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Italy's Industry 4.0 Plan: An Analysis from a Labour Law Perspective¹

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Abstract

Purpose. Examining the major challenges posed by Industry 4.0 to workers and employers (e.g. the crisis of subordination, the new roles of skills, the risk of technological unemployment, new decentralized and participatory forms of collective bargaining), this paper sets out to identify actions and perspectives to manage current changes, focusing on workers rather than on those technologies that will be used to work in the years to come.

Design/methodology/approach. Industry 4.0 will be examined adopting a labour law perspective. In the authors' opinion, labour law is not only tasked with providing protection and favouring production, but it has other important functions in historical and political terms.

Findings. Labour law is not doomed to be set aside following the demise of Fordism, but it will innovate over time to enable and balance the new productive model underlying Industry 4.0.

Research limitations/implications. The research contributes to the debate on the new functions of labour law in the Industry 4.0 era.

Originality/value. The originality of the paper lies in its approach, which considers labour law in the context of the Fourth Industrial Revolution.

¹ The present paper summarises the findings of research conducted for the project *INDUSTRY 4EU – Industry 4.0 for the future of manufacturing in the European Union*, which was funded by the European Commission (Budget Heading 04.03.01.08) and promoted by Federmeccanica in collaboration with ADAPT (Italy), the Council of European Employers of the Metal, Engineering and Technology (Belgium), Nordbildung (Germany), and the Chamber of Commerce and Industry of Slovenia (Slovenia). While the paper was the result of cooperation between the two authors, Francesco Seghezzi focused on the sociological and economic sections, while Michele Tiraboschi covered aspects related to labour law and industrial relations.

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Paper type. Issues paper.

Keywords: *Industry 4.0, Labour Law, Industrial Relations.*

1. Industry 4.0 has finally entered the public debate in Italy, though far later than in other OECD countries³. This has occurred as the effects of significant innovation on manufacturing processes, and goods and services from the spread of the Internet, and the entailing interdependence of the digital and the non-digital dimension increase⁴. Institutionally, a major contribution to Industry 4.0 and ensuing engagement on it was initiated by the preliminary survey and its analysis carried out in February 2016 by the Commission on Production, Trade and Tourism set up by Italy's Lower Chamber⁵. The aim of this was to “define a national Industry 4.0 strategy” by “better framing the legal framework needed to promote its realisation”⁶. The parliamentary survey was

³ The debate on Industry 4.0 originated in Germany in 2006 with the presentation of the High-Tech Strategy – within which the Industry Science Research Alliance was created – the aim of which was to coordinate and provide funds to those committed to developing new technology. The strategy was then renewed in 2010 and renamed High-Tech Strategy 2020. The expression “Industry 4.0” comes from the German expression *Industrie 4.0*, which was employed for the first time in 2011 during the Hannover Messe. In January 2011, the promoting committee of the Industry Science Research Alliance started a project on *Industrie 4.0* in cooperation with Acatech – the National Academy of Science and Engineering – and set up a team comprising Siegfried Dais (Robert Bosch GmbH) and Henning Kagermann, who was the President of Acatech. Over the same year, this wording was used by Wolfgang Wahlster – Director and CEO of the German Research Center for Artificial Intelligence – during the opening speech of the Hannover Messe. The topic was also addressed by the European Parliament in the document “*Industry 4.0. Digitalisation for productivity and growth*” and in the *Industry 4.0 Report* produced in 2016 by the European Parliament ITRE Committee (Industry, Research and Energy).

⁴ Significant research on the topic includes the “Fabbrica 4.0” project carried out by Confindustria, “Indagine Industry 4.0” conducted by Federmeccanica and, more recently, the Position Paper on Industry 4.0 produced by the Department of Industry and Innovation of the Research Centre of Assolombarda Confindustria Milano, Monza e Brianza. As for academic work, mention should be made of Francesco Seghezzi and his pioneering work on the topic, specifically: Come cambia il lavoro nell'Industry 4.0?, *Working Paper ADAPT*, 23 marzo 2015, n. 172, Lavoro e relazioni industriali in Industry 4.0, in *DRI*, 2016, vol. XXVI, n. 1, 178-209, and L'impatto della Manifattura 4.0 sulle relazioni industriali, in Various Authors, *La strada verso la Manifattura 4.0 – Progetto di ricerca “Focus Group Manifattura 4.0”*, Centro Studi e Area Industria e Innovazione di Assolombarda Confindustria Milano Monza e Brianza, 2016, 63-68.

⁵ See the substantial piece of research produced by the X Commission of Italy's Lower Chamber, *Indagine conoscitiva su «Industria 4.0»: quale modello applicare al tessuto industriale italiano. Strumenti per favorire la digitalizzazione delle filiere industriali nazionali*, Roma, 30 June 2016.

⁶ See Camera dei Deputati, XVII Legislatura, Bollettino delle Giunte e delle Commissioni parlamentari attività produttive, commercio e turismo, 2016, Allegato, p. 107. The relevance of

followed by a “National Industry 4.0 plan” presented in Milan by the Minister of Economy, Carlo Calenda, and the then Prime Minister Matteo Renzi on 21 September 2016.

Unlike in other countries – e.g. Germany⁷, United States⁸, the UK⁹, Spain¹⁰, and to a small extent, in France¹¹ and the Netherlands¹² – the Italian

a clear legal framework is pointed out in G.K. Hadfield, *The Fourth Industrial Revolution is here. What laws do we need to make sure we all benefit from it?*, World Economic Forum, 2016.

⁷ See, Various Authors, Recommendations for implementing the strategic initiative INDUSTRIE 4.0. Final report of the Industrie 4.0 Working Group, Forschungsunion, Acatech, 2013. In literature, see M. Hermann - T. Pentek - B. Otto, Design Principles for Industrie 4.0 Scenarios: A Literature Review, Technische Universität Dortmund Working paper series, 2015; T. Bauernhansl - M. ten Hompel - B. Voögel- Heuser (edited by), Industrie 4.0 in Produktion, Automatisierung und Logistik: Anwendung, Technologien und Migration, Springer, 2014; U. Sandler (edited by), Industrie 4.0, Springer, 2013.

⁸ The Obama administration started to understand the relevance of innovation in manufacturing as early as 2011, when it promoted the “Advanced Manufacturing Partnership”. It was a working team comprising representatives from universities and employers (MIT, University of Michigan, Berkeley, among others) which organised regional workshops helping to bring together industry and academia. The project developed and in 2014 was rebranded “Revitalize American Manufacturing and Innovation Act”. The purposes of the project were: promoting innovation, ensuring the talent pipeline and improving the business climate. In the USA, the expression Industrial Internet is preferred over Industry 4.0. The former was originally employed by General Electric, which was the first company to disseminate the Industry 4.0 concept in the country. See P.C. Evans - M. Annunziata, *Industrial Internet: Pushing the Boundaries of Minds and Machines*, GE, 2012. In literature, see M. Brettel - M. Klein - N. Friederichsen, *The Relevance of Manufacturing Flexibility in the Context of Industrie 4.0*, in *Research and Innovation in Manufacturing: Key Enabling Technologies for the Factories of the Future. Proceedings of the 48th CIRP Conference on Manufacturing Systems*, edited by R. Teti, Elsevier, 2016, 105-110; F. Almada-Lobo, *The Industry 4.0 Revolution and the future of Manufacturing Execution Systems (MES)*, in *Journal of Innovation Management*, 2015, vol. 3, n. 4, 16-21.

⁹ In 2015, the UK government presented the document “*Strengthening UK manufacturing supply chains. An action plan for government and industry*” in which six priorities are stressed that should facilitate the Industry 4.0 transition: innovation, skills, access to funding, capabilities in small and medium-enterprises, increased cooperation between supply chains and the diffusion of more resilient supply chains. The project “Innovate UK” promoted by the UK Department for Business, Innovation and Skills is also worth a mention. It identified eleven innovation centres – named “catapults” – which should promote research through private-public partnerships on a number of topics (digital manufacturing, medical technology, future cities, among others).

¹⁰ In 2016, Spain’s government and Ministry of Industry, Energy and Tourism presented the Plan “*Industria Conectada 4.0*”, which is based on cooperation between private and public bodies and involves a number of major employers (Indra, Telefónica, Santander). The plan was accompanied by a policy document titled *La transformación digital de la industria española*, which examines the local economic context and the possible implications of Industry 4.0, providing a glossary of key terms. See. Various Authors, *Las tecnologías IoT dentro de la industria conectada 4.0*, EOI, 2016.

government¹³ has not produced a fully-fledged policy on Industry 4.0. Nevertheless, it must be said that some relevant aspects of the Industry 4.0 plan were included in Italy's 2017 Budget Law¹⁴, making them more likely to be implemented. They were incentives¹⁵ – which have reported a widespread use – tax credits and benefits in relation to Industry 4.0 technologies, and investments in staff engaged in research and development (R&D). Other measures – e.g. simplified tax treatment – concerned investments in the following: innovative projects, business accelerators, industrialisation and patents of technology-rich products, network infrastructure (broadband), innovative start-ups, the conclusion of contracts for developing industrial clusters, the diffusion of industrial doctoral programmes, and the creation of links between companies, universities and technical high-schools to develop skills needed in some new occupations (see par. 2).

Given the above, the aim of this paper is not that of observing provisions and other industrial policy initiatives¹⁶ that leave little room for interpretation, as to viewing how these might impact the national system of industrial relations, the challenges posed by Industry 4.0 and work digitalisation¹⁷, more broadly. It might also be that the legal perspective¹⁸ is not the most suitable one to examine phenomena which are yet to be defined as they experience ongoing

¹¹ In 2015, the French government implemented the *Industrie du futur* project, which in 2016 was complemented by a policy document (*Nouvelle France Industrielle*).

¹² See the report *Smart Industry. Dutch Industry fit for the future*, produced by the Dutch Government in 2014 with a number of employers' associations.

¹³ Italy's Ministry of Economy only made available the slides with which the national plan was presented, but no reference was made to a more detailed policy document explaining the guidelines put forward by the Government.

¹⁴ See Draft Law AC 4127-bis, *Bilancio di previsione dello Stato per l'anno finanziario 2017 e bilancio pluriennale per il triennio 2017-2019*.

