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Industry 4.0 + Industry 5.0 = Happy Marriage Between Humans and Technology

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1. Introduction: from humans for technology to technology for humans. 2. The impact of Industry 4.0 on work and regulatory challenges and responses. 3. The idea of Industry 5.0 and its impact on work. 4. Foundational principles of care and non-extractive business conduct. 5. Conclusions: towards a happy marriage between humans and technology.

Abstract

In this paper it will be argued that the addition of human-centred Industry 5.0 to the technological innovation driven Industry 4.0 has the potential to lead to a happy marriage between humans and technology. After addressing the impacts of Industry 4.0 on work based on a literature review, the aim and aspirations of Industry 5.0 are assessed based on documents from the European Commission. The aspirations of Industry 5.0 are further evaluated in the wider context of paradigm shift in socio-economic thinking from a productivity and profit driven neoliberal free market economy to a human centred and planetary boundaries respecting wellbeing economy. Following the paradigm shift and new work narratives that come with it, the paper continues with a rethinking of the regulatory approach of work by introducing two new foundational principles. The paper concludes that with such new foundational principles, the aspirations of Industry 5.0 may lead to a more human friendly technology driven Industry 4.0.

Keywords: Industry 4.0; Industry 5.0; Humanizing The Workplace; Principle Of Care; Principle Of Non-Extractiveness; Socioecological Labour Law.

1. Introduction: from humans for technology to technology for humans.

In the context of work, it is common practice to express disruptive technological developments as industrial revolutions. This started with the invention of the steam engine in the late 18th century. With the introduction of internet in the 1990s, the internet of things (IoT), and the development of artificial intelligence (AI) since the 2010s, all disruptive technological developments, the fourth industrial revolution (Industry 4.0) has been announced. Industry 4.0 is characterized by applying and using new technologies because it is possible to do so. If every technological innovation is also considered as progress is

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debatable,[1] but within the context of the current dominant socioeconomic system of neoliberal free market capitalism, progress could mean that the introduction of new technologies results at least into higher levels of productivity and short-term profits for shareholders. Industry 4.0 has also resulted into new forms of employment relationships, especially various forms of platform labour enabling the gig-economy, which could be considered as progress because it increases the flexibility and autonomy in the employment relationship.[2]

Although many technological innovations undoubtedly have resulted in such forms of progress, for example the use of a robot to assist in surgeries and the use of AI as a 24/7 frontline helpdesk service, the use and need of many technological innovations is questionable. In fact, numerous technological innovations seem to render humans at the service of that technology instead of that technology at the service of humans.[3] Often this is illustrated with jobs in the warehouses of Amazon, employee privacy intrusive surveillance technology, and various forms of algorithmic management. The disbalance between what technologically is possible and what technology is also desirable from the perspective of the needs of the workers is core to Industry 5.0.

Unlike other industrial revolutions, Industry 5.0 is not a temporal continuation of technological developments following on Industry 4.0. Industry 5.0 should be seen as complementary to Industry 4.0 by focussing on what technology can do for humans, rather than how humans can serve technology.[4] More particularly, in combination with Industry 4.0, the aim of Industry 5.0 is to make the transition to a sustainable, human-centric, and resilient European industry.[5] This approach has the potential to fundamentally change the purpose of businesses, and the narrative and meaning of work.[6] The aim of this paper is therefore to explore what Industry 5.0 aspires to, how that fits in broader socioeconomic ideas related to post-growth, what new foundational principles this may require for business activities, and what this means for the regulation of work activities.

To explore this, the paper is structured as follows. Sections 2 and 3 address Industry 4.0 and 5.0 in more detail. For Industry 4.0 this is done based on a structural literature review

[1] *See* for example: Mueller G., *Breaking Things at Work: The Luddites Are Right About Why You Hate Your Job*, Verso Books, New York, 2021.

[2] Cf. for the idea of a changing employment relationship as a form of progress: Bueno N., *The value of work in labour law*, in Bueno N., ter Haar B., Zekić N. (eds.), *Labour Law Utopias: Post-Growth and Post-Productive Work Approaches*, Oxford University Press, Oxford, 2024, 116–132.

[3] Prassl J., *Humans as a service: the promise and perils of work in the gig economy*, Oxford University Press, Oxford, 2018; Aloisi A., De Stefano V., *Your boss is an algorithm: artificial intelligence, platform work and labour*, Hart Publishing – Bloomsbury Publishing, 2022; Rogers B., *Data and Democracy at Work: Advanced Information Technologies, Labor Law, and the New Working Class*, The MIT Press, (Cambridge – U.S.A.), 2023.

[4] Breque M., De Nul L., Petridis A., *Industry 5.0 : towards a sustainable, human-centric and resilient European industry*, European Commission – Directorate-General for Research and Innovation, Publications Office of the European Union, Brussels, 2021, 15, available at: https://data.europa.eu/doi/10.2777/308407.

[5] European Commission on Research and Innovation, *What is Industry 5.0?*, available at: https://research-and-innovation.ec.europa.eu/research-area/industrial-research-and-innovation/industry-50_en (accessed 14 June 2024).

[6] Breque M., De Nul L., Petridis A, nt. (4), 53; *see* also: ter Haar B., *The freedom to conduct a business, a care paradigm, and industry 5.0 for compliance with labour rights in global value chains*, 10th ILERA Africa Congress, Victoria Falls, Zambia, 3-4 April 2024.

on the social impact of Industry 4.0 conducted by Grybauskas, Stefanini and Ghobakhloo in 2022[7] with a particular focus on labour law research. For Industry 5.0 this is done by an analysis of the documents of the European Commission which has introduced Industry 5.0 as part of its innovation policies. More particularly, the analysis of what Industry 5.0 aspires to is based on the documents of the Expert group the European Commission established on the economic and societal impact of research and innovation (ESIR). Furthermore, the aspirations of Industry 5.0 will be related to more general socioeconomic ideas for a more human centric and planetary sustainable world.[8] This is important, because it will illustrate that the aspirations of Industry 5.0 do not stand in isolation. Based on the understanding of Industry 5.0 developed in section 3 and drawing from the more general socioeconomic ideas, section 4, turns to formulating new foundational principles for the regulation of work. Section 5 concludes with reflections on how Industry 5.0 as complementary concept to Industry 4.0 can create a happy marriage between the human and technology.

2. The impact of Industry 4.0 on work and regulatory challenges and responses.

In their structural literature review Grybauskas c.s. 256 papers for their bibliographical and content analysis. Out of those 256 papers, about two-third (173) are purely conceptual, meaning that they lack any empirical base for the social impact of Industry 4.0. Most of the selected papers (187) focused on specific (potential) social implications of Industry 4.0. Out of those 187 papers, 85 papers mainly consider the negative social implications of Industry 4.0, 70 papers address both, positive and negative social implications, and only 32 papers considered mostly the positive implications of Industry 4.0.[9] As Grybauskas c.s. highlight, this result shows that the "scientific viewpoint about the social implications of digitalisation tends to be quite negative".[10] This is even the more so, when realising that two-third of those papers (187) are not based on empirical evidence of the social impact of Industry 4.0.

