Value Chain (GVC) analysis in the Scoreboard, Small-and-Medium-sized Enterprises (SMEs), startups, Multinational Enterprises (MNEs) subsidiaries and external R&D collaborations; and 2) reconsidering R&D investments and patents as the main measures for input and output of the innovation process.

Broadening the analysis beyond top R&D spenders

The top R&D spenders, which are the focus of the Scoreboards and the main actors investigated in the GLORIA project, play a key role, widely and excellently investigated in several of the project outputs. Other actors beyond R&D spenders are also included in the project, namely startups and subsidiaries, but their contributions in terms of innovative performance and participation in the EU innovation system is not systematically accounted for.

The predominant focus on **R&D investments of global industrial firms** is too narrow to explain the causes and identify the policy implications to reduce or close the R&D gap between the EU and its main global competitors. While R&D investments of global industrial firms play a key role in technology catch-up for some innovative intensive sectors, this is an unduly narrow focus for investigating EU competitiveness. The reviews (in the Annex) identify several fundamental novel research areas, which will allow the GLORIA project to account for the main actors contributing to the EU innovative capacity. In what follows, the main research areas are introduced. They could usefully complement the existing focus on top R&D investors of the GLORIA project.

Global Value Chains

The Global Value Chain (GVC) framework is largely absent from the GLORIA project and its main outputs. The major contributions of GVC analysis—connecting the diverse governance structures of global industries to country-level and firm-level analysis of economic performance, and linking this to economic, social, and environmental upgrading—are relatively weak in GLORIA. The introduction of GVC analysis will offer both theoretical and empirical gains in documenting how innovation trajectories for firms are grounded in specific industrial upgrading experiences of countries.

An example about why the GVC perspective is helpful to account for differences in industrial and innovation dynamics is provided by the digital and the green transitions, which are twin priorities in the GLORIA project and central research topics in the GVC field as well. From a GVC perspective, the governance structures associated with digital and green industries are quite varied, and thus so are the policy and managerial implications to sustain and facilitate such transitions.

In its landmark report on the digital economy, UNCTAD (2017)² showcases not only the pervasiveness of the digital transformation across virtually all industries and global regions, but it also stresses that digital and high-tech MNEs have fundamentally different international footprints. These trends have pushed international production in multiple and sometimes conflicting directions, as documented in multiple GVC studies. Since the GLORIA Scoreboard does not distinguish types of MNEs among its 2500 top R&D investors and does not account for the innovation contribution of first vs. lower-tier suppliers, policy recommendations and managerial advice for its EU audience are diluted.

Startups and subsidiaries

Understanding competitiveness from a supply-chain perspective involves not only large MNEs at the top of global industries, but also the role of their subsidiaries and of the SMEs at the bottom. A GLORIA Policy Brief on GVCs and innovation networks in the Fourth Industrial era notes that the European economy is highly dependent on SMEs in the manufacturing sectors in which it specializes and asks how SMEs might be affected by Industry 4.0 technologies that are narrowing the cost differential between offshoring and reshoring production (Müller et al., 2021)³.

Other actors beyond R&D spenders are also investigated in the project, namely **startups and subsidiaries**. Yet, their role in innovative performance and contribution to the EU innovation system is not systematically accounted for.

² UNCTAD. (2017). World Investment Report 2017 – Investment and the Digital Economy. Geneva: UNCTAD.

³ Müller, J., Potters, L., Rentocchini, F., & Tübke, A. (2021). "Global corporate value chains and innovation networks in the fourth industrial era: new models of production and work organisation." *Industrial R&I – JRC Policy Insights – May*.

Concerning *startups*, Corporate Venture Capital (CVC) has been investigated in the 2021 Scoreboard, which finds that EU top R&D spenders invest more in startups located in the US than in Europe. A more disaggregated empirical investigation about the characteristics and the location of these startups within the EU would help to map and identify the most favorable conditions for the creation of new ventures, what are the barriers they face, and what could be done to attract more of them in the EU. With a focus on green industry, one could explore the technological specialization of the startups acquired by the top R&D spenders, compared with their own technological specialization.

Concerning the *subsidiaries*, their innovative contribution could be investigated more thoroughly within the project. In particular, there is a recent literature⁴ investigating the role played by green Foreign Direct Investments (FDI) to promote sustainability-related innovation, which highlights the role that subsidiaries can play as agents of structural change in the green technological domain. Empirical analysis of the subsidiaries of the home and host top R&D investors located in the EU could provide an additional perspective on the green EU industrial system and its innovative performance.

External R&D collaborations

While intramural R&D expenditures are an important driver of innovation, **industrial R&D also takes place in collaboration with external partners**. For instance, innovation capability may be acquired through shares in other companies (mergers & acquisitions). If such activities replace internal R&D spending, this could underestimate actual R&D efforts.