¹⁵ In relation to the topic discussed in this paper, see: E.M. Impoco - M. Tiraboschi, *La ricerca ai tempi delle economie di rete e di Industry 4.0*, Giuffrè, 2016, p. 1 and 24-40. On the strategies based on the incentives, see E. Ghera, *Le sanzioni civili nella tutela del lavorosubordinato*, relazione al convegno AIDLASS, *Le sanzioni nella tutela del lavoro subordinato*, Alba, 1-3 giugno 1978, in GDLRI, 1979, 305-381.

¹⁶ On the incentives to promote technology innovation, research carried out in companies and cooperation between industry and academia, see M. Tiraboschi, *Inquadramento giuridico del lavoro di ricerca in azienda e nel settore privato: regole, percorsi, incentivi*, in E.M. Impoco - M. Tiraboschi, *op. cit.*, 15-128. A more practical approach is provided by G. Rosolen, *Il credito d'imposta per personale altamente qualificato anche in somministrazione di lavoro*, in DRI, 2016, vol. XXVI, n. 4.

¹⁷ These challenges were also those detailed in the report produced in September 2015 by Bruno Mettling – Deputy CEO at Orange and submitted to the French Labour Minister – where the effects of digital revolution on employee relations are examined.

¹⁸ Here reference is made to those who have been the first to provide a legal analysis of labour digitalisation and platform-based work. See the introductory remarks in P. Tullini, *C'è lavoro sul web*, in Labour Law Issues, 2015, n. 1.

change (e.g. digital manufacturing and the Internet of Things¹⁹). It certainly makes no sense to lend credence to theories predicting doomsday scenarios – e.g. the end of human work²⁰ – on the one hand, or to more optimistic views foreseeing an era of creative idleness²¹, on the other hand. However, it would be sufficient to consider the most immediate consequences of using state-of-the-art technology in production and related services to appreciate the relevance of legal disciplines, particularly labour law. This is the case when attempts are made at successfully governing²² the significant technology innovation underway in our economy and society. Examples of this include the management of business restructuring and professional re-training²³ resulting from the use of technology-rich processes, which are far from easy and call for active labour policies and re-employment schemes which have been lacking in Italy in the labour reforms of the last twenty years²⁴. More to the point, one cannot fail to note the widening mismatch between labour demand and supply. This makes it necessary to rethink the legal and the institutional framework underlying the education and training system and its ties with manufacturing²⁵.

¹⁹ The expression “Internet of Things” refers to “Radio-Frequency IDentification (RFID) tags, sensors, actuators, mobile phones, etc. which, through unique addressing schemes, are able to interact with each other and cooperate with their neighbours to reach common goals”, L. Atzori - A. Iera - G. Morabito, *The Internet of Things: A survey*, in *Computer Networks*, 2010, vol. 54, n. 15, 543. The expression was employed to refer to the use of the Internet to connect a number of objects in the physical world. See D. Evans, *The Internet of Things. How the Next Evolution of the Internet Is Changing Everything*, Cisco, 2011. For an overview of this topic, see S. Greengard, *The Internet of Things*, MIT Press, 2015. More recently, see Various Authors, *The Internet of Things*, MIT Technology Review Business Report, 2014; Various Authors, *Driving unconventional growth through the industrial Internet of Things*, Accenture, 2014.

²⁰ See J. Rifkin, *The End of Work: The Decline of the Global Labor Force and the Dawn of the Post-Market Era*, Putnam, 1995. A more balanced view is provided in World Economic Forum, *The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution*, 2016.

²¹ D. De Masi, *L'ozio creativo – Conversazione con Maria Serena Palieri*, Ediesse 1995.

²² Specifically, “engineering and law should work together to advance the future. And because lawyers and engineers acquired their skills at a university somewhere, the logical entry point for change is education». See, J.M. Ottino - D.B. Rodriguez, *Law and Engineering Should Share Curriculum*, in *The Chronicle of Higher Education*, 1 May 2016.

²³ This is true if one considers that, according to the World Economic Forum, some 7 million jobs will be lost between 2015 and 2020.

²⁴ In relation to Italy's Jobs Act, see the documents and the analysis collected in F. Seghezzi - M. Tiraboschi (edited by), *Politiche attive: ultima chiamata*, Boll. spec. ADAPT, 2016, n. 8.

²⁵ See, E. Massagli, *Alternanza formativa e apprendistato in Italia e in Europa*, Studium, 2016, and A. Teselli, *Formazione professionale e politiche attive del lavoro*, Carocci, 2016. This point is also made by G. Bertagna, *La scommessa di un sistema educativo di istruzione e di formazione di pari dignità*, Rubbettino, 2006.

On this point, many²⁶ have argued in favour of university and research institutions to be managed privately rather than as a public entity²⁷, as is currently the case.

The role of “Industrial Relations Law”²⁸ – that can be defined as the collective dimension of that set of provisions laid down by labour law – is another highly-debated aspect, especially because the National Industry 4.0 Plan and the 2017 Budget Law²⁹ lay much store by this field and seem to better match them with traditional measures concerning work productivity³⁰ and company welfare³¹. In the two provisions referred to above, these measures seem to be modelled upon joint initiatives and forms of decentralised bargaining as though there was an awareness that introducing new technologies and making them effective requires the creation of participative and cooperative relationships between employer and employee³².

Yet the authors of this paper perceive that³³ the social and economic implications of the “New Great Transformation of Work” – which relevant literature has already regarded as the “Fourth Industrial Revolution”³⁴ – can be fully appreciated if this is not merely intended as based on the pervasive use of state-of-the-art technology. Industry 4.0 is not only a technical phenomenon and – as already understood at the turn of the last century³⁵ – goes beyond

²⁶ See, the remarks made by Gianfelice Rocca at the 2016 meeting of Assolombarda (in *Boll. ADAPT*, 2016, n. 34).

²⁷ This issue is also debated elsewhere. See P. Graham, *Frighteningly Ambitious Startup Ideas*, in *Paulgraham.com*, March 2012, and the note made by F. Fazio, *L’idea più coraggiosa? Rimpiazzare le Università*, in *Boll. ADAPT*, 2012, n. 14.

²⁸ A definition of the concept is provided in the editorial by L. Spagnuolo Vigorita that was published the first issue of *Diritto delle Relazioni industriali*.

²⁹ D.d.l. n. 4127-bis, art. 23 (*Premio di produttività e welfare aziendale*).

³⁰ Here reference is made to the tax credit on performance-based pay introduced for the first time in the 2008 Budget Law through par. 67 and 68, Article 1 of Act no. 247/2007.

³¹ See B. Caruso, *«The bright side of the moon»: politiche del lavoro personalizzate e promozione del welfare occupazionale*, in *RIDL*, 2016, vol. XXXV, n. 2, I, 177-207; E. Massagli, *Le novità in materia di welfare aziendale in una prospettiva lavoristica*, in *Le nuove regole del lavoro dopo il Jobs Act*, edited by M. Tiraboschi, Giuffrè, 2016, 598-611.

³² On this topic, see research promoted by Fim-Cisl, *#SindacatoFuturo in Industry 4.0*, ADAPT University Press, 2015, which draws on the study carried out in Germany by IG Metall.

³³ The New Great Transformation, which is the expression employed by K. Polanyi in his 1974 book, is examined at length on the blog *La grande trasformazione del lavoro* managed by ADAPT for *Nòva* of *Il Sole 24 Ore*.

³⁴ On the idea of the Fourth Industrial Revolution, see K. Schwab, *The Fourth Industrial Revolution*, World Economic Forum, 2016. On similar lines, see the final document produced by the X Commission of Italy’s Lower Chamber already referred to in this paper.

³⁵ B. Veneziani, *Le nuove forme di lavoro*, in *Diritto del lavoro e relazioni industriali nei Paesi industrializzati ad economia di mercato. Profili comparati. I. Diritto del lavoro*, edited by R. Blanpain - M. Biagi, Maggioli, 1991, 107-139.

moving away from the three “Aristotelian rules” of labour law, namely place of work (e.g. one’s obligation to work on the employer’s premises), time of work (e.g. performing work over a single time-period) and type of work (e.g. engaging in only one type of job at the time)³⁶.

The changing relationships between the man and the machine and between different production factors – with the latter that enable technology to control value creation – call for a thorough review of the main categories of labour law, especially some fundamental notions such as “subordination” and “business”³⁷ (see par. 4). However, more importantly, it also entails rethinking the links between technological development and the legal framework that enable³⁸ and regulate the new relationships between wealth production and redistribution (see par. 3). This is taking place against a complex background of demographic³⁹ and environmental⁴⁰ changes and globalisation involving both markets and the value production chain, which pose new challenges in terms of sustainability of economic and production processes⁴¹. One example of this is the ageing of the working population. This might have an impact on both occupational health and safety – especially because people can now work

³⁶ *Ibidem*. See also P. Tullini, *op. cit.*, esp. 4, where a question is raised as to whether digital work can be assessed making use of criteria like space and time.

³⁷ In this sense, see: Federal Ministry of Labour and Social Affairs, *Green Paper Work 4.0. Re-Imagining Work*, 2015, esp. 67, where the following question is made: “Are the basic concepts of labour law (such as “employee” or “establishment”) still applicable in the digital world of work?”. See also Germany’s White Paper on Industry 4.0 presented in Berlin on 20 November 2016: Bundesministerium für Arbeit und Soziales, *Weißbuch Arbeiten 4.0*.

³⁸ An interesting contribution to discussions on the sharing economy is provided by G. Smorto, *I contratti della sharing economy*, in *FI*, 2015, vol. CXL, n. 4, V, 221 and ff.

³⁹ See M. Tiraboschi, *Le nuove frontiere dei sistemi di welfare: occupabilità, lavoro e tutele delle persone con malattie croniche*, in *DRI*, 2015, vol. XXV, n. 3, 681-725. See also M. Barbera, *Cambiamenti demografici, mercato del lavoro e regolazione giuridica*, in *RGL*, 2015, vol. LXVI, n. 2, 243-248. In international literature, see P. Braveman - L. Gottlieb, *The Social Determinants of Health: It’s Time to Consider the Causes of the Causes*, in *Public Health Reports*, 2014, vol. 129, suppl. n. 2, and P. Love (ed.), *Ageing: Debate the Issues*, OECD, 2015.

⁴⁰ See M. Tiraboschi, *Prevenzione e gestione dei disastri naturali (e ambientali): sistemi di welfare, tutele del lavoro, relazioni industriali*, in *DRI*, 2014, vol. XXIV, n. 3, 573-604, e anche a L. Rustico - M. Tiraboschi, *Le prospettive occupazionali della green economy tra mito e realtà*, 2010, vol. XX, n. 4, 931-965. In international literature, see J. Escribano Gutiérrez, *Lavoro e ambiente: le prospettive giuslavoristiche*, 2016, vol. XXVI, n. 3, 679-704.