For the analysis of the topics addressed in the selected papers, Grybauskas c.s. follow a micro-macro sustainability perspective that is widely used in the literature to assess the scope and extent of the social impact of Industry 4.0. This perspective is based on a definition of Industry 4.0 as "the digitalization of value creation and delivery processes at the micro (individual/inter-organizational) level, meso (intra-organizational) level, and macro (industry/regional) level."[11] For the purpose of this paper, namely to get an impression of the impact Industry 4.0 made on labour law, the following six topics that are also addressed

[7] Grybauskas A., Stefanini A., Ghobakhloo M., *Social sustainability in the age of digitalization: A systematic literature Review on the social implications of industry 4.0*, in *Technology in Society*, 70, 2022.
[8] ter Haar B., Otto M., *AI for a More Human Friendly Workplace Recovery After COVID-19*, in Addabbo T., Ales E., Curzi Y., Fabbri T., Rymchevich O., Senatori I. (eds), *Work Beyond the Pandemic*, Palgrave MacMillan, London, 2024, 113–132; ter Haar B., *Industry 5.0 key to face Europe's challenge to create a human face*, in *Revue de Droit du Travail*, 1, 2024, 300-304; and ter Haar B., *Economic Paradigm Shifts for Labour Law*, in Bueno N., ter Haar B. and Zekić N. (eds.), *Labour Law Utopias: Post-Growth and Post-Productive Work Approaches*, Oxford University Press, Oxford, 2024, 129–150.
[9] Grybauskas A., Stefanini A., Ghobakhloo M., nt. (7), 5-6.
[10] Grybauskas A., Stefanini A., Ghobakhloo M., *ibidem*, 6.
[11] Grybauskas A., Stefanini A., Ghobakhloo M., *ibidem*.

by Grybauskas c.s. will be addressed:[12] 1) increase/decrease of the number of jobs; 2) Automation of jobs by AI and robots; 3) Skill needs to work side-by-side with AI and robots; 4) Skill development and lifelong learning; 5) Changing employment relationships and work arrangements; and 6) Occupational health and safety and fundamental rights. Since the research and literature on topics 2 and 3 are intertwined, those topics are discussed together.

Topic 1. Increase/decrease of the number of jobs.

Both, in research and policy documents, there seems to be no consensus on whether the number of jobs will increase or decrease. In general, in the field of labour law research this topic has gained not a lot of attention, maybe because it is considered more as a labour market issue rather than one of labour law sic. There seem to be merely two strong voices that warn for serious job losses and that something needs to be done to prevent it (Estlund)[13] and/or to ensure alternative forms of income (Estlund;[14] Weil).[15] Most other labour law academics seem to follow the more optimistic policy analyses of the European Union and the International Labour Organization, which indicate that more or less as many jobs will disappear as will be created.[16] In fact, the EU's *Digital Decade Programme 2030*[17] mentions nothing about the loss of jobs, instead the focus is on the digitalisation of jobs and what kind of digital (up)skilling and (re)training of the workforce will be needed.[18]

Topic 2. Automation of jobs by robots and AI

Topic 3. Skill needs to work side-by-side with robots and AI

Since in the literature topics 2 and 3 are intertwined, I address them here together. Starting with topic two, what kind of jobs will be automated, on this too there seems to exist no consensus, except that empirical evidence shows that all types of jobs are at risk to be automated. Whereas in previous industrial revolutions automation seemed to be limited to jobs with repetitive or routine elements,[19] no job seems to be safe from automation in this fourth industrial revolution. An interesting analysis of this development is provided by

[12] Grybauskas A., Stefanini A., Ghobakhloo M., *ibidem*, 6, qualify these six topics as micro-level. The three macro topics are: digital regional development; digital literacy; and the effects of remote working on society. Grybauskas c.s., nt. (7), 7-8.

[13] Estlund C., *Automation anxiety: why and how to save work*, Oxford University Press, Oxford, 2021.

[14] Estlund C., *ibidem*.

[15] Weil D., *The Fissured Workplace: Why Work Became So Bad for So Many and What Can Be Done to Improve It*, Harvard University Press, Cambridge (USA), 2014.

[16] Cf. Ramaphosa C., Löfven S., *Work for a Brighter Future.* Global Commission on the Future of Work, ILO, Geneva, 2019.

[17] Decision (EU) 2022/2481 of the European Parliament and of the Council of 14 December 2022 *establishing the Digital Decade Policy Programme 2030* (OJ[2022] L323/4). See also the page "Europe's Digital Decade" on the EU's website on "Shaping Europe's digital future, available at: https://digital-strategy.ec.europa.eu/en/policies/europes-digital-decade#tab_3 (accessed 30 July 2024).

[18] See for a quick overview of the "trajectories" of the Digital Decade Policy Programme the Annex to European Commission Communication *establishing Union-level projected trajectories for the digital targets* (C(2023) 7500 final), and for a quick overview of the progress on those trajectories on the EU's website on "Shaping Europe's digital future", the facts on the yearly State of the Digital Decade report, which for 2024 is on this page: https://digital-strategy.ec.europa.eu/en/factpages/state-digital-decade-2024-report (accessed 30 July 2024).

[19] These kinds of jobs are still extremely susceptible for (further) automation though: cf. Drahokoupil J., *Introduction: Digitalisation and automotive production networks in Europe,* in Drahokoupil J. (ed.), *The challenge of digital transformation in the automotive industry: jobs, upgrading and the prospects for development*, ETUI, Brussels, 2020.

Daugherty and Wilson based on their experience and research on the digitalisation of work and work processes with about 1500 organisations.[20] Particularly, in their research they emphasise what kind of skills or work activities can be automated by machines (robots and AI) and what that will leave for the human worker and what kind of collaborations that will create between the human and the machine. What is interesting in their approach is that the focus is not so much on jobs, rather it is on skills and competences needed to perform certain job activities.[21]

In their follow-up study in which they describe a profound shift toward more human-centred and more humane technology. They present two main reasons for this shift. First AI is becoming more human and more adjusted and adapted to the needs of humans and the ways of doing as humans, which makes it more humane. Second, at the same time, humans are getting more used to working with AI and adopt activities and working processes to AI and are getting more adapted to AI, which makes AI more human-centred.[22] This means that in any case more workers (or in fact every citizen) need to become (more) digitally skilled, which is exactly what the EU promotes in its *Digital Decade Programme 2030*.[23]

However, how adaptable humans in general and workers in particular are to new technologies is debatable. As analysed by Rogers, the lack of the feeling of influence on technological innovations at the workplace, may lead to a certain resistance to adapt to those technological innovations.[24] In general, in labour law literature not a lot of attention is raised for these two topics,[25] instead it seems often taken as a given, which then turns the attention to the possible consequences of the digitalised workplace by addressing issues such as occupational safety and health, working time, equal treatment, and workplace democracy. These are all subjects that are part of topics 5 and 6 as identified by Grybauskas c.s. in their literature review (see below).

Topic 4. Skill development and lifelong learning

Related to especially topics 1 and 2, the research question follows of what kind of education will be needed. When work activities are replaced by robots and AI, what kind of activities will be left for the human workforce and what kind of knowledge and training does that require. What kind of skills are needed to work together with robots and AI? These questions clearly move beyond the need of digital literacy only, however, in labour law literature, these are hardly addressed. To a certain extent this makes sense, since these are

[20] Daugherty P.R., Wilson H.J., *Human + Machine: Reimagining Work in the Age of AI*, Harvard Business Review Press, Brighton, 2018.
[21] Daugherty P.R., Wilson H.J., *ibidem*. In similar vein: Susskind R., Susskind D., *The future of the professions: how technology will transform the work of human experts, updated edition*, Academic & Trade, 2019, 391-394.
[22] Daugherty P.R., Wilson H.J, nt. (20), 12, 230-232
[23] Digital target 1 of the EU projected trajectories of the Digital Decade Policy Programme. See European Commission C(2023) 7500 final, nt. (18), par. 3.2.1 Basic Skills. See on this also Susskind D., *A World without Work: Technology, Automation, and How We Should Respond*, Penguin Books, London, 2021; Susskind R., Susskind D., nt. (21).
[24] Rogers B., nt. (3), 131.
[25] Besides Rogers B. nt. (3), among a few others: ter Haar B., Otto M., nt. (8), 113–132; Taes S., *Robotisation and Labour Law. The Dark Factory: the Dark Side of Work?*, in De Bruyne J., Vanleenhove C. (eds), *Artificial Intelligence and the Law*, Intersentia, 2021, 285–316.

questions more related to labour market policies, however, there are labour related issues linked to these issues. For example, who will pay for the costs for retraining, reskilling and upskilling that will be needed: is it the employer, the employee, the state, or a combination? Also, when should these training activities take place: during working hours or private time? Additionally, is there or should there be a role for social partners, such as information and consultation rights, and should training arrangements be part of collective labour agreements or social plans? Other, related questions include, what happens when the employee fails in the retraining or upskilling (demotion; termination of the employment contract); which employees will be entitled for retraining/upskilling;[26] or what happens when the employee wants to leave the job after the retraining/upskilling?[27]

Of course, the topic of retraining/upskilling is not new in the field of labour law but given the fact that it is acknowledged that it will be needed for many workers to make the twin-transition (technological and green),[28] it seems justified to expect that the topic would raise renewed attention in labour law research.[29] Especially, as is emphasised by Martišková in a study conducted in collaboration with the European Trade Union Institute on the implementation of Industry 4.0 in the automotive industry in Central Eastern European countries (CEE), '[e]ffective reskilling and retraining policies are costly and require both personal engagement and a plausible institutional framework whose parameters are set by collective bargaining and/or by public institutions.'[30] However, in practice, so concludes Martišková, all of these seem to be lacking.

