eit Digital

Makers & Shapers

# DIGITAL TRANSFORMATION OF EUROPEAN INDUSTRY


PLC Status
All
Status
Metric
Value
Servo Temp
220 °F
Air Pressure
285 PSI
Hydolyser
11%
Pressure Pump
2915 PSI
Fan Speed
1300 RPM
Compressor
4450 PSI
Temperature (°F)
°F
200
160
120
80
40
0
10
20
30
40
50
60
Last Minute (seconds)
Robotic Arm Health and Performance
Overall Performance
%
89
Unit Efficiency
%
49
Temperature
°F
195
Humidity
%
25

# CONTENTS

# EXECUTIVE SUMMARY

**Digital innovation and transformation drive what has been called the Fourth Industrial Revolution or Industry 4.0. This digital transformation of all industry sectors will revolutionise the structure and governance of markets and lead to a significant reconfiguration of work and employment.**

On the one hand, integrating digital innovations in business strategies is an essential means of creating value. Further, the digital transformation allows deep connection of systems creating seamless digitalised value chains with increased efficiency. On the other hand, there may be pressure on social cohesion, since only certain social groups and/or regions and/or countries will benefit while others are left behind. Also, the distribution of the newly created value may be uneven, for example via the potential erosion of the tax base due to fewer taxable jobs, or due to the fact that digital platforms and transactions risk to be elusive to taxation. Thus, the digital transformation of the industry puts serious challenges to the European economies and social welfare models. In order to support an informed debate on how to address these challenges, scenarios have been developed reflecting different labour and taxation policy options, and analysing the impact on economic growth, jobs and social cohesion of Europe's economies and societies.

Four extreme scenarios have been investigated: utopian, ultra-social, dystopian, and ultra-liberal, for which the analysis shows that policy measures can be designed for a future in between the extremes of ultra-social and ultra-liberal. A smart combination of elements from both, together with policy measures in other areas (competition and consumer protection law, measures influencing labour cost, data sharing regulation, public procurement, industrial policy and other incentives) may eventually lead to a solution that can bring Europe's social, economic and strategic autonomy interests together.

Political cohesion in the EU is essential for the realisation of such a scenario having the right balance to sustain economic growth and social cohesion within Europe during the digital transformation of the industry. EU level consensus should especially be created regarding a strong policy stimulating European industry platform development and take up; flanked by policies regarding data sharing and competition regulation. Only in that way Europe can avoid being pushed to some extreme scenarios where specific European economic and social interests risk to be marginalised.

# TECHNOLOGICAL, ECONOMIC AND SOCIETAL PERSPECTIVES

**From a technological perspective Industry 4.0 can be characterised as resting on three pillars: a) Internet of Things (IoT), which allows objects to interact with each other and cooperate with their neighbouring smart components; b) Cyber-Physical Systems (CPS), integrating computation and digital processes where embedded computers and networks monitor and control physical processes; and c) Smart Factories that are context-aware and assist people and machines in execution of their tasks[1].**

Digital integration and connection of systems create seamless digitalised value chains, thus revolutionising the structure and governance of markets. Meanwhile, automation and digitisation of production processes could lead to a significant reconfiguration of work and employment[2]. So-called 'Work 4.0' entails challenges in terms of new skills requirements, unemployment or intermittent employment, and potential polarisation of the labour force. Thus, Industry 4.0 may transform both how jobs are performed (work) and how activities are coordinated (markets).

Industry 4.0 is often closely associated with the concept of platform as the conduit for its implementation and development. More generally, digital platforms are an essential and key feature of digital transformation. The central features of platforms are direct and/or indirect network effects[3]. In platforms 'more users beget more users, a dynamic which in turn triggers a self-reinforcing cycle of growth'[4]. Scale is for platforms both the sign of initial success and the source of continuous future growth. Platforms create value mainly by matching transactions, or facilitating the rise of innovation ecosystems, or both. Digital platforms, due to the special nature of digital goods, can scale to dominance through network effects and lock-in and thus create polarisation effects[5]. In view of this potential for monopolistic or at least oligopolistic outcomes, integrated digital platforms are described as a source of concern by legal scholars[6].

There are several aspects of the industrial value chains that may limit platform and network effects and scale to dominance, such as differentiation, heterogeneity, and also the fact that vertical and horizontal integration make 'Multi-Homing' likely and lock-in more difficult. It is an open empirical question whether digital industry platforms will emerge that have the potential for scale to dominance in the same degree as occurred for the integrated digital platforms that currently dominate certain consumer sectors. On the other hand, some of the incumbent integrated platforms may expand into industrial sectors, extending their dominance also to these markets. The concern about global level competition is clearly stated in the EC communication on digitising industry[7]. Also the European Parliament (EP) warns that European industry may be forced to adopt and live with standards set by the 'US, Japan, China and South Korea.'[8] Will Industry 4.0 strengthen the EU industry or will leadership be passed to the new emerging economies such as China?[9] Europe must find policy responses that strengthen its industrial leadership and capture the opportunities inherent in the Platform Economy.