⁴¹ These are the views contained in the Position Paper on Industry 4.0, which are shared by the authors. The concept of sustainability from a labour law perspective is examined in Eurofound, *Sustainable work over the life course: Concept paper*, 2015.

outside the employer's premises⁴² – and on senior workers' mastery of new technology, due to the lack of proper skills and the difficulty to develop them⁴³. Based on the considerations outlined above, this paper sets out to provide a new conceptual framework to examine Industry 4.0 and its dynamics (both current and future). The analysis will consider the relevant role of technology, but it will also emphasise that of people and employees in new manufacturing processes. Such an approach will also serve the purpose of reasserting the historical and political function of labour law as a branch of law safeguarding employee protection but also production⁴⁴. This means that the demise of the Fordist paradigm will not cause labour law to disappear – far from it. It will help this domain to innovate, making sure the production model underlying Industry 4.0. provides and ensures social justice.

This is the perspective we are most interested in. Simply put, this work is not aimed at reasserting – if from a different standpoint⁴⁵ – the inadequacy of Italy's Jobs Act to regulate modern production processes and the ongoing industrial revolution (see par. 5). The ultimate purpose of this paper is to raise awareness among labour law scholars and industrial relations practitioners of the changes currently underway, which will soon affect the wealth creation chain and thus labour law discourse. This includes the interconnections between producers and consumers (so-called “prosumers”)⁴⁶, between research, production and development; between manufacturing and services; the emergence of the sharing economy and the increasing relevance of the Internet in the production of goods, making aspects like company size completely irrelevant. The changes referred to above will also have an impact on skills development – which calls for a close cooperation between education and industry; on the political, economic and social factors leading to wealth redistribution and labour productivity; and, finally, on the contractual dynamics – both individual and collective – enabling a social and economic model which

⁴² See the *Position Paper on Industry 4.0* already referred to in this paper. See also Assolombarda (ed.) *Indicazioni per la gestione degli aspetti di salute e sicurezza legati al “Lavoro Agile/SmartWorking”*, Dispensa, 2015, n. 1.

⁴³ On the New Great Transformation of Work and the entailing labour law issues, see M. Brollo, *Disciplina delle mansioni*, in *Commento al d.lgs. 15 giugno 2015, n. 81: le tipologie contrattuali e lo jus variandi*, a cura di F. Carinci, ADAPT University Press, 2015, 33.

⁴⁴ An overview of the issue is provided in M. Tiraboschi, *Lavoro temporaneo e somministrazione di manodopera. Contributo allo studio della fattispecie lavoro intermittente tramite agenzia*, Giappichelli, 1991, esp. 88-93 and the bibliography therein.

⁴⁵ See the observations made in F. Seghezzi - M. Tiraboschi, *Al Jobs Act italiano mancano l'anima e la visione di un lavoro e una società che cambia*, in *Il Jobs Act dal progetto all'attuazione* edited by F. Nespoli - F. Seghezzi - M. Tiraboschi, ADAPT University Press, 2015, 11-18.

⁴⁶ The word “prosumer”, which is obtained by merging “producer” with “consumer”, was employed for the first time by A. Toffler in *The Third Wave*, Bantam Doubleday Dell, 1999.

is legally compatible with the Internet of Things and related people and services⁴⁷.

As we will attempt to demonstrate in the concluding part of this paper (see par. 5) it might also be the case that the “National Industry 4.0 Plan” can trigger the long-overdue modernisation process of the Italian labour market, especially if properly implemented with the support of national industrial relations actors⁴⁸.

This might be likely if one considers the January 2014⁴⁹ draft of Italy's Jobs Act, and above all the US Jobs Act enacted in November 2011⁵⁰. In this latter case, and unlike the Italian version, the aim was not that of reforming labour regulation, but to provide people with necessary infrastructure⁵¹ to adapt the US labour market and education system to the profound changes affecting production and workplaces taking place on a global scale⁵².

2. Answering the question as to whether the initiative put forward by the Italian government is part of a national industrial policy⁵³, an evolution of or simply an attempt to move away from it⁵⁴ falls outside the scope of this paper. However, the National Industry 4.0 Plan should be praised in that it no longer makes investments in new technologies dependent on public funds appropriated or steered by political actors or on public contracts fraught with considerable red tape. The plan can be credited with focusing on the promotion of enabling factors, and easy-to-access funds which have nothing to do with what has been notoriously known as the “political market” of the public incentives to employers⁵⁵.

⁴⁷ See Various Authors, *From the Internet of Thing to the Internet of People*, in *IEEE Internet Computing*, 2015, vol. 19, n. 2, 40

⁴⁸ This is one of the main concerns contained in Germany's White Paper on Industry 4.0. Specifically, it is pointed out that work organisation and its social dimension should be seen as linked together and that collective bargaining and co-determination are still the most relevant tools to deal with them also in the digital economy and Industry 4.0-related production.

⁴⁹ See the project outlined by the former Prime Minister, Matteo Renzi, in the e-news of 8 January 2014. Here, priority was given to industrial plans in a key economic sectors (e.g. digital manufacturing) without however attaching relevance to labour reform.

⁵⁰ A detailed outline of the Jobs Act in the US see *by the President Barack Obama to a Joint Session of Congress* of 8 September 2011 and the official document issued on 12 September 2011, which can be found at the A-Z Index of www.adapt.it (heading: *Jobs Act*).

⁵¹ C. Mancini, *Il settore delle infrastrutture negli Stati Uniti: creazione di lavoro, competenze, formazione in Nòva*, 30 May 2016.

⁵² See M. Ori, *Il Job Act di Renzi, cos'è e come funziona*, in *Linkiesta*, 8 January 2014.

⁵³ On this issue, see the documents collected in F. Onida - G. Viesti (eds.), *Una nuova politica industriale in Italia. Investimenti, innovazione, trasferimento tecnologico*, Passigli, 2016.

⁵⁴ See F. Seghezzi, *Il piano del governo e la mappatura delle imprese*, in *Il Foglio*, 26 September 2016, and F. Seghezzi - M. Tiraboschi, *La vera sfida di Industry 4.0*, in *Avvenire*, 3 October 2016.

⁵⁵ See the Giovazzi report, *Analisi e Raccomandazioni sui Contributi Pubblici alle Imprese*, which was submitted to the Prime Minister, the Minister of Economy and Finances, and to the Minister

After outlining the new technologies enabling the new production paradigm⁵⁶, the expected benefits resulting from the plan are listed in relation to production flexibility. Among them are cost reduction benefitting both customised and large-scale products; a quicker shift from prototypes to industrialised goods; and the increase in product and service quality. The benefits portrayed above are particularly concerned with better qualitative processes, while also taking into account other competitive factors enabling companies to stay afloat in an ever-changing international market.

The plan goes on to briefly describe the progress made thus far by France, Germany, and the United States as regards governance models and funding allocated to Industry 4.0, focusing on the former and on the fact that a number of actors are called into play (e.g. representatives from the institutions, university and private bodies)⁵⁷. The number and variety of actors involved in the governance of the Industry 4.0 process leads one to believe that their role is rather formal. This holds particularly true in consideration of the explicit aim of Minister Calenda, that is to make the whole system leaner and more flexible. The plan then goes into the details and illustrates both key and supplementary actions. The former are based on innovation investments and the skills to govern new technology, while the latter are concerned with enabling infrastructure and public facilities. At the core of both lies a commitment on the part of the government to raise awareness of the relevance of the Industry 4.0 phenomenon and the setting-up of proper governance.

Innovation investments are needed to trigger private actors to put money into technology and services related to Industry 4.0. This should take place by extending the deadline to apply for a number of tax incentives. The significant amount of tangible and intangible assets (e.g. software) that might benefit from this incentive – a detailed list of which is provided in the Budget Law⁵⁸ – speaks volumes for the willingness of the provision to let employers decide on which type of technology they want to invest.

Another action that has been put in place to favour R&D investments is the increase of tax credits on incremental expenditure, which both concern the

of Development, Infrastructure and Transportation on 30 April 2012. The document clearly stressed that employers' focus on the mechanisms of "political market" through which funds are allocated divert attention away from business management.

⁵⁶ The following enabling technologies have been identified: *Advanced Manufacturing, Additive Manufacturing, Augmented Reality, Simulation, Horizontal/Vertical Integration, Industrial Internet, Cloud, Cybersecurity, Big Data and Analytics*.

⁵⁷ Specifically, the following institutional bodies have been involved: Prime Minister's Office; the Ministry of Education, University and Research; the Ministry of Labour and Social Policies; the Minister of Agriculture, Food and Forestry; and the Ministry of the Environment and the Protection of Land and the Sea.

⁵⁸ See art. 3 of the d.d.l. AC 4127-*bis* and Attachment A already referred to.

amount of the maximum contribution provided – now raised to €20 million – and the domestic tax rate⁵⁹. This move – which at first glance might appear as hampering expenditure – should be interpreted as a tool to avoid the use of these funds to cover business costs which have nothing to do with innovation. Lastly, reference should also be made to a set of financial and tax-related initiatives devised to support the creation of Industry 4.0-related start-ups and venture capitals.

As for skills, the plan places emphasis on two measures – namely the establishment of Digital Innovation Hubs (DIHs) and Competence Centers (CCs). The wording and purpose of DIHs call to mind the EU initiative “Digitalise European Industry”⁶⁰ and refers to bodies set up within the local offices of national employers’ associations (*Confindustria* and *R.E.TE. Imprese Italia*) with the aim of building relationships between people operating in industry, research and finance. This should take place by means of awareness-raising initiatives organised by employers concerning the advisability to engage in Industry 4.0 activities and a number of other actions intended to seek private and public funds for planning and development. The ultimate goal of DIHs is thus that of serving as local hubs established by local entrepreneurs, who therefore will support the digitalisation process.

With respect to competence centers, only a small number of them will be created and will be associated with technological parks – which are linked to or complement one another – that would involve actors seen as value generators, i.e. universities, research centers and start-ups⁶¹. The purpose of CCs is that of facilitating the transfer of skills used to govern Industry-4.0 technology and supporting experimentations related to specific projects.