[26] Given the costs and time investment that comes with the training, requirements may apply concerning length of service, experience, and age. See on this, among others, the case law of the Court of Justice of the European Union in the context of age discrimination, particularly Case 416/13 Mario Vital Pérez v. Ayuntamiento de Oviedo [2014] ECLI:EU:C:2014:2371; Case 229/08 Colin Wolf v Stadt Frankfurt am Main [2010] ECLI:EU:C:2010:3; and Case 258/15 Gorka Salaberria Sorondo v. Academia Vasca de Policía y Emergencias [2016] ECLI:EU:C:2016:873.

[27] See on this also the case law of the European Court of Human Rights with regard to Article 4 of the European Convention of Human Rights (on slavery and forced labour), in particular the cases *Chitos v. Greece*, no. 51637/12, ECHR 2015 and *Lazaridis v. Greece* (dec.), no. 61838/14, 12 January 2016.

[28] E.g. the ILO's Strategy on skills and lifelong learning 2023: https://www.ilo.org/publications/ilo-strategy-skills-and-lifelong-learning-2030 (accessed 31 July 2024); and on its 'reform support' webpage , available at https://reform-support.ec.europa.eu/what-we-do/digital-transition_en#digital-skills-education-and-training (accessed 31 July 2024), the EU states that "[o]ngoing digital and green transformations bring fast economic restructuring, which requires people to engage in lifelong learning. Moreover, these transitions require Member States to unlock their full skills and innovation potential. This includes reforms to improve the quality of education and training systems." [emphasis in original].

[29] In the field of labour law, the issue of lifelong learning is addressed, but as a labour market policy and not in relation to labour rights, obligations, and relations. See for example: Cassano L., *The Future of European Labour Law and the Right to Employability: Which Role for the Validation of Non-Formal and Informal Learning?*, in *European Labour Law Journal*, 7, 3, 2016, 498–519; Numhauser-Henning A., *Flexible Qualification — a Key to Labour Law?*, in *International Journal of Comparative Labour Law and Industrial Relations*, 17, 1, 2001, 101–116. There might be exceptions in national literature that I have no access to, for example this book in Dutch: Heerma van Voss G.J.J. (ed.), *Scholing in het sociaal recht*, Kluwer, 2008. The research group Labour law and lifelong learning is working on a collective book exploring various labour law issues related to lifelong learning. Planned publication date is Spring 2025; see: https://blogs.helsinki.fi/lifelonglearning-labourlaw-researchgroup/ (accessed 31 July 2024).

[30] Martišková M., *The transformation of jobs and working conditions: Towards a policy response*, in Drahokoupil J. (ed.), *The challenge of digital transformation in the automotive industry: jobs, upgrading and the prospects for development*, ETUI, Brussels, 2020, 153-175.

Topic 5. Changing employment relationships and work arrangements

Issues addressed under this topic include the proliferation of various forms of flexible work arrangements, among which short term contracts, various forms of platform labour, and the idea of "working anytime and anywhere", and their consequences, especially the loss of labour law protection and the blurring lines between private and working time. These are issues that are extensively addressed in the field of labour law, with as typical examples the issue of the qualification and the protection of the rights of atypical workers, including platform workers,[31] collective labour rights of such workers,[32] and remote work, work-life balance, and the right to disconnect for all workers.[33]

Topic 6. Occupational health and safety of workers and fundamental rights

Similar to topic 5, this topic too is extensively addressed in labour law research. There seems to exist consensus that the occupational health and safety of workers can be improved by the automation of dangerous jobs, but it also comes with challenges.[34] At a rather general level, the health and safety of workers may be negatively impacted by the flexible work arrangements (topic 5) and lifelong learning (topic 4), since these could exacerbate the human non-stop working and learning cycle, which contribute to risks such as stress, mood, and fatigue. Besides occupational health and safety, this also strongly relates to working time

[31] Among numerous publications: Devolder B. (ed.), *The platform economy: unravelling the legal status of online intermediaries*, Intersentia, 2019; Durri I., *Casual work arrangements and platform-based work: the casual work agenda as a way to enhance the labour protection of platform workers*, Kluwer Law International, 2023; Kocher E., *Digital work platforms at the interface of labour law: regulating market organisers*, Hart Publishing, 2022; Perulli A., Treu T. (eds.), *The future of work: labour law and labour market regulation in the digital era*, Wolters Kluwer, 2021; De Vos M., Anderson G., Verhulp E. (eds), *The Cambridge Handbook of Technological Disruption in Labour and Employment Law*, Cambridge University Press, 2023; Aloisi A., *Platform work in Europe: Lessons learned, legal developments and challenges ahead*, in *European Labour Law Journal*, 13, 1, 2022, 4–29; Hiessl C., *The legal status of platform workers: regulatory approaches and prospects of a European solution,* in *Italian Labour Law e-Journal*, 15, 1, 2022, 13-28; Mangold S., *Platform work and traditional employee protection: The need for alternative legal approaches*, in *European Labour Law Journal*, 2024.

[32] Especially: Stylogiannis C., *Collective Labour Rights for Self-Employed Workers A Human Rights-Based Approach of Platform Work,* Wolters Kluwer Law International, 2023; Carinci M.T., Dorssemont F. (eds.), *Platform work in Europe towards harmonisation?,* Intersentia, 2021; Senatori I., Spinelli S. (eds.), *Litigation (Collective) Strategies to Protect Gig Workers' Rights. A Comparative Perspective,* Giappichelli Editore, Turin, 2022.

[33] Various contributions in: Carby-Hall J., Méndez L.M. (eds.), *Labour Law and the Gig Economy. Challenges posed by the digitalisation of labour processes*, Routledge, London, 2020, especially: Ushakova T., *Work-life balance and Industry 4.0 in the legal framework of the European Unio*n, 190-208; Rodríguez González S., *Digital disconnection as a limit to corporate control of working time*, 209-221; Lerouge L., *The right to disconnect from the workplace: strengths and weaknesses of the French legal framework*, 222-229. *See* also: Rosin A., *Cross-border telework and the applicable labour law: The role of different connecting factors in determining objectively applicable law*, in *European Labour Law Journal,* 2024; Senatori I., Spinelli S., *(Re-)Regulating Remote Work in the Post-pandemic scenario: Lessons from the Italian experience*, in *Italian Labour Law e-Journal*, 14, 1, 2021, 209-260; Tardivo D., *Digital nomads' health and safety: the European perspective*, in Menegatti E. (ed.), *Law, Technology and Labour*, Italian Labour Law e-Studies, 2023, 246-260; ter Haar B., *Study on issues of Remote Work in Times of the COVID-19 Pandemic and Beyond*, CIELLS Study, 2021; Zucaro R., *The right to disconnect. Protection profiles*, in *Labour & Law Issues,* 5, 2, 2019, 214-233; Ludera-Ruszel A., Naumowicz K., *Personal Dimension of the Right to Disconnect in the EU Directive Draft,* in *Studia z Zakresu Prawa Pracy i Polityki Społecznej*, 30, 3, 2023, 201-209.

