European Commission

Concept Note[1] and Agenda 2nd GLORIA Workshop on:

Global corporate value chains and innovation networks in the fourth industrial era: new models of production and work organisation

Brussels, 17 May 2019
University Club Foundation, meeting room Félicien Cattier, Rue d'Egmont 11

1. BACKGROUND AND RATIONALE

The emergence and development of new advanced technologies and materials have spurred **tremendous changes in corporate strategic approaches and the organisational models underlying the production, innovation and work systems** (Smit *et al* 2016; Ulmann, *et al* 2017; Porter & Heppelman 2014). Although still many years away, the full integration of these new technologies and materials and the multiplication of their applications - *Internet of Things, big data and cloud computing, robotics, artificial-intelligence based systems and additive manufacturing, smart factory, precision farming, fintech, microengineering, predictive medicine, synthetic biology, etc..* – are already bringing many opportunities and challenges for organisations and people through further digitalization, automation, connectivity and data intelligence possibilities. At the EU policy level, Key Enabling Technologies (KETs) and advanced manufacturing have for long been considered as important drivers for the modernization and the development of new industries, also in tackling broader societal challenges in areas related for instance to energy, environment and resource scarcity.[2]

Referred to as the **fourth industrial revolution (I4.0)**, these new changes have come with increasingly geographically distributed production and innovation resources, reflecting novel dynamics into global value chains (GVCs) and innovation networks (GINs) (e.g. Gereffi 2018; Cano-Kollmann et al 2018; Ramirez 2018; OECD 2016; Liu et al 2013). New products and innovations are increasingly resulting from fragmented GVCs and dispersed GINs. The integration of I4.0-enabling technologies provides multiple possibilities for firms, such as the optimization of production and supply chains management, the reorganization of

[1] Contribution by Mafini DOSSO, European Commission, Joint Research Centre, Seville, Spain

[2] See the Europe 2020 Strategy and the different EC communications in order to have an overview of the EC's framework for industrialisation, innovation and digitalization (see for instance, EC, 2009; EC, 2010a,2010b; EC, 2010c, EC, 2010d, 2012, 2014, 2015, 2016, 2017a, 2017b).
"A Stronger European Industry for Growth and Economic Recovery" (EC COM, 2012) lists six fast-growing initial priority areas including, *Markets for advanced manufacturing technologies for clean production; Markets for key enabling technologies (micro- and nano-electronics, advanced materials; industrial biotechnology; photonics; nanotechnology and advanced manufacturing systems); Bio-based product markets; Sustainable industrial policy, construction and raw materials; Clean vehicles and vessels; Smart grids* (EC, 2012).

suppliers relations, the reduction of failures and the increase in manufacturing efficiency, the improvement of traceability, transparency and customer-centric and customizable products or the introduction of new work management systems, just to name a few. Given the increasing intensity of competition, the reduction of products and technologies life cycles and the potentially huge gains expected from first mover advantages, firms are incentivized or pushed to redefine or innovate in their business models (see the box of definitions). **The transition to the fourth industrial era affects the way firms create value** (performance of tasks internally, relations with suppliers and other business partners), **how they capture value** (monetization of the offers) and **how they offer value** (for instance, servitization or more integrated or bundled products and services) (e.g. Müller et al 2018a).

Importantly, the emergence of new geographies of production and innovation have come with a gradual shift from trade in goods to **trade in activities**[3] performed through global and local networks of places, organisations and people (e.g. Gereffi 2018; Cano-Kollmann et al 2018; Ramirez 2018). At the same time, increasing value is generated from **more knowledge-intensive intangibles** arising from specialized knowledge-based activities, which are also subject to outsourcing and offshoring to research centres/universities, Contract Research Organisations (CROs) and to suppliers, from both developed and emerging economies (see the policy briefs by Dosso et al 2019, 2017).

The rapid changes in GVCs and GINs configurations enabled by the application of I4.0 technologies have also important implications for the new models of work organisation and workplaces management. So far, most of the debate has focused on phenomena of **polarization and skill-biased technological change**. In a nutshell, greater automation and digitalization are expected to displace low-skilled jobs but to increase the demand for high-skilled jobs (software and data experts, engineering, etc;), leading to a simultaneous increase of employment in both the highest and lowest occupational levels and a decrease in middle-skilled occupations. Skill-biased technical change refers to shifts in technology of production that favor skilled labour over unskilled labour (see for instance Okazawa 2013 for a discussion of the effects of technological change on labour market and wage inequalities).