In parallel, there exist further projects concerning skills development. Examples include the implementation of the National Plan “*Scuola Digitale*” (Digital School), initiatives aimed at bringing together universities and local employers, projects involving the alternation of school and work focusing on Industry 4.0, master’s degrees and other courses set up in collaboration with private bodies, and the widening of the number of those who can access

⁵⁹ See G. Rosolen, *Legge di Bilancio 2017: le novità sul credito d'imposta per le attività di ricerca e sviluppo*, in *Boll. ADAPT*, 2016, n. 34. See also E.M. Impoco - M. Tiraboschi, *op. cit.*

⁶⁰ *Digital Innovation Hubs* were funded with €500 million provided through the 2020 Horizon financing line within the European Plan “Digitalize European Industry”. The plan was announced in April 2016 as a part of the initiatives related to the Digital Single Market, through COM(2016)180 final of 9 April 2016, *Digitising European Industry. Reaping the full benefits of a Digital Single Market*.

⁶¹ The concept of Competence Centers was also developed in a number of European countries. See the Dutch model of the top consortia for knowledge and innovation in E. Prodi, *Industria 4.0: dalla vecchia politica industriale a una politica per l'empowerment delle imprese. Il caso dei Paesi Bassi*, in *Nòva*, 19 October 2016.

technical schools. Reference should also be made to the willingness to invest a larger number of public funds in doctoral programmes focusing on Industry 4.0 and based on so-called “innovative” or “inter-sectoral” Doctoral degrees⁶². Compounding the picture are some other supplementary measures, for instance new investments to complete broadband infrastructure, the widening of the Loan Guarantee Scheme for companies and tax credits on productivity-based pay negotiated at the decentralised level⁶³.

3. Looking at the National Industry 4.0 Plan, one cannot fail to note that its main focus is on manufacturing and factory production, more broadly. This seems to strike a discordant note, especially in a time when the Internet makes it possible to connect industry and services, giving rise to new integrated business models⁶⁴, markets, processes and products. It is as though a part of the reasoning went astray, namely that on the Fourth Industrial Revolution, which is not limited to automation of production, as the latter has been in place for years in firms. Rather, this new industrial revolution is concerned with the constant interaction – also by means of online platforms and devices – of research, planning, production, services and consumption, which have an impact on production factors and on demand in terms of sharing and reciprocity (e.g. the sharing economy) as opposed to traditional industrial processes and utilisation of goods. We are under the impression that Italy’s Industry 4.0 plan has been based on such old-fashioned concepts as the supply

⁶² On this point, and in consideration of Italy’s difficulties, see M. Tiraboschi, *Dottorati industriali, apprendistato per la ricerca, formazione in ambiente di lavoro. Il caso italiano nel contesto internazionale e comparato*, in *DRI*, 2014, vol. XXIV, n. 1. Recently, a note issued by the Ministry of Education, University and Research (note no. 1059 of 31 August 2016) implementing the 2015-2020 National Research Plan has clarified the definition of Industrial Doctorates which was introduced in Italian legislation through Ministerial Decree no. 45/2013. On this point, see E. Prodi, *Dottorato industriale e ricerca in azienda: un importante chiarimento del MIUR*, in *Boll. ADAPT*, 2016, n. 33.

⁶³ See, d.d.l. n. 4127-*bis*, art. 23.

⁶⁴ On the scientific impact of technology related to Industry 4.0, see H.C. Pfohl - B. Yahsi - T. Kurnaz, *The Impact of Industry Supply Chain*, in *Innovations and Strategies for Logistic and Supply Chains*, edited by W. Kersten - T. Blecker - C.M. Ringle, Epubli, 2015, 31-58. A more general discussion on the separation between manufacturing and services following technological development is provided in K. De Backer - I. Desnoyers-James - L. Moussiégt, “*Manufacturing or Services – That is (not) the Question*”: *The Role of Manufacturing and Services in OECD Economies*, OECD Science, Technology and Industry Policy Paper, 2015, n. 19. At the core of these models lie so-called Cyber-Physical Systems which can connect physical elements through the Internet, providing new services along with a certain good. On this point, see Acatech (ed.), *Cyber-Physical Systems Driving force for innovation in mobility, health, energy and production*, Acatech Position Paper, 2011.

chain and the value chain⁶⁵. Accordingly, while the discussion takes place at a global and not at a national level, it comes down to matters concerning factories, machinery and enabling technology. However, there is more than meets the eyes. Economic research has pointed out that “future factories” will not be individual companies, but interconnected, highly-populated cities featuring a concentration of resources, technologies and skills⁶⁶. In this sense, the walls between industry and school are broken down, both practically and metaphorically. This will favour the creation of hubs made up of R&D centers and innovative start-ups – to be intended as a means for value multiplication – and “an increase of competitiveness also for small-sized companies”⁶⁷. In this sense, the growing interest towards apprenticeships and the dual system is not coincidental, nor are attempts to revive programmes alternating school and work and inter-professional funds to favour adults’ lifelong learning. Simply put, the promotion of training and the fight against unemployment do not take place only by means of guidance programmes and re-training schemes⁶⁸, but they also reflect the profound changes in terms of planning, production and development.

Compared to other technical and scientific disciplines, labour law and industrial relations appear to have better framed the demise of the Fordist⁶⁹ and the post-Fordist paradigm⁷⁰. This change is not only reflected in work organisation, but also impacts in the founding categories of labour law and on notions like “business” and “employment”, as we have seen already. In some respect, this approach also affects the concept of “a contract”⁷¹, because production based on networks and with no hierarchies challenges traditional contract theory and the command-and-control management model regulated

⁶⁵ A criticism to the time-honoured *global supply chain* and *value chain*, see P. Khanna, *Connectography. Le mappe del futuro ordine mondiale*, Fazi, 2016.

⁶⁶ Among the most relevant contributions to the analysis of this perspective, see E. Moretti, *La nuova geografia del lavoro*, Mondadori, 2013. Along similar lines, see P. Khanna, *op. cit.*

⁶⁷ That was the view of the *Position Paper on Industria 4.0* already referred to.

⁶⁸ That is the assumption made by the public opinion when referring to alternating school and work.

⁶⁹ An overview of the concept of “Fordism” which takes account of all meanings, see B. Jessop, *Fordism and post-Fordism: a critical reformulation*, in *Pathways to Regionalism and Industrial Development*, a cura di A.J. Scott - M.J. Storper, Routledge, 1992, 43-65.

⁷⁰ An overview of the issue is provided in A. Amin (ed.), *Post-Fordism, a reader*, Blackwell, 1994. Fordism has been given a number of interpretations. A review of international literature has been provided in B. Jessop - N.L. Sum, *Beyond the Regulation Approach*, Edward Elgar, 2006, especially the chapter *Fordism and Post-Fordism*, 58-88.

⁷¹ On the role of the employment contract and labour law in the Fordist paradigm, see S. Deakin - F. Wilkinson, *The Law of the Labour Market. Industrialization, Employment and Legal Evolution*, Oxford University Press, 2005.

by Private Law⁷². By introducing the Internet in processes concerning production of goods and services – up to the point of involving consumers in the supply and value chains – the whole manufacturing cycle is turned on its head⁷³. Through sensors, firms can monitor, optimise and update information about goods already sold (e.g. geolocalisation, status, security level) and provide a number of customised services. This can also be done remotely, thanks to cloud platforms and big data regularly generated by the goods themselves and by manufacturing processes.

Members of the value chain are also empowered, with their tasks that are made easier thanks to the use of robots and innovative “man-machine” interfaces that increase their decision-making⁷⁴ and performance.

Due to the increasing relevance attributed to the final consumer in the manufacturing process, the concept of “a service” also changes and is given fresh momentum in manufacturing, to such an extent that the definition of “an entrepreneur” laid down in Italy’s Civil Code is also challenged. This is because the advent of the web and the Internet of Things causes the difference between goods and services⁷⁵ to become increasingly blurred. Against this backdrop, the notion of Industry 4.0 risks being misleading, too, in that it brings to mind the industrial dimension, which is only one of the many aspects that come into play when discussing the Fourth Industrial Revolution.

What seems to be missing in the national plan put forward by the Italian government is a holistic approach to Industry 4.0, which can be used to appreciate the fact that firms are no longer alone in manufacturing and value creation. The traditional spaces for doing business are also being replaced by more innovative industrial districts, technological centres, clusters, science parks, and business networks⁷⁶.

Increasingly, these processes will develop at both global and local level and will depend on wide networks – either formal or informal – which require new and diverse skills to govern them.

⁷² In this sense, see R.J. Gilson - C.F. Sabel - R.E. Scott, *Contracting for Innovation: Vertical Disintegration and Interfirm Collaboration*, in *Columbia Law Review*, 2009, vol. 109, n. 3, 431-502. A classic interpretation of contract theory is provided in O. Hart - B. Holmstrom, *The Theory of Contracts*, MIT Working Paper of Economics, 1986, n. 418.

⁷³ Various Authors, *Industry 4.0 and the consequences for labour market and economy. Scenario calculations in line with the BIBB-LAB qualifications and occupational field projections*, IAB-Forschungsbericht, 2015, 12-13.

⁷⁴ See *Position Paper on Industry 4.0*, cit.

⁷⁵ See Article 2082 of Italy’s Civil Code, according to which the entrepreneur is “the person that performs an economic activity professionally with the aim of producing or exchanging goods or services”.

⁷⁶ See K. De Backer - I. Desnoyers-James - L. Moussiégt, *op. cit.*

These skills will be developed in state-of-the-art knowledge districts and cooperative platforms, where the sharing of goods, services, knowledge and information⁷⁷ will take precedence over capital quantity and ownership. In this context, research centers, universities and innovative start-ups cannot be regarded as merely providers of labour, ideas and knowledge but as major components of a new, network-based, local ecosystem⁷⁸, where the interests and the goals of all those involved are nicely balanced through shared coordination and decision-making mechanisms.

The plan also presents some major shortcomings as regards those involved in the production of capital and labour. On this point, one might note that only a passing reference is made to decentralised bargaining and tax credits on variable pay. This is despite the fact that Industry 4.0 will have an enormous impact on employment and employee relations in terms of skills needs⁷⁹, productivity, trade unions and industrial relations actors⁸⁰. The ongoing industrial revolution will also have an effect on the contractual arrangements and the incentives put in place to regulate and promote the new economic and social transactions⁸¹. In turn, the latter will support innovative processes and bring about a number of social implications that will trigger new approaches to employee representation – which will revolve around the notions of “trades” and “territory” – and welfare (both of a local, occupational and individual nature)⁸².