To account for external R&D efforts, GLORIA could expand beyond its current scope by capturing collaborative R&D more explicitly via information on **R&D alliances, joint ventures, and acquisitions** and tracking **networks between companies beyond co-patenting and patent citations**. While co-patenting is certainly important, it only captures specific technologies. In addition to the traditional measures for mapping knowledge spillovers, networks of companies could be traced, based on novel approaches

⁴ See for instance Amendolagine, V., Lema, R., & Rabellotti, R. (2021). Green foreign direct investments and the deepening of capabilities for sustainable innovation in multinationals: Insights from renewable energy. *Journal of Cleaner Production*, 310, 127381.

that make use of links on websites or news about collaborations in press releases and social media (see below).

Going beyond R&D expenditures and patents

The adoption of **R&D expenditures** and **patents** as the main indicators of inputs and outputs of innovation activity has long been a challenge in economic research. In several GLORIA project outputs, other indicators usefully complement patents, such as trademarks and publications. Nonetheless, new approaches could help identify and **measure innovation based on the availability of big data sources on firms**, including websites and social media, as well as other digital sources such as media reports, job offerings, and online platforms. These complementary indicators can capture innovative activities beyond patenting and are useful for tracking R&D networks and external collaborations. The advantage of big data for measuring innovation in firms is **more timely innovation indicators** (key for providing useful information to the private sector) **for all industries and size classes**, at a **high disaggregated spatial level**.

4.4. Recommendations on impact and communication

GLORIA outputs could be substantially improved in two areas: **policy and managerial implications**. Regarding policy, most of the documents, including the Scoreboards, are missing a clear and compelling policy section. Managerial implications are totally missing, and if included in the outputs of the project, they could generate more interest by the business sector.

The private sector would value the introduction of qualitative **case studies**, including new companies entering the list of the top R&D performers, target companies acquired by top R&D investors, and GVC analyses. Company case studies, describing what successful firms are doing and what innovation strategies are pursued, would provide interesting managerial implications and increase the relevance of the reports to industry practitioners and financial analysts. Besides, company case studies could be complemented by the analysis of their value chain, also focusing on top and lower-tier suppliers.

Clear and concise language would make the **Scoreboards** more accessible, and their findings could be more effectively conveyed to a non-academic audience. The introduction of clear, applicable recommendations in each report will be welcomed by industry.

While the visibility of the Scoreboards is good, the remaining outputs of the projects – technical reports, scientific articles – have less visibility, or as with scientific articles, they mainly target an academic audience. The reports and the other complementary outputs of the GLORIA project can provide background evidence for the Scoreboard reports and their findings could be presented in thematic chapters or boxes.

The response rates for the **Surveys** (if continued) could potentially be increased by directly communicating the results to participating companies. Firms' managers are motivated to participate in the survey only if they find value in its findings, which need to be communicated in a clear, accessible, and effective manner.

5 Main points raised during the final review workshop

The topics of Open Strategic Autonomy, technological vulnerabilities, transformation (e.g. uptake of Industry 4.0 or twin transition) and disruptions (from the energy crisis, COVID-19 pandemic, Brexit, great financial crisis) will determine the need for science-to-policy evidence in the medium to longer term for the GLORIA project.

The workshop participants acknowledged the good project quality and visible improvements compared to the previous review, conducted in 2020. For example, the 2021 EU Industrial R&D Investment Scoreboard has a format that could be presented by a CTO to the CEO. The project collaboration with the OECD and the open nature of the data (with its subsequent use in the scientific community) were praised.

The discussions on recommendations within existing work centred on the following proposals for short-term improvement:

- longitudinal analysis looking at relevant shocks;
- disaggregated territorial analysis;
- disaggregated sectoral analysis;
- introduction of new industries and characterisations.

Recommendations on expanding the project scope in the medium to long-term centred on:

- deeper characterisation of the actors, e.g. firm-level business models;
- how to integrate the GVC perspective/narrative;
- how to address startups and subsidiaries;
- the importance of M&A, alliances and R&D collaboration, eventually extended by tech transfer (uni-to-industry; ind-to-ind);
- potential of shifting from quantitative to qualitative measures (e.g. R&D efficiency or intensity measures);
- potential of network analysis and mappings (at least from the regional level upwards);

- the importance of R&D productivity analysis (where there is past stock in the project);
- importance of understanding the balance of Open Strategic Autonomy vs. EU Single Market access and optimisation;
- need to incorporate novel measures of innovation, based on big data sources, social media, LinkedIn, or webscraping;
- need to improve policy and managerial implications, add illustrative case studies, and explore tools to facilitate quick reading (possible two-pagers on Scoreboard/Survey results).