[34] Brown R., *Robots, New Technology, and Industry 4.0 in Changing Workplaces. Impacts on Labor and Employment Laws*, in *American University Business Law Review*, 7, 2018, 349-382; Jarota M., *Artificial intelligence and robotisation in the EU - should we change OHS law?*, in *Journal of Occupational Medicine and Toxicology*, 16, 18, 2021, available at: https://doi.org/10.1186/s12995-021-00301-7 ; and Maroń J., *Challenges for the development of the principles of Industry 4.0 in the context of occupational security and safety – selected conditions*, in Makiela Z., Stuss M. M.,Borowiecki R. (eds.), *Sustainability, Technology and Innovation 4.0,* Routledge, London, 2021, 84-99.

issues, especially the blurring of private and working time.[35] At a more detailed level, the impact of Industry 4.0 leads to issues of employer liability and decision-making.[36] By far most of the research attention is dedicated to the infringements of fundamental rights, especially the right to privacy, equal treatment, and collective bargaining, due to the introduction of technological innovations, particularly algorithmic management and digital surveillance.[37]

3. The idea of Industry 5.0 and its impact on work.

The literature on the impact of Industry 4.0 shows that what is technological possible often drives innovations, especially when they promise to boost workplace productivity.[38] Sometimes the technological innovation is also beneficial for the worker, but in general it seems that technological innovations pose significant challenges for workers and labour law. Since in general the aim of academic research is to find solutions for problems, it is not surprisingly that most of the research focuses on the negative impacts of technological innovations for work, the worker and labour law. That technological innovations have a disruptive effect has clearly not remained unnoticed by academics only, it has also raised the attention of policy makers. Four years after the Japanese Council for Science presented a government-wide vision for the future of Japan called Society 5.0,[39] the EU introduced something similar called Industry 5.0. On its website about Industry 5.0, the European Commission emphasises that Industry 5.0 complements Industry 4.0 by 'specifically putting research and innovation at the service of the transition to a **sustainable, human-centric** and **resilient European industry**.'[40] [emphasis in original] To this end, Industry 5.0

[35] *See*: nt. (33).
[36] *See*: nt. (34). *See* also: Cefaliello A., Inversi C., *The impact of the gig-economy on occupational health and safety: Just an occupation hazard*?, in De Stefano V., Durri I., Stylogiannis C., Wouters M. (eds.), *A Research Agenda for the Gig Economy and Society*, Edward Elgar Publishers, Cheltenham, 2022, 33-52.
[37] *See* among numerous others: the various contributions in ETUI-Transfer, *Regulating AI at work: labour relations, automation, and algorithmic management*, 29, 1, 2023; the various contributions in the special issue of *European Labour Law Journal,* 14, 2, 2023, with guest editors Adams-Prassl J., Abraha H., Kelly-Lyth A., Silberman M. 'Six', and Rakshita S.; the various contributions in *Automation, Artificial Intelligence & Labor Law*, in *Comparative Labor Law & Policy Journal,* 41, 1, 2019, special issue with guest editor De Stefano V. *See* also: Aloisi A., *Regulating Algorithmic Management at Work in the European Union: Data Protection, Non-discrimination and Collective Rights*, in *International Journal of Comparative Labour Law and Industrial Relations*, 40, 1, 2024, 37-70; Molè M., Mangan D., *Just more surveillance: The ECtHR and workplace monitoring*, in *European Labour Law Journal*, 14, 4, 2023, 694-700; Otto M., *A step towards digital self- & co-determination in the context of algorithmic management systems*, in *Italian Labour Law e-Journal*, 15, 1, 2022, 51-64; Atkinson J., Collins P., *Algorithmic Management and a New Generation of Rights at Work*, Institute of Employment Rights, 2024, available at SSRN: http://dx.doi.org/10.2139/ssrn.4853536 (accessed 1 August 2024).
[38] Cf. Albin E., *Channelling Technologies to Benefit Employees via Labour Law*, in Bueno N., ter Haar B., Zekić N. (eds.), *Labour Law Utopias: Post-Growth and Post-Productive Work Approaches*, Oxford University Press, 2024, 177-200.
[39] Hitachi-UTokyo Laboratory (ed.), *Society 5.0. A people-centric Super-smart Society,* Springer Singapore, 2018; and UNESCO, *Japan pushing ahead with Society 5.0 to overcome chronic social challenges,* 2019, available at: https://www.unesco.org/en/articles/japan-pushing-ahead-society-50-overcome-chronic-social-challenges (accessed 1 Augustus 2024).
[40] European Commission on Research and Innovation, *Industry 5.0*, available at: https://research-and-innovation.ec.europa.eu/research-area/industrial-research-and-innovation/industry-50_en?prefLang=da (accessed 1 August 2024).

contributes to three of its priority policies: 1) An economy that works for people; 2) The European Green Deal; and 3) A Europe fit for the digital age. This means that Industry 5.0 aims to bring a human-centric approach into Industry 4.0 to link the digital transformation of the industry more closely to social development goals, such as social equality and sustainability.

Moreover, from *ESIR Policy Brief No.3*,[41] entitled "Industry 5.0: A Transformative Vision for Europe",[42] which is featuring on the EU's website about Industry 5.0, it is clear that the EU's aspirations go much further than merely a refocus of the development of AI. In fact, the authors of the *ESIR Policy Brief No.3* aspire a 'deep systemic transformation' that 'takes into consideration learnings from the pandemic and the need to design an industrial system that is inherently more resilient to future shocks and stresses a truly integrated European Green Deal social and environmental principles.'[43] To achieve this, Industry 5.0 'means first and foremost a decisive move away from neo-liberal capitalism models', and instead a move towards 'a more balanced view of value over time and a multi-valent understanding of capital – human and natural as well as financial.'[44] Besides regenerative features of industrial transformation embracing the circular economy (dimension 1), and a mandatory environmental dimension which crafts new ways of thriving in respectful interdependence with natural systems (dimension 3), Industry 5.0 includes an inherently social dimension which includes 'the adoption of technologies that do not substitute, but rather complement human capabilities whenever possible' (dimension 2).[45]

More fundamentally, to enable a full transition to Industry 5.0 it needs a European enterprise model that is based on principles of fairness, resilience, sustainability, circular economics, and multi-valent forms of capital.[46] To achieve this, governments need to fulfil a new role (Government 5.0), characterised by 'a degree of resource fluidity, strategic agility and leadership in the public sector' and by harnessing the power of public-private collaborations.[47] Corporations will have to change their goals and orientation of their actions towards Industry 5.0 objectives. Effectively, this means a move away from the shareholder model of capitalism and short-term gains to meeting, among others, requirements of de-carbonisation, resiliency measures, circular economy principles, regenerative practices and stakeholder approaches (people-planet-sustainable prosperity).[48]

All this would remain aspirational if this policy brief would be a "stand alone", a mere single publication. However, that is not the case. In its *Policy Brief No. 6* entitled 'Why Europe needs a systemic R&I policy. Redefining competitiveness for long-term sustainability',[49] an

[41] ESIR is a high-level expert group advising the Commission on how to develop a forward-looking and transformative research and innovation policy.
[42] *See*: https://research-and-innovation.ec.europa.eu/knowledge-publications-tools-and-data/publications/all-publications/industry-50-transformative-vision-europe_en (accessed 5 August 2024).
[43] ESIR, *Industry 5.0: A Transformative Vision for Europe*, ESIR Policy Brief 3, 2022, 3 and 7.
[44] ESIR, *ibidem*, 7.
[45] ESIR, *ibidem*, 5.
[46] ESIR, *ibidem*, 7.
[47] ESIR, *ibidem*, 15-17.
[48] ESIR, *ibidem*, 17-18 and 23.
[49] *See*: https://op.europa.eu/en/publication-detail/-/publication/3717b938-2a01-11ef-9290-01aa75ed71a1 (accessed 5 Augustus 2024).

explicit reference is made to the concept of Industry 5.0 as worked out in *Policy Brief 3*, emphasising that for industry in Europe to remain competitive, it needs to go beyond a narrow construction of productivity.[50] Particularly, since in this report, ESIR redefines a competitive EU economy as "**a fore-runner in maximising the societal value gained by using the Earth's limited natural resources while at the same time minimising the environmental and social costs**."[51] [emphasis in original] To remain competitive, two building blocks are defined for a systemic approach to Research & Innovation (R&I) policies that maximises sustainability and wellbeing. The first building block is to adopt resource and material productivity as key targets for R&I policy, and the second building block is social attractiveness. More specifically, '[i]n a broad view of competitiveness, the EU needs to be truly attractive for skilled labour and capital, but also in general as a society and a place to live and work.'[52]

To achieve this ESIR recommends that:

[i]nnovation policies should target improved resource productivity and sustainable production and consumption systems that efficiently deliver essential services—such as built environment, mobility, food, and energy — with significantly reduced material and energy inputs and diminished emissions as part of a broader systemic policy mix.