4. This paradigm shift resulting from the emergence of Industry 4.0 will once again test the relevance of a number of legal definitions and categories laid down in Italy's Civil Code – among other those of “subordination” and a

⁷⁷ These links are seen as key to the approach underlying so-called Open Production. The latter is based on the idea of an integrated and open system to which actors outside the firm contribute. See J.P. Wulfsberg - T. Redlich - F.-L. Bruhns, *Open production: scientific foundation for co-creative product realization*, in *Production Engineering*, 2011, vol. 5, n. 2, 127-139.

⁷⁸ Some reflections concerning the management of complex situations in an Industry 4.0 context are provided in the reviewed definition of the notion of “subjectifying action” in S. Pfeiffer - A. Suphan, *The Labouring Capacity Index: Living Labouring Capacity and Experience as Resources on the Road to Industry 4.0*, Universität Hohenheim Working Paper, 2015, #2. On the cooperation in contexts where value is produced see P.S. Adler - C. Heckscher, *Towards Collaborative Community*, in *The Corporation as a Collaborative Community*, edited by P.S. Adler - C. Heckscher, Oxford University Press, 2006, 11-105. At the national level, see D. Marini, *Le metamorfosi dei distretti industriali*, in *QRA*, 2015, vol. III, n. 2, 265.

⁷⁹ F. Seghezzi, *Lavoro e relazioni industriali in Industry 4.0*, cit., 194-199, and K. De Backer - I. Desnoyers-James - L. Moussiégt, *op. cit.*

⁸⁰ Again, see F. Seghezzi, *Lavoro e relazioni industriali in Industry 4.0*, cit., 203-208.

⁸¹ This is in line with the theory of contracts of Nobel Oliver Hart and Bengt Holmstrom (O. Hart - B. Holmstrom, *op. cit.*).

⁸² See G. Sateriale, *Come il welfare crea lavoro. Guida per contrattare nel territorio*, LiberEtà, 2016, where cities and local areas are discussed.

“factory” – on which capitalistic production has thus far been based. The notion of a “factory” can be called into question in that it is no longer the privileged channel where manufacturing and the exchange of goods and services take place. As for the legal definition of “subordination” – which has been questioned for a while now⁸³ – it seems as if it failed to capture the current working patterns that move away from a Fordist⁸⁴ approach based on command and control. On close inspection, workers are now required to work autonomously⁸⁵ and on a project-by-project basis. Thus how, when and where they perform work is no longer relevant and what matters is the outcome of their work. All of this makes it evident that a gap exists between ongoing technology development and the current legal framework that should regulate the new manufacturing model and the individual, collective and contractual relationships thereof⁸⁶.

One can take cognizance of this gap when looking at the recommendations issued by the German government on Industry 4.0⁸⁷, which give emphasis on the role of consumers in product planning and development⁸⁸. One implication of this state of affairs is that manufacturing becomes more flexible to adapt to unexpected results and different demands. Lean manufacturing has introduced a number of changes that have made standardised production more adaptable⁸⁹ and paved the way for much-discussed flexibility in employment contracts and working time. Conversely, Industry-4.0 enabling technology facilitates mass customisation⁹⁰ which turns production upside down and requires one to

⁸³ See the observations made by A. Supiot, *Beyond Employment. Changes in Work and the Future of Labour Law in Europe*, Oxford University Press, 2001.

⁸⁴ See G. Vardaro, *Tecnica, tecnologia e ideologia della tecnica nel diritto del lavoro*, in PD, 1986, 75-140.

⁸⁵ This point was already made by M. Biagi, *Competitività e risorse umane: modernizzare la regolazione dei rapporti di lavoro*, in Marco Biagi, *Un giurista progettuale. Scritti scelti*, edited by L. Montuschi - M. Tiraboschi - T. Treu, Giuffrè, 2003, 151.

⁸⁶ On the relationship between salaried employment and technology see O. Razzolini, *La nozione di subordinazione alla prova delle nuove tecnologie*, in DRI, 2014, vol. XXIV, n. 4, 974-998.

⁸⁷ See, Various Authors, *Recommendations for implementing the strategic initiative INDUSTRIE 4.0*, cit.

⁸⁸ See M. Dujarier, *Il lavoro del consumatore*, Egea, 2015.

⁸⁹ On the differences and similarities between *lean manufacturing* and *Industry 4.0* see D. Kolberg - D. Zuhlke, *Lean Automation Enabled by Industry 4.0 Technologies*, IFAC, 2015, 1870-1875.

⁹⁰ Here reference is made to the concept introduced in the 1990s referring to the possibility to produce customised goods on an industrial scale. See *Mass Customization*, in G. Salvendy (edited by), *Handbook of Industrial Engineering: Technology and Operations Management*, Wiley, 2001, 684-709. At the national level, see B.J. Pine, *Mass Customization: dal prodotto di massa all'industriale su misura. Il nuovo paradigma manageriale*, Franco Angeli, 1997. Industry 4.0 has contributed to the dissemination of this concept. See, Various Authors, *Industry 4.0 – Potentials for Creating Smart Products: Empirical Research Results*, in *Business Information Systems. 18th International Conference, BIS 2015*, edited by W. Abramowicz, Springer, 2015, 16-24.

review the idea of work and its underlying rules. Among these rules is the principle that “work is not a commodity”, that was codified into the 1919 Versailles Treaty that ended World War I and then laid the foundations for the creation of the International Labour Organisation.

The core of this innovation lies in so-called Cyber Physical Systems⁹¹ which integrate physical with digital space and give rise to new ways to coordinate processes and customise products, while cutting costs and increasing productivity. Yet it is their impact on business organisation, production processes and labour utilisation⁹² that makes them a contributing factor to the transformation of industrial manufacturing⁹³.

The ability to coordinate production processes through real-time, market-related information with the supply chain and consumers requires that manufacturing is optimised “via a network of globally cooperating, adaptive, evolutionary and self-organizing production units belonging to different operators”⁹⁴.

Simply put, it all boils down to digitalisation, which however does not only refer to making productive processes more effective. Rather, it entails moving away from our idea of “a firm” as the only legal entity combining capital and labour and thus governed by bilateral contractual relations between producers and workers.

Hence the emergence of spontaneous practices – which are now well-established – such as co-sourcing, net-sourcing, selective-sourcing, multi-sourcing, back-sourcing, and co-specialization / value added outsourcing –

⁹¹ They are defined as “integrations of computation with physical processes. Embedded computers and networks monitor and control the physical processes, usually with feedback loops where physical processes affect computations and vice versa». See E.A. Lee, *Cyber Physical Systems: Design Challenges*, in *11th IEEE Symposium on Object Oriented Real-Time Distributed Computing*, 2008, 12. A similar definition is provided in E. Geisberger - M. Broy (edited by), *Living in a networked world. Integrated research agenda Cyber-Physical Systems*, Acatech Studie, 2015, 4.

⁹² Acatech has identified the following innovation elements that CPSs can provide to the company: “the units of a smart factory know their fields of activity, configuration possibilities and production conditions and communicate independently and wirelessly with one another; optimized manufacturing of an individual customer product through the intelligent compilation of an ideal production system, taking into account product properties, costs, logistics, security, reliability, time and sustainability; resource-efficient production; tailored adjustments to the human workforce (“the machine follows the human work cycle”)”. See Acatech (ed.), *op. cit.*, 26.

⁹³ See the *Position Paper on Industry 4.0*, cit.

⁹⁴ For a more detailed overview of the outcomes outlined in Acatech’s Position Paper and achieved in the “agenda CPS” project, see Geisberger - M. Broy (edited by), *agendaCPS. Integrierte Forschungsagenda Cyber-Physical Systems*, Acatech Studie, 2012.

which are all contributing to forms of co-employment⁹⁵. Yet Italian legislation limits the use of these arrangements – which fall within the name of “network contracts” – because they can be concluded by business operators but not by universities, foundations or other institutions which lack the legal “entrepreneur” status. Equally limited is the possibility to resort to temporary agency work, which lawmakers and relevant literature see as an alternative to temporary work and not as a useful means to help small-medium companies with little capital to access global chains of value production.

The potential of Cyber Physical Systems can be tapped into only if a comprehensive conception of “a firm” and “business network” is developed that is based on cooperation with those contributing to the value chain and giving rise to forms of creative and collaborative economy⁹⁶. On this point, Moretti has pointed out that “physical factories will keep losing importance, but cities with a large percentage of interconnected workers will become the new factories”⁹⁷.

What has been said above is already happening in those areas serving as genuine “brain hubs”⁹⁸ in the context of global production and distribution. Drawing on the traditional notion of industrial districts, brain hubs can be defined as both “knowledge districts” and “local innovation platforms”⁹⁹. This is so because innovation takes place at the local level, usually triggered by “a network of relations and interactions favoured by proximity”¹⁰⁰ that also involves language, culture, and above all critical thinking. In other words, innovation is fostered by an agglomeration of ideas, projects, resources and highly-qualified staff that is increasingly examined by economists¹⁰¹ and that

⁹⁵ See also A. Ross, *The New Geography of Work. Power to the Precarious?*, in *Theory, Culture & Society*, 2008, vol. 25, n. 7-8, 31-49.

⁹⁶ See I. Mandl, *New forms of employment: Developing the potential of strategic employee sharing*, Eurofound, 2016. See also P. Cappelli - J. Keller, *La classificazione del lavoro nella New Economy*, in *DRI*, 2015, vol. XXV, n. 3, 621-666.

⁹⁷ This is the views of E. Moretti, *op. cit.*, 215. A similar approach is taken by K. Schwab, *op. cit.*, 74 and ff.

⁹⁸ See E. Moretti, *op. cit.*, 85 and ff.

⁹⁹ See M. Bellandi, *Piattaforme territoriali per l'innovazione, fra città e distretti industriali*, in *Investimenti, innovazione e città. Una nuova politica industriale per la crescita*, edited by Various Authors, Egea, 2015, 161-166, and A. Gervasoni, *Infrastrutture, capitali, intelligenze, le città come hub di sviluppo*, 345-348.

¹⁰⁰ This is the perspective adopted by G. Garofoli, *Le interrelazioni tra ricerca e industria nei sistemi innovativi locali: i fattori critici*

di successo, intervento alla II Conferència Econòmica de la Mediterrània Nord-Occidental, *La Cooperació Territorial a la Mediterrània Occidental*, Barcellona, 6-7 giugno 2011, p. 2.