However, on the one hand, we need more industrial and firm-level insights in order to better characterize and anticipate[4] the implications of the new paradigm on the new world of employment – **Workforce 4.0.** –, for instance, in terms of conditions and capabilities, qualifications, skills needs, technical aptitudes or awareness. Indeed pressures at both organizational and plant levels can entail complex unbalances between control, liability, flexibility, autonomy and empowerment, and concerns from the greater human-machine interactions allowed by the diffusion of advanced technologies (e.g. Craglia et al., 2018; Cirillo et al., 2018; UN DESA/DPAD, 2017). The patterns of these unbalances may differ

[3] Also referred to as fine-grained GVC activities (e.g. Gereffi and Sturgeon 2013) that should underline the development of GVC-oriented industrial policies.

[4] See the notion of anticipatory regulation (NESTA 2017).

much across industries and types of occupations (e.g. Brynjolfsson et al., 2018; Frey and Osborne, 2017). Besides I4.0-enabling technologies and processes also bring up many legal and accountability concerns and would certainly require the setting up of completely new forms of working and social contracts, which should account better for the socio-political aspects of digitalization (Burh and Stehnken, 2018). On the other hand, **I4.0 can also bring many benefits to employees** through enhanced human learning through intelligent assistance systems as well as human machine interfaces that lead to increased employee satisfaction in industrial workplaces (Müller et al 2018b).

Relatedly, the benefits, opportunities and challenges of I4.0 are not only technical and economic. Indeed, a key societal and policy concern is to ensure that the transition towards I4.0 and the adoption of new production, innovation and work models **are sustainable[5] from the – economic, social and environmental – perspectives** (European Commission 2019; UN 2015). EU, the Member States and regions are also expected to contribute to transform the industrial behaviours in order to *"Ensure Sustainable Consumption and Production patterns"* (Sustainable Development Goals 12 of the 2030 UN Agenda) and thereby contribute to the creation of sustainable economic value, social value and environmental value.

2. OBJECTIVES AND SCIENCE-TO-POLICY QUESTIONS

As in previous workshops, this one should be introduced by a keynote speaker and then developed along the lines presented below.

Keynote speech – Global corporate value chains and innovation networks in the fourth industrial era: new models of production and work organisation

Prof. Dr. Julian Müller, Salzburg University of Applied Sciences

Prof. (FH) Dr. Julian M. Müller has been working extensively on the implementation of Industry 4.0 using survey data and models with a focus on the sustainability aspect, developing this research line previously at the University of Nürnberg, Germany. He has received the Young Researcher Award of the Erich-Gutenberg-Arbeitsgemeinschaft Köln e.V (2018) and the Alex Gofman Award (Best Student Paper) of International Society for Professional Innovation Management (ISPIM) in 2017. His line of research is relatively young and highly relevant to offereing a fresh and applied starting point for this Gloria Workshop, while taking into account the wider policy issues.

[5] See also the Box of Definitions

Questions to be tackled at the workshop via short presentation and discussions:

- What are the main **Industry 4.0/Workforce 4.0 (I4.0)** issues and trends? (*Workforce 4.0 can refer, for instance, to the new (mix) of skills or aptitudes, of capabilities and the related emerging organisation of work within and across firms, that are driven or triggered by the adoption and diffusion of Industry 4.0 technologies and their applications*)
- What are the implications of I4.0 for the current and future **glocal – *global + local* – value chains** (GVCs) and for the development of **Innovation Networks at the local and global levels** *(organisation of production, innovation processes and organisation of work)*?
- Are there new **Ownership, Location and Internationalization advantages** in the I4.0 context? Can these serve as an **incentive for re-investing/re-shoring**?
- How can policy better account for the **heterogeneous needs and weaknesses of regions and firms** with respect to I4.0 (infrastructure, skills, information, awareness and readiness, etc.)?

The day will be concluded by a **policy round table** where policymakers, experts from research and high education and industry representatives will discuss the policy relevance of the evidence presented and ideas on how to bring forward the research agenda to support policy-making in adressing these new realities. We propose that a representative from DG RTD A.4 closes the workshop with some concluding remarks.

This second GLORIA workshop is part of the Global Research & Innovation Analyses (GLORIA) project undertaken jointly between the Commission's Joint Research Centre and DG-RTD, where, nine previous workshops have been held. [6] The objective of these workshops is to obtain feed-back from policy-makers, industry representatives and experts about how the GLORIA activities are best serving their needs, and can continue to do so, particularly in terms of providing empirical evidence to support policy-making and offering information and benchmarking tools for companies.