ESIR further emphasises that a competitive Europe can only thrive when the subcontractors and suppliers of European companies (trade partners), can also benefit and meet their own transition goals.[53] More concretely, ESIR outlines the ideas of Enrico Letta on how a Circular Single Market could benefit European competitiveness as understood in ESIR's broad definition (see above).[54] This includes: the elimination of production inefficiencies that are currently hidden because prices for resources do not include all costs, especially the extraction costs for the environment;[55] the prospect of achieving first-mover advantages in exporting technologies, especially products and services around the circular economy;[56] and production and consumption systems with significantly reduced absolute material and energy inputs.[57] All three should lead to a circular economy which will reduce the need of critical raw materials, which will make the EU more resilient to geopolitical changes from a systemic perspective and therewith more competitive in a long-term perspective.[58]

[50] ESIR, *Why Europe needs a systemic R&I policy. Redefining competitiveness for long-term sustainability*, ESIR Policy Brief, 2024, 11.
[51] ESIR, *ibidem*, 3, with reference to: Richardson K., Renda A., *A competitive and resilient Europe requires transitioning from sectoral to systemic thinking*, EURACTIV, 10 May 2024.
[52] ESIR, nt. (50), 11.
[53] ESIR, *ibidem*, 12-13.
[54] Letta E., *Much More Than a Market-Speed, Security, Solidarity: Empowering the Single Market to deliver a sustainable future and prosperity for all EU Citizens*, Report presented to the European Council on 18 April 2024.
[55] ESIR, nt. (50), 16-19.
[56] ESIR, *ibidem*, 19-23.
[57] ESIR, *ibidem*, 23.
[58] ESIR, *ibidem*, 25, with reference to: ESIR, *Transformation in the poly-crisis age*, ESIR Policy Brief 5, 2024 (which also refers to ESIR 2022 nt. (43)).

As such, the EU is building a new narrative for not just a Single Market, but as Letta calls it a Circular Single Market.[59] Although the social dimension of this new narrative is recognised, proposed policy focus (in R&I) seems to be oriented more on the environmental than the social dimension. Nevertheless, these developments do not stand on their own, indeed they can be related to broader ideas to aim to change the narrative (or paradigm) of the neoliberal free market economy into one that is more human-centred and respects the planetary boundaries.[60]

Despite the fact that these ideas are relatively young (since the mid-2010s), some of these ideas are already picked up in practice. The ideas underpinning the 'Wellbeing Economy Alliance' (WEAll) which is 'the leading collaboration of organisations, alliances, movements and individuals working towards a Wellbeing Economy, delivering human and ecological wellbeing',[61] for example are based on among others, Fioramonti's *Wellbeing Economy*, Hickel's *Less is More*, and Raworth's *Doughnut Economics*.[62] Part of WEAll is 'Wellbeing Economy Governments (WEGo), which is a partnership between national and regional governments (when writing this article: Scotland, Iceland, New Zealand, Wales, Finland, and Canada) that are 'interested in sharing expertise and transferrable policy practices to advance their shared ambition of building Wellbeing Economies'.[63] Raworth's *Doughnut Economics* also engages with local and national governments and policy makers through its *Doughnut Economics Action Lab (DEAL)*. DEAL's aim is 'to help create 21st century economies that are regenerative and distributive by design, so that they can meet the needs of all people within the means of the living planet."[64] Among the organisations involved in DEAL is the EU via the Doughnut4EU group. The group exists of civil servants working across the European Commission and explores how the "Doughnut" can be used in EU context. One of the group's conclusions is that the "Doughnut framework" is useful in further working out the twin-transitions narrative of "leaving no-one behind" by developing a growth strategy which embraces the principle of distributive design that makes it more caring and invests in people, in line with the spirit of the European Pillar of Social Rights.[65] Additionally, a conference

[59] Letta E., nt. (54). Similarly: Bartl M., Claassen R., van der Horst N. (eds.), *Sustainable by Design: Industrial policy for long-term competitiveness in the EU,* White Paper, July 2024, available at: https://act.uva.nl/research/research-projects/sustainable-by-design/sustainable-by-design.html?cb (accessed 9 August 2024).

[60] Whatever economic paradigm is predominant, there are always others competing for dominance or critiquing the dominant one. Since the mid-2010s it seems to be a bit different, since most of the ideas seems to be presented more as a response to problems and challenges economies and societies are facing, among which the digital and green transitions. Most also are a critique on the dominant neoliberal free market economy, but not all of them.

[61] *See*: https://weall.org/ (accessed 5 August 2024).

[62] Fioramonti L., *Wellbeing Economy: Success in a World without Growth*, Pan McMillan, South Africa, 2017; Hickel J., *Less is More: How Degrowth Will Save the World*, Penguin Random House, 2021; Raworth K., *Doughnut Economics. Seven ways of thinking like a 21st-Century Economist,* Random House Business, 2018.

[63] See: https://weall.org/wego (accessed 5 August 2024).

[64] See: https://doughnuteconomics.org/about (accessed 5 August 2024).

[65] See: https://doughnuteconomics.org/stories/eu-commission-experiments-with-doughnut-economics and for the report from the conference talk and workshop *Ensuring a just transition towards sustainable prosperity and well-being: which role for Doughnut4EU?*, available at: https://drive.google.com/file/d/1Ibiop8THA8rdIKD7bQRY3j92cCctk6O2/view (both accessed 5 August 2024).

hosted by the European Parliament on "Beyond Growth", was extensively based on the ideas of the wellbeing economy and Doughnut Economics.[66]

More generally, analysis of these ideas[67] shows that while each of them has a specific focus, they have several commonalities which together give an impression of a tacit consensus about what the new socioeconomic narrative will be.[68] When focusing on the aspect of work, this new socioeconomic narrative, or wellbeing paradigm, has the potential to fundamentally change the purpose of work and the values underpinning labour law.[69] To give a brief impression, societies, for example, are to be based on values such as of loyalty, liberty, fairness, hierarchy, care, and sanctity. Business activities are expected to contribute to the realisation of those values, which means, among others, that work activities are not about increasing productivity to create higher profits, instead they are about offering people the possibility to develop their full potential, their talents, and delivering them feelings of self-esteem, belonging, and satisfaction.[70]

4. Foundational principles of care and non-extractive business conduct.

As presented in section 2, Industry 4.0 brings forward technological innovations that are disruptive in various ways, not in the least place on work and labour law. In addressing regulatory challenges, especially in seeking ways to ensure the protection of labour laws for workers that need it, new regulatory approaches are introduced. A much used approach is regulation based on risk-management.[71] Such a risk-based approach can be found in EU legislation, with as most pronounced examples Regulation 2016/679, also known as the General Data Protection Regulation (GDPR), the Commission's proposals to regulate