¹⁰¹ See the detailed report of the World Bank, *World Development Report 2009. Reshaping Economic Geography*, 2009, esp. 126 and ff. An analysis of scholarly work discussing the relationship between agglomeration and innovation and how the latter affects productivity and growth is

can serve the purpose of creating value, productivity and growth¹⁰² only in globalised markets. The sharing economy itself can be seen as the ultimate expression of both proximity relations and agglomeration¹⁰³.

Within this new conception of doing business, the technological component makes it possible to shelve the notion of workers being dependent upon the dominance of machinery that was typical of Gaetano Vardaro's Beruf¹⁰⁴. The idea based on the worker's willingness to simply perform task – which was at the core of the working process – appears to have become passé thanks to production automation. Concurrently, reliance on production means can be questioned in knowledge economies, as the latter now require a higher contribution from individuals in terms of creativity¹⁰⁵.

One key aspect of this transformation of the ways of doing business is research work, which can be regarded as important as middle management and

offered in G. Carlino - W.R. Kerr, *Agglomeration and Innovation*, Harvard Business School Working Paper, 2014, n. 15-007; S.S. Rosenthal - W.C. Strange, *The Determinants of Agglomeration*, in *Journal of Urban Economics*, 2001, vol. 50, n. 2, 191-229; B.T. McCann - T.B. Folta, *Location Matters: Where We Have Been and Where We Might Go in Agglomeration Research*, in *Journal of Management*, 2008, vol. 34, n. 3, 532-565.

¹⁰² See *OECD Business and Finance Outlook 2016*, 2016, 78 and ff. On the close connection between research, innovation and productivity, see the report *L'innovazione come chiave per rendere l'Italia più competitiva*, Aspen Institute Italia, 2012. On the links between Industry 4.0, globalisation and local dynamics, see the German case discussed in Acatech (ed.), *Industry 4.0, Urban Development and German International Development Cooperation*, Acatech Position Paper, 2015.

¹⁰³ The point is nicely dealt with in N.M. Davidson - J.J. Infranca, *The Sharing Economy as an Urban Phenomenon*, in *Yale Law & Policy Review*, 2016, vol. 34, n. 2, 215-279.

¹⁰⁴ "Entpreneurial" Beruf manages "machinery", whereas working as an employee is based on subordination. Yet this subordination does not only refer to reliance on production output or ownership of production means, but on machinery itself. In relation to the latter, the essence of subordination lies in the fact that human work is seen as a production factor and used accordingly. It is thus placed on the same footing as technology. This means that human work will be instrumental in achieving the employer's production results. It will also entail that this work will have an instrumental function in relation to the technical means used by the employer to reach a certain production outcome. It is true that this machinery will work only because operated by an employee. It is likewise true that, in order to operate these tools, the employee will have to adapt their working activity to their technical features, being the latter a necessary condition to make them function. The technical tool perfectly exemplifies the two-fold function of salaried work, that is that related to production output and that concerning the working tool. Accordingly, employees serve as both a "machine" and a "machine operator". See G. Vardaro, *op. cit.*, 81-82.

¹⁰⁵ An overview of main research on this topic and knowledge workers is provided in H. Zhan - T. Tang - Y. Zhang, *The Research on Characteristics of Knowledge Workers and Their Motivating Factors: A Review and Comparison Study*, in *American Journal of Industrial and Business Management*, 2013, vol. 3, n. 6, 557-564. At the national level, see F. Butera - S. Bagnara - R. Cesaria - S. Di Guardo, *Knowledge Working. Lavoro, lavoratori, società della conoscenza*, Mondadori, 2008.

executives¹⁰⁶ were in post-Fordism. This branch of research focuses on what international literature has termed “intermediate labour markets”¹⁰⁷, which is where innovation and interconnections take place regarding those production processes based on links between intelligent systems¹⁰⁸. These systems are such not because of the massive use of technology, but because of the input of people, creatives, start-uppers, and modern researchers that invent and implement them, therefore contributing to their ongoing development and high-added value.

The complex nature of technology and modern workplaces leads to a reversal in relation to the dependency of employees to employers, in that now the former better govern innovation than the latter do. Moreover, it is not only machinery that generates value but also workers, who provide an active contribution to it¹⁰⁹.

Accordingly, a change occurs to performance that is regulated and defined in the employment contract, significantly affecting the exchange between remuneration and hours worked and paving the way for forms of cooperation where both responsibilities¹¹⁰, decision-making and profits are shared¹¹¹.

In practical terms, this translates into a watering down of those elements constituting traditional subordination – to be intended as the employer’s control over workers’ tasks¹¹² – which results from employees’ economic dependency, lack of capital and production means. As these conditions no

¹⁰⁶ On the obsolescence of managerial and supervisory roles in Industry 4.0, see Various Authors, *Man and Machine in Industry 4.0. How Will Technology Transform the Industrial Workforce Through 2025?*, in *bcg.perspectives*, 28 September 2015.

¹⁰⁷ In this sense, see C. Lanciano-Morandat - H. Nohara, *The Labour Market for the Young Scientists*, in *How Europe’s Economies Learn. Coordinating Competing Models*, edited by E. Lorenz - B-A. Lundvall, Oxford University Press, 2006, 156-189.

¹⁰⁸ See the *Indagine conoscitiva su «Industria 4.0»* already referred to, especially p. 31, where the focus is on the shift between a linear economy to a circular one featuring constantly monitored products and processes.

¹⁰⁹ It is important to point out that a review of the concept of “an employer” is also needed. An innovative proposal has been put forward in J. Prassl, *The Concept of Employer*, Oxford University Press, 2015.

¹¹⁰ A theoretical model, which however fails to consider a labour law perspective, can be found in the idea of business regarded as a Collaborative Community put forward in P.S. Adler, C. Heckscher (edited), *op. cit.*

¹¹¹ See D. Marini, *op. cit.*, 263.

¹¹² Many proposals have been put forward attempting to strike a balance between the need of management to control complex contexts and unexpected situations and that of ensuring staff more freedom so as to express their creativity. In this sense, see the notion of large-scale collaborative creativity in P.S. Adler - C.X. Chen, *Combining Creativity and Control: Understanding Individual Motivation in Large-scale Collaborative Creativity*, in *Accounting, Organizations and Society*, 2011, vol. 36, n. 2, 63-85.

longer apply – either because workers have access to them or because co-management systems are in place – aspects such as fixed working hours and presence at work are not relevant anymore, also because of the potential interconnections characterising Cyber Physical Systems and the value chain in Industry 4.0.

A new debate is about to take place about the regulation of remote working. In this sense, the idea is to move on from traditional teleworking – which still features all the aspects related to employee control and subordination – to modern forms of remote working whereby one can work anytime, anywhere¹¹³. This state of affairs will result in the establishment of virtual offices thanks to the use of online platforms where the employer shares only information needed to perform work.

Consequently, one might easily understand that both Italy's Jobs Act¹¹⁴ and the draft law on “agile working” represent a missed opportunity to innovate national labour legislation. The provision tabled by the Italian government has failed to effectively deal with the labour issues raised by Industry 4.0¹¹⁵. It downplays the importance of aspects like “smart factories” and “smart working” and discuss them only in terms of work-life balance, which is now made easier thanks to new technologies¹¹⁶.

Although the wording “agile working” has even been welcomed by the Accademia della Crusca¹¹⁷ – an authority on research into Italian language – the legislative proposal relative to this form of employment appears to be a misguided attempt to circumvent those occupational health and safety rules laid down by national and EU legislation which apply to remote work performed through ICT tools¹¹⁸. This might be attributed to a

¹¹³ See R. Krause, *Numérisation du monde du travail: défis et besoin de réglementation en droit allemand*, in *Revue de Droit du Travail*, 2016, n. 10, which contains a number of useful references to Industry 4.0.

¹¹⁴ This can be seen in general, but also in particular circumstances (e.g. the rewriting of Article 4 of Act no. 300/1970). See E. Dagnino, *Tecnologie e controlli a distanza*, in *Le nuove regole del lavoro dopo il Jobs Act*, cit., 107-123, and the papers collected in the issue 1/2016 of *Labour Law Issues*.

¹¹⁵ Save for “the right to disconnect”, the parliamentary debate has not taken into account Draft Law no. 229/2016 presented, among others, by Senators Sacconi and D'Ascola, which aimed “to adapt negotiation processes to agile working in the fourth industrial revolution”

¹¹⁶ See Article 13 of Draft Law No. 2233/2016 that defines agile working as “a flexible way of performing salaried employment intended to increase productivity and easing work-life balance”.

¹¹⁷ See the Press Release n. 3 of the Incipit Group working at the Accademia della Crusca, titled “*Accogliamo con piacere il “lavoro agile”*”, 1 February 2016.

¹¹⁸ Reference is made to a “misguided attempt” because, notwithstanding the approval of the provision regulating agile working of 3 November 2016, par. 10, Article 3 of Legislative Decree no. 81/2008 still applies to teleworking and “to workers on salaried employment performing remote work on a continuous basis by means of ICT tools”.

misunderstanding concerning the concept of “teleworking” and “fixed workstation”¹¹⁹, with even the research centre of Italy’s Lower Chamber¹²⁰ apparently confirming that this law has come up short of regulating the ways of working that will be in place in the Fourth Industrial Revolution. Yet the production model associated with Industry 4.0 features a high degree of digitalisation and a close connection with the service sector, thus extending the use of agile working to other industries and trades requiring onsite presence in the past (e.g. manual labour)¹²¹. Needless to say, this form of employment also gives rise to a number of issues, among which is the role of working time which was used to assess performance and safeguard workers¹²². Because of technology, the concept of “place of work” becomes irrelevant and so do rules concerning occupational health and safety, making it more difficult to determine the start and the end of one’s working day. The fact that workers make themselves always available to work leads to the distinction between family and working life becoming blurred, increasing work-related stress and the degree of employee subordination. This state of play has produced a debate about work porosity, whereby working time is no longer based on a clear separation between private and professional lives, but on their alternation and complementarity¹²³, which also entail modern rights. Among them is the right to disconnect, which was codified into law for the first time in France¹²⁴.

¹¹⁹ See the European Framework Agreement on Telework of 16 July 2002 – which was implemented in Italy through Interconfederal Agreement of 9 July 2004. The agreement does not include the fixed workstation among the elements constituting telework. On this point, see E. Dagnino, *Lavoro agile: una questione definitoria*, in #Lavoroagile: misura di conciliazione o il lavoro ai tempi dell’Internet of Things?, Boll. spec. ADAPT, 2016, n. 2, edited by E. Dagnino - M. Tiraboschi.