6 See: http://iri.jrc.ec.europa.eu/home/. The activity is undertaken jointly by the Directorate General for Research and Innovation (DG RTD.A; see: http://ec.europa.eu/research/index.cfm?lg=en) and the Joint Research Centre, Directorate B Growth & Innovation (JRC-B; see: https://ec.europa.eu/jrc/en/science-area/innovation-and-growth).

2nd GLORIA Workshop on:

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08:45 – 09:00
Welcome and Registration

09:00 – 09:10
GLORIA as a policy tool: objectives of the workshop

- Peter DRÖLL & Doris SCHRÖCKER (RTD F1) & Alexander TÜBKE (JRC B3)

09:10 – 09:30
Industrial and Workforce challenges: evidence from the JRC

- Lesley POTTERS (JRC B3)

9:30 – 10:15
Keynote speech - **Global corporate value chains and innovation networks in the fourth industrial era: new models of production and work organisation**
(30 min + 15 min Q&A)

- Prof. Dr. Julian MÜLLER, Salzburg University of Applied Sciences, Austria

10:15 – 11:30
Session: Focus on Industry 4.0
(20 min. for each presentation + 15 min. Q&A and discussion)

- Dirk TORFS
  - **Innovation challenges in industry 4.0: a practitioner's view**
  - Flanders Make and EARTO

- Mafini DOSSO and Paulina RAMIREZ
  - **Towards a better understanding of firms' R&D and innovation value chains: insights from qualitative and quantitative evidence**
  - JRC B.3 and University of Birmingham

- Doris SCHRÖCKER and Jürgen TIEDJE (RTD)
  - **Grasping challenges of the new industrial era: a policy view**
  - RTD F.1 and F.3

Q&A and discussion, 15 minutes

11:15 – 11:45 Coffee Break

11:45 – 12:40

Session: Focus on Workforce 4.0
(20 min. for each presentation + 15 min. Q&A and discussion)

- Irene MANDL
  - The future of Manufacturing in Europe: new technologies, new jobs?
  - Eurofound (Ireland)
- Koen JONKERS
  - The future of Manufacturing in Europe: new technologies, new jobs?
  - JRC B.7

12:40 – 13:30: Networking Lunch Reception

13:30 – 14:30 POLICY ROUND TABLE

Policy Options in Global corporate value chains and innovation networks in the fourth industrial era: reshoring as an option?
(20 min. for pitches between policy panellists + 40 min. Q&A and discussion)

Panellists:

- Bernhard DACHS
  - AIT (Austria)
- Steffen KINKEL
  - University of Karlsruhe
- Comments from ALL meeting participants

Roundtable discussion

Closing remarks from DG RTD F.1 (5 min.)

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Box. Some definitions

Examples of definitions of Industry 4.0

"Industry 4.0 describes the organisation of production processes based on technology and devices autonomously communicating with each other along the value chain: a model of the 'smart' factory of the future where computer-driven systems monitor physical processes, create a virtual copy of the physical world and make decentralised decisions based on self-organisation mechanisms"

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"Industry 4.0 is the combination of new technologies and organization of labor to push manufacturing into a new realm of optimization. It is a trend that focuses on creating smart factories through innovative communication and design between machines and humans."

Other definitions

Global Value Chains (GVCs): "The value chain describes the full range of activities that firms and workers do to bring a product/good or service from its conception to its end use and beyond. This includes activities such as design, production, marketing, distribution and support to the final consumer." (https://globalvaluechains.org/concept-tools)

Global innovation networks (GINs): "*GIN is the more recent term used to refer to the complex webs of internationally dispersed research, development and innovation (RDI) networks*" (see Ramirez 2018 for a detailed state of the art)

Business model: *"The sum of the value creation mechanisms, value offer, and value capture mechanisms and their links,… Value creation refers to the tasks, which a company performs in order to provide an offer to its customers. In manufacturing organizations, value creation is the sum of the tasks undertaken at own production locations and of the ones performed by suppliers and partners in the business ecosystem. Value capture, also termed as monetization refers to the means, by which a company is compensated by customers and, by which it sustains itself through commercial activity….Finally, the value offer is the assortment of products and services individual to each company and can be conceptually located on a continuum from product-only offers to service-only offers"* (Müller et al 2018a)

Sustainable industrialisation: *"The term "sustainable" addresses the need to decouple the prosperity generated from industrial activities from excessive natural resource use and negative environmental impacts. It implies that no one is left behind and all parts of society benefit from industrial progress, which also provides the means for tackling critical social and humanitarian needs". (https://isid.unido.org/about-isid.html)*

Anticipatory regulation: "…is an emerging method of regulation that is proactive, iterative and responds to evolving markets" (NESTA, 2017)