[66] Jensen L. (coord.), *Beyond growth: Pathways towards sustainable prosperity in the EU*, European Parliamentary Research Service in collaboration with the Joint Research Centre of the European Commission, 2023; and for more information about the conference, *see*: https://www.beyond-growth-2023.eu/ (accessed 5 August 2024).
[67] New publications appear regularly, but only a few seem to also reach a broader audience, these include besides those mentioned in footnote 62: Schwab K., Vanham P., *Stakeholder Capitalism. A Global Economy that Works for Progress, People and Planet,* Wiley, 2021; Mazzucato M., *Mission Economy. A Moonshot Guide to Changing Capitalism*, Allen Lane, 2021; Jackson T., *Post Growth – Life after Capitalism,* Wiley, 2021; Schenderling P., *Er is leven na de groei. Hoe we onze toekomst realistisch veiligstellen*, Bot Uitgevers, 2022; and more focused on work and employment: Seidl I., Zahrnt E. (eds.), *Post-Growth Work. Employment and Meaningful Activities within Planetary Boudaries*, Eartscan Routledge, 2022; Bueno N., ter Haar B., Zekić N. (eds.), *Labour Law Utopias: Post-Growth and Post-Productive Work Approaches*, Oxford University Press, 2024.
[68] ter Haar B., nt. (8).
[69] ter Haar B., *ibidem*, 29-50; ter Haar B., *Capitalism, Doughnut Economics, Eldorica, and the Role of Labour Law*, in von Adamovich E., Zernikow M. (eds.), *Philosophical and Sociological Reflections on Labour Law in Times of Crisis*, Cambridge Scholars Publishing, 2022, 401-422.
[70] Collier P., *The Future of Capitalism. Facing the New Anxieties*, HarperCollins Publishers, 2018. Similar: Henderson R., *Reimagining Capitalism in a World on Fire*, Penguin Books, London, 2020; and more focused on work and labour law: Bueno N., nt. (2), 116-132; and Bueno N., *Freedom at, through and from work: Rethinking labour rights*, in *International Labour Review*, 160, 2, 2021, 311-329.
[71] Aloisi A., De Stefano V., *Between risk mitigation and labour rights enforcement: Assessing the transatlantic race to govern AI-driven decision-making through a comparative lens*, in *European Labour Law Journal – Special Issue Contribution*, 2023, 1-25; Otto M., nt. (37).

platform labour (COM/2021/762 final)[72] and the draft AI Regulation, also known as the AI Act (COM(2021) 206 final)[73]. Risk-based approaches are also found in the ILO's approach presented by the ILO Global Commission's landmark report *Work for a Brighter Future*.[74]

While the positive side of such a risk-based approach is that it offers a (quasi-)legal framework to hold certain parties responsible, these approaches rely on forms of self-governance and -assessment of which its effectiveness is debatable.[75] Moreover, a risk-based approach allows and enables the adoption of technology despite its harms.[76] Particularly, since it makes risks the main standard for assessing the performance of the addressees of the regulations, rather than compliance with labour rights standards. To overcome this problem, suggestions have been to adopt more prescriptive frameworks protecting non-waivable (labour) rights.[77] However, with these proposals they forget that the risk-based approach is used, because a more prescriptive framework is not feasible because the rapid developments make it difficult if not impossible to foresee the consequences of those developments as well as the regulatory activities.

In addition, emphasis is placed on the need for a stakeholder's approach, especially including workers participation rights. Thus, the ILO Global Commission proposes steps to 'actively' manage 'technology to ensure decent work' and to ensure 'human in command', and puts forth other mechanisms, such as union involvement, to counteract the sole management of technologies by employers.[78] Yet, as elaborated by ESIR in its *Policy Brief No.3*, participation rights are crucial, however, they will not be enough to make the deep systemic transformation that is needed for a socioeconomic system that is truly people- and planet-centric.[79] That means something else, more, is needed for Industry 5.0 to truly balance the disruptive effects of technological innovations on the wellbeing of humans and the planet. The question is: what?

As I explored in previous research, the socioeconomic change that Industry 5.0 aspires to represents a paradigm shift away from a productivity- and profit-driven neoliberal free market economy to a human-centric and planetary needs respecting wellbeing paradigm.[80]

[72] On which an agreement was reached between the European Parliament and the Council's presidency on 11 March 2024, *see*: https://www.consilium.europa.eu/en/press/press-releases/2024/03/11/platform-workers-council-confirms-agreement-on-new-rules-to-improve-their-working-conditions/ (accessed 6 August 2024).
[73] On which the Council gave its final green light on 21 May 2024, *see*: https://www.consilium.europa.eu/en/press/press-releases/2024/05/21/artificial-intelligence-ai-act-council-gives-final-green-light-to-the-first-worldwide-rules-on-ai/ (accessed 6 August 2024).
[74] The report is available on the ILO's Research and Publications webpage: https://www.ilo.org/publications/work-brighter-future (accessed 6 August 2024).
[75] Aloisi A., De Stefano V. nt. (71); Otto M., nt. (37); and García-Muñoz Alhambra A., ter Haar B., Kun A., *Independent monitoring of private transnational regulation of labour standards: A feasible proposition for a "transnational labour inspectorate" system?* in Ales E., Senatori I. (eds.), *The Transnational Dimension of Labour Relations: a New Order in the Making?*, Giappichelli Editore, 2014, 254-290.
[76] Aloisi A., De Stefano V., nt. (71), 12.
[77] Hidvegi F., Leufer D. Massé E., *The EU Should Regulate AI on the Basis of Rights, Not Risks*, 17 February 2021, available at: https://www.accessnow.org/eu-regulation-ai-risk-based-approach/ (last updated 13 January 2023 – accessed 6 August 2024); Otto M., nt. (37); and Aloisi A., De Stefano V., nt. (71).
[78] ILO Global Commission, *Work for a Brighter Future*, 2019, 41-44. See for a similar argument: Aloisi A., De Stefano V., nt. (71), 25.
[79] ESIR, nt. (43), 7.
[80] ter Haar B., nt. (8).

Such a paradigm shift would also require a rethinking of the full labour law system. On this, lessons can be drawn from the past. With the paradigm shift from a social market economy to the neoliberal free market economy in the 1980s and 1990s, the work narratives have changed significantly, whereas the labour law systems have been adapted in a patchwork-manner only, resulting in a general conclusion that labour law is in crisis.[81] Thus, drawing on this lesson, anticipating the socioeconomic change that Industry 5.0 aspires to and the new work narratives that will come with it,[82] a more fundamental rethinking of regulating work is needed. One that starts with redefining the foundational principles of the regulation of work. This does not mean that the current foundational principles should be abandoned, but rather than continuing with patchwork adaptations such as the regulations based on forms of risk management, it would be good to first consider at a more fundamental level what kind of regulatory changes would be needed. Especially, since changes at a more fundamental level may also have implications for the more concrete regulatory measures.

Following the deep systemic socioeconomic changes Industry 5.0 aspires to and the changing work narratives that come with it as briefly described in section 3, I would like to propose two, related, new foundational principles for the regulation of work, or better, human activities: the principle of care and the principle of non-extractiveness. Before addressing these principles in more detail, please note that this also comes with another change, namely the object of the regulation: "human activities" instead of "labour" or "work". Such in contrast to the object of the current labour law systems which in general have as object of regulation economically valuable labour, which excludes many other human activities that are valuable (and essential) for society and the wellbeing of humans.[83] That means that the object of regulation guided by the two new foundational principles will be activities conducted in the context of businesses, but also that of governments, public organisations, and households. As such, my argument is that following what Industry 5.0 aspires to, in essence all human activities should always be based on a set of ethical principles that ensure the wellbeing of humans and the planet. However, for as far as such ethical principles currently exist for business activities (read: economically valuable work), they seem to favour short-term financial gains for shareholders over the general wellbeing of humans and the planet.[84] Following what Industry 5.0 aspires to, namely an embedded economy that