¹²⁰ See the interpretation provided in the dossier 364/2015 by the Research Centre of Italy’s Lower Chamber concerning the draft law containing provisions promoting smart working A.C. 2014. According to this document, agile working is not prohibited, therefore this law serves the only purpose of derogating from existing rules (e.g. occupational health and safety legislation).

¹²¹ An example of this are maintenance persons, who make use of predictive technology featuring sensors producing data which help preventing issues or malfunctioning. This can take place through connected systems enabling operators to work on machine settings remotely. On this point, see T. Tiraboschi, *Manutentori 4.0: non solo nuove tecnologie ma anche nuovi modi di lavorare*, in Boll. ADAPT, 2016, n. 12.

¹²² On this topic, see the legal and historical reconstruction put forward by V. Bavaro, *Il tempo nel contratto di lavoro subordinato*, Cacucci, 2008, cap. I.

¹²³ See É. Genin, *Proposal for a Theoretical Framework for the Analysis of Time Porosity*, in *International Journal of Comparative Labour Law and Industrial Relations*, 2016, vol. 32, n. 3, 280-300.

¹²⁴ These risks have led lawmakers to discuss the so-called “right to disconnect”, especially following the introduction of France’s *Loi Travail*. On this topic, see S. Tourres, *Lavoro agile e diritto di disconnessione: una proposta francese*, in *Nova*, 4 giugno 2016. More generally, see I. Moscaritolo, *Diritto alla disconnessione: un diritto di nuova generazione?*, in Boll. ADAPT, 2016, n. 30.

The impact of digital manufacturing on labour markets, mobility, and occupational transitions is another aspect that is widely debated in discussions about Industry 4.0. Presently, it is difficult to predict the consequences that the Industry 4.0 paradigm will have on employment, though it might be the case that an overall decline will take place in the number of those employed in traditional manufacturing industry¹²⁵. These projections lead many to call into question the current welfare system – which is based on occupational status¹²⁶ – and to consider the provision of income support as an alternative to those aimed at safeguarding one's earnings¹²⁷. Examples of this include the universal basic income¹²⁸, early retirement schemes for those who have been pushed out of the labour market and are unable to re-enter it due to an increase of the skills level needed¹²⁹ to govern digitalisation, and monetary benefits to be used for training courses helping workers to find new employment. The way things stand now, it might also be important to overhaul the current system of active labour policies as they should consider the fluidity of Industry 4.0 processes – which somehow confirms the theory underlying transitional labour markets¹³⁰ – and elements like transferability of skills and forms of protection safeguarding workers when moving between jobs¹³¹. This is true if one considers that technical skills are given more relevance than soft ones, as the former are needed to manage software and operational models and to fully understand the links between complex systems.

¹²⁵ In relation to the US labour market, see E. Torpey, *Got skills? Think manufacturing*, Bureau of Labour Statistics, 2014.

¹²⁶ See the fascinating re-interpretation of research carried out by U. Prosperetti, *La posizione professionale del lavoratore subordinato*, Giuffrè, 1958. On this point, and on a review of the traditional welfare system, see ADAPT, *Lavoro e welfare della persona. Un "libro verde" per il dibattito pubblico*, 2016.

¹²⁷ See, also for comparative purposes, S. Spattini, *Il nuovo sistema degli ammortizzatori sociali dopo la legge 28 giugno 2012, n. 92*, Giuffrè, 2012, 18-20.

¹²⁸ See P. Van Parijs, *Basic Income: A Simple and Powerful Idea for the Twenty-First Century*, in *Politics & Society*, 2004, vol. 32, n. 1, 7-39. An evaluation of the possible results as compared to the effects of the unemployment insurance, see A. Fabre - S. Pallage - C. Zimmermann, *Universal Basic Income versus Unemployment Insurance*, IZA Discussion Paper, 2014, n. 8667.

¹²⁹ While not directly connected to the "technology" question, see T. Boeri - P. Garibaldi - E. Moen, *A Clash of Generations? Increase in Retirement Age and Labor Demand for Youth*, Inps, 2016.

¹³⁰ G. Schmid, *Sharing Risks of Labour Market Transitions: Towards a System of Employment Insurance*, in *British Journal of Industrial Relations*, 2015, vol. 53, n. 1, 70-93.

¹³¹ French legislation has recently introduced the *compte personnel d'activité*. On this point, see N. Maggi-Germain, *Il "conto personale di attività". Requiem for a dream?*, in *Loi travail: prima analisi e lettura. Una tappa verso lo "Statuto dei lavori" di Marco Biagi?*, edited by L. Casano - G. Imperatori - C. Tourres, ADAPT University Press, 2016, 46-51. In the United States, the Freelancers Union proposed to make use of "portable benefits" for workers operating in the digital economy. More information is provided in M. Saccaggi, *Statuto degli Autonomi: il "dettaglio" tralasciato sulla portabilità delle tutele previdenziali*, in *Boll. ADAPT*, 2016, n. 9.

It is often the case that much relevance is given to the consequences that the fourth industrial revolution will bring on industry, while the effects on administrative services, which are increasingly automatized, are largely neglected. Rather than devising initiatives to modernise specific sectors, the aim should be that of reviewing the planning and management of active policies¹³². Accordingly, occupational retraining in the context of employment services will need to be carefully developed to assist workers in moving between jobs. To this end, two paths should be followed: analysing skills needs at a local level to prepare future talent, on the one hand¹³³. Developing the ability to analyse individual skills by implementing skills certification systems as laid down by Fornero Law, on the other hand¹³⁴.

Investments in new technology, Big Data analysis and management, online platforms and interactive workstations call for new digital skills¹³⁵ which cannot be gained through traditional channels¹³⁶ but by means of innovative and

¹³² In his introduction to Klaus Schwab, op. cit. 3, the author insists on the general and cross-cutting nature of the current transformation, which affects both economic and social sub-systems, involving “entire systems, across (and within) countries, companies, industries and society as a whole”.

¹³³ Rather than a disruptive transformation, we are dealing with a progressive evolution. For example, the expression “labour law territorialisation” has been employed in France to underline the need to move beyond simple skills decentralisation and promote the role of labour policies: “Inscrite dans le cadre juridique de la décentralisation, la territorialisation fait appel à une autre logique: il s’agit d’articuler, lors de la prise de décision, les dimensions économique et sociale autour d’un projet commun structurant le territoire. Pour autant, l’une n’est pas exclusive de l’autre. Si décentralisation et territorialisation obéissent à des logiques différentes, elles s’inscrivent dans une certaine complémentarité » N. Maggi-Germain, *La territorialisation du droit. L’exemple des politiques de l’emploi et de la formation professionnelle continue*, in *Droit et Société*, 2008, vol. 2, n. 69-70, 441-477. More recently, S. Berhuet - C. Tuchsirer, *Les maisons de l’emploi ou l’introuvable politique territoriale de l’emploi*, in *Connaissance de l’Emploi*, 2015, n. 118.

¹³⁴ On the difficulties experienced in Italy to implement a system to clearly identify individual skills in the context of employment services, see Casano, *Il sistema della formazione: fondi interprofessionali, certificazione delle competenze*, in *Le nuove regole del lavoro dopo il Jobs Act*, cit., 471-484.

¹³⁵ On the relationship between technology and skills, see P. Adler, *New Technologies, New Skills*, in *California Management Review*, 1986, vol. 29, n. 1, 9-22; D. Acemoglu - D. Autor, *Skills, tasks and technologies: Implications for employment and earnings*, in *Handbook of Labor Economics*, vol. 4, part B, edited by O. Ashenfelter - D.E. Card, Elsevier, 2011, 1043-1171.

¹³⁶ There exists considerable research on training tools and techniques related to Industry 4.0. See Various Authors, *Educating Engineers for Industry 4.0: Virtual Worlds and Human-Robot-Teams. Empirical Studies towards a new educational age*, in IEEE, *Proceedings of 2016 IEEE Global Engineering Education Conference (EDUCON2016) “Smart Education in Smart Cities”*, 2016; Various Authors *Preparing for Industry 4.0 – Testing Collaborative Virtual Learning Environments with Students and Professional Trainers*, in *International Journal of Advanced Corporate Learning*, 2015, vol. 8, n. 4, 14-20. An evaluation of the “AssistMe” project aimed at introducing collaborative robots is offered in A. Weiss - A. Huber - J. Minichberger - M. Ikeda, *First Application of*

experimental methods¹³⁷ which alternate theory and practice. This is an aspect that has been pointed out in international literature¹³⁸. In other words, in the context of Industry 4.0, technical skills to perform non-routine tasks should complement non-cognitive ones. The main goal of new educational and pedagogical models is to enable workers to successfully manage unexpected situations which are typical of new production cycles. They should be trained to understand physical and digital reality and to examine increasingly complex problems¹³⁹.

The new skills needed by workers¹⁴⁰ and the network-like structure of the supply and the value chain in global markets also have an impact on local, national and international industrial relations systems, especially if one considers the new terms laid down by the employment contracts, which are now based on exchange and sharing. An example is provided by collaborative communities in which aspects like responsibility and autonomy are not rights granted to workers but a necessary condition to enable the smooth functioning of complex and unpredictable productive processes.

Moving on from standardised production in place during Fordism, along with the internationalisation of markets resulting from globalisation make the function of labour law and collective bargaining ineffective as forms of “common rule”¹⁴¹ to regulate the way of doing business, somehow frustrating

Robot Teaching in an Existing Industry 4.0 Environment: Does It Really Work?, in *Societies*, 2016, vol. 6, n. 3. In Italian-language literature, see G. Bertagna, *Il filo rosso della nuova formazione*, in *Lombardia 4.0. Competenze e lavori per il futuro. Materiali del Forum Interuniversitario promosso dalla Direzione generale Istruzione formazione e lavoro di Regione Lombardia nel periodo aprile-luglio 2016*, edited by Assolombarda - Regione Lombardia - Unioncamere Lombardia - Éupolis Lombardia, 2016, 86-96.

¹³⁷ The issue of devising new training and educational models resulting from social and economic changes is nicely dealt with in D. Barricelli (ed.), *Spazi di apprendimento emergenti. Il divenire formativo nei contesti di coworking, FabLab e università*, Isfol Research Paper, 2016, n. 29.