Annex 1: Final Review Workshop Agenda

FINAL REVIEW WORKSHOP OF THE GLORIA 2020-21 PROJECT

6 October 2022

European Commission - DG RTD - Square Frère-Orban 8, 1000 Bruxelles

ROOM ORBN 05/A066 + virtual

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| 14:30 – 14:45 | Welcome (DG-R&I and the JRC): Overview of GLORIA project (key science-to-policy messages) and objectives of the meeting (DG R&I, E1 and JRC.B7) |
| 14:45 – 15:00 | General introduction by the review coordinator |
| 15:00 – 15:40 | Review and discussion of GLORIA activities – presentations by Roberta Rabellotti and Hanna Hottenrott |
| 15:40 – 16:00 | Round table discussion |
| 16:00 – 16:30 | Coffee Break |
| 16:30 – 17:10 | Review and discussion of GLORIA activities – presentations by Gary Gereffi and Alex Nussem |
| 17:10 – 17:30 | Round table discussion |
| 17:30 - 17:45 | Conclusions (DG R&I and the JRC) |

Annex 2: Bios of the Review Panel Members

Roberta Rbellotti (reviewer and team coordinator) is Professor of Economics at the Department of Political and Social Science, University of Pavia (Italy). Rbellotti is an economist with experience in the field of economics of innovation, economic development, and regional economics.

She has widely published in international outlets on issues related with innovation with a special focus on developing countries, China, and Asia. Throughout her career, Roberta participated in and led several research and consultancy projects. She has provided academic advice to, amongst others, the European Commission, the IADB, OECD, UNIDO, UN-CEPAL, UNCTAD, and various national and regional governments. She has been expert evaluator for many institutions such as The Italian Ministry of Research and University, VICI NL, Honk Kong National Research Council, KU Leuven, South Africa National Research Foundation, US National Science Foundation, Swiss National Science Foundation, Copenhagen Business School.

Hanna Hottenrott (reviewer) is Professor for Economics of Innovation at the Department of Economics & Policy (School of Management) of the Technical University Munich (Germany) and a Senior Research Associate at the Leibniz-Centre for European Economic Research (ZEW). She is also a core member of the Munich Data Science Institute. Hottenrott is an economist with experience in the field of innovation economics & policy, the economics of science, and industrial organization.

Her research deals with the evaluation and design of innovation and science policy instruments. She has published in international outlets on issues related to innovation with a special focus on small and medium-sized companies as well as young, innovative companies. She has been an expert evaluator for the German Ministry of Education and Research and for several national science foundations in Europe (e.g., DFG, SNF, FNR, FWO, NOW, ECF). She is a member of the scientific advisory board of the NHH Innovation School and the Leibniz Center for Science and Society.

Gary Gereffi (reviewer) is Emeritus Professor of Sociology and Founding Director of the Global Value Chains Center at Duke University (<https://gvcc.duke.edu/>). Gereffi has published over a dozen books and numerous articles on globalization, global supply chains, and economic, social, and environmental upgrading, and he is an originator of the Global Value Chains (GVC) framework. Recent books include: [*China's New Development Strategies: Upgrading from Above and from Below in Global Value Chains*](#) (G. Gereffi, P. Bamber, and K. Fernandez-Stark, eds.), Palgrave Macmillan, Sept. 2022; [*Handbook on Global Value Chains*](#) (S. Ponte, G. Gereffi, and G. Raj-Reichert, eds.), Edward Elgar Publishing, 2019; [*Global Value Chains and Development: Redefining the Contours of 21st Century Capitalism*](#) (G. Gereffi), Cambridge University Press, 2018; and [*Global Value Chains in a Postcrisis World: A Development Perspective*](#) (O. Cattaneo, G. Gereffi, and C. Staritz, eds.), The World Bank, 2010. Professor Gereffi was invited to testify at the U.S. Senate Commerce Committee hearings on [*“Implementing Supply Chain Resiliency”*](#) in Washington, DC on July 15, 2021. Gary also was an academic facilitator and commentator for the [*2022 Supply Chain Ministerial*](#) hosted by U.S. Secretary of State Anthony Blinken and Secretary of Commerce Gina Raimondo with 17 partner economies and the European Union on July 19-20, 2022.

Alexandre Nussem (reviewer) is Secretary General of the European Industrial Research Management Association (EIRMA). He obtained an MBA from VUB Solvay Business School – (Belgium) and has over 20 years of experience developing and managing innovating technology driven companies/ organizations towards international markets. Alex served as Intl' Director of Sales for INX Digital/International (Chemistry Industry), introducing the first market BIO solvent inks, VP Business Development at CMA (the successor of ILFORD Imaging Switzerland), He served as Technology Attaché Diplomat in Germany and Managed the International Technical Training center of HP (Indigo division) in the Netherlands. Among other technology business projects, Alex also established the initial supply in Europe of HQ Visual Display Media from China and officiated a shared economy mobile phone application start-up in the IT/Communication sector.

Annex 3: List of main project outputs

| Document hyperlink | Title | Authors |
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