[81] Davidov G., *A purposive approach to labour law*, Oxford University Press, Oxford, 2018. and various contributions in Davidov G., Langille B. (eds.), *The idea of labour law*, Oxford University Press, Oxford, 2011.
[82] ter Haar B., nt. (8), 39-46.
[83] This is a common feminist comment on capitalism. See among many others: Fudge J., *Feminist Reflections on the Scope of Labour Law: Domestic Work, Social Reproduction, and Jurisdiction*, in *Feminist Legal Studies*, 22, 1, 2014, 1–23; Cossman B., Fudge J. (eds), *Privatization, Law, and the Challenge to Feminism*, University of Toronto Press, 2016; Zbyszewska A., Routh S., *Challenging Labour Law's "Productivity" Bias Through a Feminist Lens: A Conversation'*, in Blackham A., Kullmann M., Zbyszewska A. (eds.), *Theorising Labour Law in a Changing World. Towards Inclusive Labour Law*, Hart Publishing, Oxford, 2019, 245-263; Busby N., *A Right to Care?*, Oxford University Press, Oxford, 2011. Encinas de Muñagorri R., *Labour Law for Care and Wellbeing*, in Bueno N., ter Haar B., Zekić N. (eds.), *Labour Law Utopias: Post-Growth and Post-Productive Work Approaches*, Oxford University Press, Oxford, 2024, 156–176; and more sociologically Ferguson S., *Women and Work: Feminism, Labour, and Social Reproduction*, Pluto Press, London, 2019.
[84] Raworth K., nt. (62), with reference to: De Martino G.F., *The economist's oath: on the need for and content of professional economic ethics*, Oxford University Press, Oxford, 2011.

is human-centred and planet-friendly by design, Raworth, inspired by DeMartino, proposes four ethical principles that are interesting:

1. *Act in service* to human prosperity in a flourishing web of life, recognising all that it depends upon.
2. *Respect autonomy* in the communities that you serve by ensuring their engagement and consent, while remaining ever aware of the inequalities and differences that may lie with them.
3. *Be prudential* in policymaking, seeking to minimise the risk of harm - especially to the most vulnerable – in the face of uncertainty.
4. *Work with humility* by making transparent the assumptions and shortcomings of your models, and by recognising alternative economic perspectives and tools.[85]

Another point to highlight here is that using such ethical principles for any kind of human activity, is fundamentally different than having such principles supporting the current labour law system. Of course, labour law systems need to be based on a set of principles to justify the rights and obligations it creates, as well as the limitations of those rights and obligations on other rights, especially the fundamental freedom to run a business. And, although businesses are expected to conduct their activities in compliance with the law, at the same time their economic purpose of short-term profit making for shareholders forces them to be creative with those laws to save costs for higher profits. This means that compliance with labour laws is a constant battle against the power of money and that its purpose needs to be proven over and over again. When any kind of human activity, whether for profit or non-profit, for pay or unpaid, is bound by a set of ethical principles, those principles become the purpose and legitimisation of any human activity, including the activities of businesses.[86] Profit-making could still be part of a business' purpose, but in the context of what Industry 5.0 aspires to, it will not be the most prominent purpose, on the contrary.

The ethical principles of Raworth are rather abstract and need further interpretation and concretisation. Limited to the context of work and new technologies, which is the core focus of this paper, there are two principles in particular that I would like to propose: the principle of care and the principle of non-extractiveness. In a certain way these two principles are related to one other, whereas the principle of care could be considered as a positive obligation and the principle of non-extractiveness as a negative obligation for any business activity to comply with. Both principles are rather broad, and it would go beyond the scope of this paper to address them in full,[87] therefore their introduction here is limited to the basic ideas.

The idea of a principle of care in relation to work was presented by Méda in her ILO Future of Work Research paper on the meaning and value of work in Europe, as an

[85] Raworth K., *ibidem,* 161.
[86] Yanis Varoufakis plays with such an idea in his utopia: Varoufakis Y., *Another now: dispatches from an alternative present*, Vintage, 2021, 61, in which business activities are subjected to a Socialworthiness Index based on which every business' conduct, activities and effects on communities is monitored and graded.
[87] *See* for an elaboration of these two principles in relation to the freedom to run a business: ter Haar B., nt. (6).

obligation for businesses to *care for* and *care about* our natural heritage, social cohesiveness and human labour.[88] In the *Care Manifesto*, the care collective makes this idea more concrete. For them, care is based on the premise of a recognition of our mutual interdependence and an intrinsic value of all living creatures.[89] From this premise it follows that care should be taken as the organisational principle of any society putting in front and at the centre of every aspect of life. To be able to do this, a broad understanding of care is embraced, namely that of Joan Tronto: '*caring for* which includes the physical aspects of hands-on care, *caring about,* which describes our emotional investment in and attachment to others, and *caring with*, which describes how we mobilise politically in order to transform our world.[90] [emphasis BtH] Furthermore, it comes with an inclusive interpretation of kinship that redefines care relationships extending beyond the mere blood and family ties, and including the land, water, and animals that keeps the planet a viable and sustainable living place.[91] This also requires the market to be embedded in society in the manner as promoted by Raworth's *Doughnut Economics*, namely a market that serves the planet and needs of societies and people. A market thus that is regenerative and distributive by design,[92] and that is local.[93]

Thus, the principle of care is all about putting the care for, about and with, at the centre of any activity – human, governmental or business. It is all about enabling. Enabling straight forward hands-on care for those in need of care and those who want to care. Enabling solidarity and attachments between humans, between humans and non-humans, and with the planet. Enabling involvement and engagement with humans, non-humans and the planet. Enabling equal access to resources, opportunities, talent development, flourishing in life and of life on the planet. More work-related, the principle of care determines the purpose of business activities as to contribute to the wellbeing of society, the individual, and the planet. For the persons performing the business activities it means that the activities ideally enable those persons to contribute to their values, explore their interests, and develop their talents.[94] Any technology used to perform those business activities need to accommodate[95] the needs of the persons performing those activities, this can include increasing productivity, but that cannot be the sole reason.

Contrary to the principle of care, the principle of non-extractiveness is all about what human activities, and therewith also technology, should not do. Pijl describes non-extractive by what it should not be, namely what the current extractive economy is about: extracting ever more unpaid energy, resources, money, personal data, labour, health and well-being

[88] The paper is available at: https://www.ilo.org/publications/future-work-meaning-and-value-work-europe (accessed 8 August 2024).
[89] Chatzidakis A., Hakim J., Littler J., Rottenberg C., Segal L., *The Care Manifesto. The Politics of Interdependence*, Verso, New York, 2020, 21.
[90] Chatzidakis A., Hakim J., Littler J., Rottenberg C., Segal L., *ibidem*; Tronto J.C., *Caring democracy: markets, equality, and justice*, New York University Press, New York, 2013.
[91] Chatzidakis A., Hakim J., Littler J., Rottenberg C., Segal L., nt. (89), 40-41.
[92] Chatzidakis A., Hakim J., Littler J., Rottenberg C., Segal L., *ibidem*, 79.
[93] Chatzidakis A., Hakim J., Littler J., Rottenberg C., Segal L., *ibidem*, 82, which aligns with the ideas of Fioramonti L., nt. (62), which is one of the inspirational sources of the Wellbeing Economy Alliance (WEALL).
[94] Similar to Amartya Sen's interpretation of capability and Marta Nussbaum's human capability approach. See about these in the context of work: Langille B., *The capability approach to labour law*, Oxford University Press, Oxford, 2019, 126.
[95] See on an accommodation approach to technology and work: Albin E., nt. (38).

from people and from places.[96] Raworth presents the idea of a non-extractive economy by stating that business (or economic) activities should be regenerative and distributive in order to maintain 'a social foundation of well-being that no one should fall below, and an ecological ceiling of planetary pressure that we should not go beyond'.[97] Related to the context of work it means that business, or broader human, activities should not be extractive or exploitative. Not from society, or the individual worker, or the planet.