¹³⁸ See. S. Pfeiffer - A. Suphan, *op. cit.*

¹³⁹ In this sense, see L. Orsenigo, *Politiche per la ricerca e l'innovazione*, in *Investimenti, innovazione e città. Una nuova politica industriale per la crescita*, cit., qui spec. 219. See also the report produced by the World Economic Forum, *op. cit.*

¹⁴⁰ See L. Marcolin - S. Miroudot - M. Squicciarini, *Routine jobs, employment and technological innovation in global value chains*, OECD Science, Technology and Industry Working Paper, 2016, n. 1.

¹⁴¹ Reference should be made to outstanding, and still relevant, research produced by Sidney and Beatrice Webb back in 1897: “If, in the absence of a Common Rule, the “small employer”, with his imperfect machinery and insufficient capital, with inferior scientific training and inadequate knowledge of the markets, is enabled to divert business from superior establishments by nibbling at wages, requiring systematic overtime, overcrowding his factory, or neglecting precautions against accident, his existence is not only detrimental to the operatives, but also a clear diminution of the nation’s productive efficiency. Hence the enforcement of a Common Rule, by progressively eliminating the worst equipped employers

the traditional two-fold purpose of labour legislation¹⁴² (i.e. safeguarding both production and workers).

Although many see them as the most appropriate context to engage in industrial relations, firms too risks being inadequate to provide a legal framework that takes account of the new geography of work and innovative forms of agglomeration. This will impact on the revival of collective bargaining taking place at the local¹⁴³ and the individual¹⁴⁴ level. Confirming this aspect is the recent debate held in the US in relation to collective bargaining. Once focused on the company level, collective bargaining is now entering the local level, therefore moving outside the employer's premises¹⁴⁵.

All of this will result in a paradox. So far, the renewal of collective bargaining – which is even more difficult in Italy due to a large number of small and medium-sized companies – has involved striking a balance between the company and the national bargaining level. However, new production dynamics rely on trades and collective bargaining taking place at the local level, on which employee representation will also be assessed. In all likelihood, this new trend will pave the way for a comeback of those “craft unions” in place during the First Industrial Revolution or those forms of local bilateralism that

and concentrating the whole pressure of competition on securing the utmost possible efficiency of production, tends constantly to the development of the highest type of industrial organisation”. Significantly, they also specified that “the Device of the Common Rule is, from the workman's point of view, always the enforcement of a minimum, below which no employer may descend, never a maximum, beyond which he may not, if he chooses, offer better terms”. See, S. Webb - B. Webb, *Industrial Democracy*, Longmans, 1926 (but first printed in 1897), 732 and 715.

¹⁴² In relation to theories concerning internal and external labour markets, reference needs to be made to P.B. Doeringer- M.J. Piore, *Internal Labor Markets and Manpower Analysis*, Lexington, 1971.

¹⁴³ In this sense, see G. Sateriale, *Sindacato 5.0: come, quale*, in *Il Diario del Lavoro*, 27 October 2016. The author acknowledges, if partly, the need to regulate the new geography of work and related processes (i.e. Industry 4.0). For this reason, he points out that “an innovative model of social and employee representation should be necessarily based on the higher involvement of union confederations as opposed to unions operating at industry level and on a new contractual system where local collective bargaining should be seen as a privileged channel for negotiations taking place at the company level. This is without prejudice to a national collective agreement ensuring basic protections to all workers” (emphasis added).

¹⁴⁴ This was the project outlined in Draft Law no. 2229/2016 among others, by Senators Sacconi and D'Ascola, which aimed “to adapt negotiation processes in agile working in the fourth industrial revolution”, which proposed to make use of the certification of the employment contracts to ensure the genuine nature of workers' claims.

¹⁴⁵ See D. Madlan, *The Future of Workers Voice and Power*, Center for American Progress, 2016. A comment in Italian is provided by P. Tomassetti, *E se il contratto del futuro fosse il CCNL? Una provocazione e una ipotesi di convergenza tra modelli contrattuali sulle sponde dell'Atlantico*, in *Boll. ADAPT*, 2016, n. 35.

Biagi Law¹⁴⁶ considered as a privileged channel to regulate Italy's industrial relations¹⁴⁷. The local character of collective bargaining is particularly welcome if one considers that Italy's National Institute of Statistics¹⁴⁸ has calculated that 600 "local labour areas"¹⁴⁹ have developed in our country so far.

5. As already pointed out in the introductory section of this paper (see par. 1), the initial version of Italy's Jobs Act and the National Industry 4.0 Plan had much in common. After admitting the shortcomings of the previous labour reforms and in an awareness that "it is entrepreneurs, and not laws, that create employment"¹⁵⁰, in 2014 the then Prime Minister Matteo Renzi put forward proposals concerning different areas (energy, taxes, red tape) and sectors (manufacturing, digital and ICT industry). Yet measures related to labour market regulation and employee representation remained in the background.

Industry 4.0-related initiatives are neither openly aimed at creating more job opportunities nor intended to limit the consequences of production automation. Nevertheless, the investments set aside to boost employment in manufacturing – one of the sectors employing the largest number of workers in Italy – seem to be in line with the original aim of the Jobs Act in relation to industry digitalisation.

On close inspection, statistics confirm that the number of workers in manufacturing is dropping in all OECD countries. Some recent research¹⁵¹ has pointed out that this decrease started in 1980, the year in which the sector employed the largest number of people. Significantly, the share of workers in manufacturing is higher in Italy and Germany than it is in other countries (e.g.

¹⁴⁶ Mention should be made of let. h), par. 1 of Article 2 of Legislative Decree no. 276/2003, which regarded bilateralism as a privileged channel for labour market regulation.

¹⁴⁷ In this sense, see M. Tiraboschi, *Bilateralism and Bilateral Bodies: The New Frontier of Industrial Relations in Italy*, in *E-Journal of International and Comparative Labour Studies*, 2013, vol. 2, n. 1, 113-128 and the bibliography therein.

¹⁴⁸ The National Institute of Statistics (ISTAT) regularly releases data on the number of people employed and those looking for a job in a given "local labour system". The information used to provide estimates is based on surveys carried out on the workforce considering 611 local labour systems. These are sub-regional geographical areas where the bulk of the labour force lives and works. They have been identified by ISTAT in the 15th Census on the Population and Housing, according to a new methodology recognised at the European level (Euro).

¹⁴⁹ Against the context of the new geography of work, a more detailed identification of local labour markets should consider not only workers' mobility, but also local production, the number of business networks and industrial districts in the area, the degree of interaction between school and industry, the rate of tax evasion, the number of workers coming from abroad, and local collective bargaining and welfare systems.

¹⁵⁰ See M. Renzi, *eNews 381*, in *www.matteorenzi.it*, 8 January 2014.

¹⁵¹ See D. Rodrik, *Premature Deindustrialisation*, National Bureau of Economic Research, 2015.

United States, the UK, and France)¹⁵². Rather than an exception in the international scenario, this trend can be seen as Italy's delay in the transition towards the service economy.

These indicators suggest that taking on the challenges posed by Industry 4.0 should be considered as a way to modernise national industry and not to increase the number of workers in manufacturing, as was the case in the past. This transition would step up job quality in the sector (in terms of specialisations, economic value and protections) while also increasing labour productivity, more broadly. However, this will take place provided that an evolution of the national industrial relations system is put in place – particularly at a local level¹⁵³ – which should help to create networks between school and businesses¹⁵⁴ and prompt change when national legislation fails to do so.

A further element that upholds the importance of looking at the National Industry 4.0 Plan from a labour law perspective and not only from a technological one concerns workers' skills¹⁵⁵ and trade evolution. New trades and skills are enabling factors at the time of using new technologies adopted in the value creation chain and favour the matching of labour demand and supply in innovative contexts.

As seen, this can be done only if institutions and rules governing local labour markets are modernised, thus laying the foundations of a new “Labour Market Law”. Unlike the skills certification system laid down in Fornero Law¹⁵⁶, this new legal paradigm should facilitate occupational transitions¹⁵⁷ and the link

¹⁵² See OECD, *Employment by activities and status*, OECD.Stat. Data collected on 10 November 2016.

¹⁵³ On p. 43 of the *Position Paper on Industry 4.0* already referred to, it is stressed that “one of the challenges of Industry 4.0 will concern the industrial relations system and the need to move away from the concept of “guaranteed pay” and perfectly defined, routine tasks. Evidently, the national collective agreement will provide the general framework within which employment relationships will be defined, but aspects like productivity and new tasks resulting from Industry 4.0 are to be dealt with at a local level”.

¹⁵⁴ On the relationship between school and industry, cf. A. Balsamo, *Reti scuola-impresa: un modello d'integrazione tra scuola e lavoro per l'industria 4.0*, ADAPT University Press, 2017. On the networks comprising university and industry cf. M. Tiraboschi, *Dottorati industriali, apprendistato per la ricerca, formazione in ambiente di lavoro. Il caso italiano nel contesto internazionale e comparato*, cit.

¹⁵⁵ See, M.R. Weise - C.M. Christensen, *Hire Education Mastery – Modularization, and the Workforce Revolution*, Clayton Christensen Institute for Disruptive Innovation, 2014. See also L. Casano, *Istruzione e formazione, ovvero il tassello mancante della grande trasformazione del lavoro*, in *Nòva*, 15 settembre 2014.

¹⁵⁶ See par. 51, Article 4 of Act no. 92/2012, and the rights to lifelong learning and skills certification. On this point, see G. Bertagna - L. Casano - M. Tiraboschi, *Apprendimento permanente e certificazione delle competenze*, in *La nuova riforma del lavoro*, edited by M. Magnani, M. Tiraboschi, Giuffrè, 2012, 398 and ff.

¹⁵⁷ Cf. G. Schmid, *op. cit.*

between an innovative education and training system¹⁵⁸ and the labour market, also when adults are involved.

Against such a complex background, one should recall that nearly half of Italian workers possess low technological skills¹⁵⁹, which makes it difficult for the National Industry 4.0¹⁶⁰ plan to take off. This is also because of the fact that Italy features a large number of small- and medium-sized enterprises¹⁶¹. This will hold even truer if the Industry-4.0 phenomenon will be examined only from a technological point of view and not from a labour law perspective, as we have attempted to do in this paper.

¹⁵⁸ See the *Position Paper on Industry 4.0*, cit., esp. par. 3.4 titled “The educational system”.

¹⁵⁹ Cf. OECD, *OECD Skills Outlook 2015: Youth, Skills and Employability*, OECD Publishing, 2015.

¹⁶⁰ On this point, see Airi, *Nota di approfondimento su Industria 4.0*, 2016.

¹⁶¹ See the *Position Paper on Industry 4.0*, p. 46.