Activities can be extractive from society when they cost society more than they benefit society. This can be in terms of the relationship between how much money is invested in the worker versus how much value is created in return for society by the activities performed by the worker. Classical examples are a city banker who destroys about £7 of social value for every £1 paid, and a nurse who generates about £7 of social value for every £1 paid.[98] Of course, for many professions it is not this black and white. A city banker working for a bank that is operating in service of society will not extract as much, if anything at all,[99] than a city banker who works for a bank that aims to optimise profits. A lawyer can choose to use its talents to support or polluter (which will extract from society; the planet), or to support the group of people that want to stop the polluter (which will add value to society). A farmer can choose to produce tropical fruits for export to make more profits, which will extract from the planet by use of among other things fertile ground and polluting transport and from society by withholding affordable, healthy, fresh food, or to produce for the local market, which will extract less from the planet and add value to the local society. The same principle applies to architects and construction workers depending on whether they construct holiday homes or houses for people that need them.[100]

On a more individual level, activities are evidently extractive when they exploit the person performing the activities. This will be the case in the classical sense of forced labour or more generally when the requirements of the ILO's decent work are not complied with.[101] However, the ILO's decent work will not be enough, because it does not include any standards about the value of work,[102] not for society as illustrated by the examples above or for the individual worker in being truly free and able to pursue and develop their talents.[103]

[96] Pijl K., *From an Extractive to a Non-Extractive Economy: Disentangling the Building Blocks of Non-Extractive Economic Practices'*, in *International and Comparative Corporate Law Journal*, 15, 2, 2022, available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4037070 (accessed 19 March 2024). *See* more elaborately about the idea of non-extractiveness in: ter Haar B., nt. (6).

[97] Raworth K., nt. (62), 11.

[98] *See* on this: Graeber D., *Bullshit jobs: a theory*, Penguin Books, London, 2019, 210-212, with references to: Lockwood B.B., Nathanson C.G., Weyl E.G., *Taxation and the Allocation of Talent*, in *Journal of Political Economy*, 125, 5, 2017, 1635–1682; Lawlor E., Kersley H., Steed S., *A bit rich: Calculating the real value to society of different professions*, on *New Economics Foundations,* 2009, available at: https://neweconomics.org/2009/12/a-bit-rich (accessed 6 November 2024).

[99] For example, the Dutch Triodos Bank invests the savings of its clients in sustainable businesses to make a positive impact on society. *See*: https://www.triodos.nl/ (accessed 8 August 2024).

[100] Examples from: Bueno N., nt. (2), 125.

[101] See about the ILO's recent work: https://www.ilo.org/topics/decent-work (accessed 8 August 2024).

[102] Something that is elaborately demonstrated by Graeber D., nt. (98). *See* on the relationship between the purpose of work and the wellbeing of workers also: Henderson R., nt. (70).

[103] Bueno N., nt. (2), 123, with references to: Dermine E., Dumont D., *A Renewed Critical Perspective on Social Law: Disentangling Its Ambivalent Relationship With Productivism*, in *International Journal of Comparative Labour Law and Industrial Relations*, 38, 3, 2022, 237–268; Weidel T., *Moving Towards a Capability for Meaningful Labor*, in *Journal of*

The same applies for the "classical" forms of exploitation of workers that are covered by decent work. In relation to the technological developments of Industry 4.0 this includes issues such as algorithmic management, surveillance of remote workers, and real-life work performance monitoring. All risk to negatively affect the individual's feelings of self-esteem, dignity, belonging and security, which extract from the overall wellbeing of the individual.[104]

5. Conclusions: towards a happy marriage between humans and technology.

I realise that the last part of section 4 sounds idealistic, utopian even, however, this may be less the case when it is reviewed in the wider context of the point that I am trying to make in this paper. Sure, it may be unrealistic to expect that everyone can perform a work activity that makes them happy, but that would be a very narrow and literal reading of the argument that I am trying to make here. The main problem that I addressed in this paper is that the technological innovations of Industry 4.0 are disruptive on the world of work and that this is more often than not in a negative manner. One of the root causes for the negative disruptive effect of Industry 4.0 is because what is technologically possible is leading for the innovations rather than what technological innovations would be desirable. A second root cause is that for as far as Industry 4.0 is led by what innovations would be desirable, this seems to concern mostly neoliberal free market economic purposes, especially increasing productivity and short-term profit making, instead of the wellbeing of people and the planet.

Industry 5.0 aims to change this by adding to Industry 4.0 a human- and planetary-centred approach. Although the idea of Industry 5.0 risks to be "white- and green-washing" policy rhetoric, the Commission's advisor, ESIR, on these issues has made it clear in several policy briefs that Industry 5.0 aspires to a deep systemic change. A change that finds support in academic thinking, such as Raworth's *Doughtnut Economics*, Fioramonti's *Wellbeing Economy*, Mazzucato's *Mission Economy* and Schwab's *Stakeholder Economy*, which despite their different angles in approach, have many commonalities. The deep systemic change ESIR envisions for Industry 5.0 finds also support in movements that are based on the academic thinking, especially the Doughnut Economics Action Lab (DEAL) and the Wellbeing Alliance (WEAll). Initiatives that the Commission and the European Parliament seem to be "flirting" with.

The deep systemic change Industry 5.0 aspires to will unavoidably change what drives technological innovation: not because it is possible and will lead to higher productivity and short-term shareholder profits, but because it will serve the needs of humans while respecting the planetary boundaries. That also means that the need to manage risks of negative impacts of technological innovations on the wellbeing of people and the planet will become marginal. Afterall, a technological innovation has been developed in the interest of the wellbeing of people and the planet. Of course, such needs to be guided by ethics and principles. Raworth formulated four ethical principles for a 21st century economist, which could also be applied

Human Development and Capabilities, 19, 1, 2018, 70–88; and Laruffa F., *Re-thinking Work and Welfare for the Social-Ecological Transformation*, in *Sociologica*, 2022, 123-151.

[104] Cf. Collier P., nt. (70); Raworth K., nt. (62); Fioramonti L., nt. (62); and Henderson R., nt. (70).

to business conduct. Following ideas in (labour) law, I have proposed to complement Raworth's ethical principles with two principles to further guide business activities, namely the principle of care and the principle of non-extractiveness. These two principles could operate as reciprocal obligations that come with the freedom to run a business.

There are several advantages of formulating foundational principles as reciprocal obligations on the freedom to run a business. For the main issue of this paper, how Industry 5.0 in addition to Industry 4.0 can create a happy marriage between human and technology, I want to highlight two. First, by complementing the fundamental freedom to run a business with reciprocal obligations that go beyond mere compliance with legal obligations, such as labour laws, the general purpose of business conduct is guided into a certain direction. In the case of what Industry 5.0 aspires to, this is to create work activities that serve the wellbeing of society and the individual workers, while respecting the planetary boundaries. Second, with Industry 4.0 technological development is driven by what technologically seems to be possible, but also what will sell on the market. The latter is based on what drives businesses and under the current predominant socioeconomic paradigm of neoliberal free market capitalism that is technology that boosts productivity and therewith short-term profits for shareholders. With what Industry 5.0 aspires to, this drive will change fundamentally and consequently, the drive for technological innovation will also change fundamentally. In other words, the purpose for technological innovation will be increasing the wellbeing of society and the individual worker, while respecting the planetary boundaries. How technology could contribute to this can be further guided by the foundational principles of care and non-extractiveness.

To conclude, because Industry 5.0 aspires to a deep systemic change on multiple levels, it creates a new narrative, a new drive, for technological innovation. One that puts the wellbeing of humans and the planet central. An aspiration that is not isolated or utopian, but that finds support in socioeconomic thinking and sociopolitical movements. That is how Industry 4.0 complemented by Industry 5.0 can create a happy marriage between humans and technology. Of course, from a labour law perspective this is just the beginning. Since labour law reform has already missed out on one major paradigm change in work (from a social-market economy to the neoliberal free market economy), which has resulted in a permanent crisis of labour law, it cannot afford to miss this one (from a neoliberal free market economy to a wellbeing economy). Of course, labour law is largely responsive to the changes, but by not getting engaged in the current debates and reflect on what that will mean for work and labour law, an opportunity is missed to create a sustainable, resilient, socioecological labour law.

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