From a societal perspective, Industry 4.0 may benefit certain social groups and/or regions and/or countries, while leaving others behind. In addition, the potential erosion of the tax base due to less employed people paying taxes and contributions whilst digital platforms and transactions are increasingly elusive to taxation, may seriously challenge the European Social Model and its underlying welfare and social policies. The digitalisation of economy and society also profoundly impact upon how our free market liberal democracies function. In sum, there are also risks in terms of social cohesion and of the regulation modes that make the fabric of our society thick[10]. Furthermore, there is the potential to enhance cognitive diversity and collective intelligence, allowing human workers to do more diverse activities, become more efficient and undertake more creative, fulfilling labour[11]. One could also envisage workers without employers in a system breaking down rigid organisations and internal labour markets and liberating workers' autonomy[12].

# TRENDS

**Tangible economic gains relate to efficiency, productivity, increased revenues and investments. As Germany has been the first to launch Industry 4.0 initiatives, it is the country for which most quantitative estimates are available. Boston Consulting Group (BSC), estimated that Industry 4.0 will contribute about 1 percent per year to German GDP over ten years (additional revenue growth of about €30 billion per year), create as many as 350,000 net jobs (610,000 will be lost to automation, but 960,000 new jobs will be created), and add €250 billion to manufacturing investment (or 1 to 1.5 percent of manufacturers' revenues)[13].**

Also, for Germany, Fraunhofer estimated productivity gains of around €78 billion in six sectors over a period of almost ten years: a yearly sectoral average of 1.7 per cent could be achieved as additional gross added value[14].

Another source of potential economic gains is data-driven innovation through the full deployment of big data and data analytics, as stressed by the European Policy Strategic Centre (EPSC), the EC Think Tank[15]. EPSC cites research according to which, even limited use of big data analytics solutions by the top 100 EU manufacturers could boost EU economic growth by an additional 1.9% by 2020. Citing empirical econometric estimations[16], EPSC also stresses that data-driven decision-making has been found to have a 5-6% higher output and productivity. Economic benefits would also spill over whether the needed investments to implement Industry 4.0 would be realised.

Ability to master digitisation will be key to firms' competitiveness. If Europe's traditional industries are unable or unwilling to leverage the current possibilities, and especially if they do not understand the implications of data-driven strategy, they will be unable to provide the customised and smart products and services future markets will demand. Across all sectors, SMEs will be most directly affected, either through lack of awareness or lack of the resources needed for the investments. European firms have yet to fully embrace new digital technologies. A 2015 monitoring report of the German Federal Government indicated that in Germany, the first country to launch an Industry 4.0 policy initiative, adoption of advanced digital technology was low and expected to continue to be so at least until 2020[17].

Europe lags behind the US and Asia in digital platforms. A global survey of platforms by Evans and Gawer shows that the largest transaction, innovation, and integrated digital platforms currently originate mostly in the US and Asia[18].

Market concentration within the Platform Economy presents new regulatory challenges. Firstly, the classical argument is that dominant firms are eventually disrupted; yet, empirically in the last 5-10 years turn-over at the top within the digital space has all but decreased[19]. Secondly, it is claimed that the market leaders need to innovate to maintain their position and they thus ensure the best value for markets and consumers; but recently we have seen big platforms taking over potential competitors in pre-emption strategies. Thirdly, one positive effect of a dominant player is that it creates standards that are good for users and for integrating innovation; on the other hand, however, proprietary standards render users captive, reduce competition and diversity of innovation, while proprietary use of data creates a strong competitive edge.

The rise of highly integrated digital platforms could lead to new oligopolies and monopolies. Competition law identifies several important issues posed by digital platforms[20]. Firstly, the diffusion of mobile devices amplifies market power by providing a gateway to complementary applications. Secondly, controlling access to its own service, which affects the services and products of others may amount to bottleneck monopoly. Thirdly, and most importantly, customer data and information are critical and strategic assets and inputs to production. Platforms' own data and the data from other producers using the platforms can create considerable market power and competitive advantages.

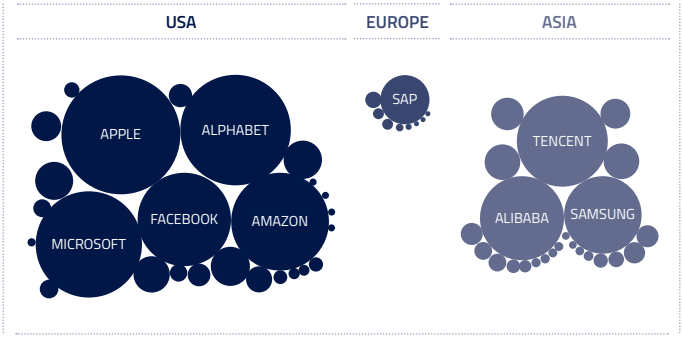


**Figure 1:** Platform economy: Europe lagging behind (bubble size: market capitalisation as of December 31, 2017; source: platformeconomy.com, after Evans and Gawker).

From the perspective of orthodox economic and managerial thinking, concerns about market structures in Industry 4.0 are just ways to call for unnecessary and distortive governmental interventions (i.e. industrial policy, new competition regulation, etc.). Nevertheless, it is relevant to ask questions about whether Industry 4.0 platforms will reproduce oligopolistic or monopolistic tendencies, as well as which kind of platforms from which countries may end up in a dominant position. How pluralistically open or monopolistically closed will the market structure of Industry 4.0 become? Can incumbent integrated platforms from the US (or new platforms from China) get the upper hand and encroach European industry? This domain of change has geopolitical implications for global economic competition, as recognised also by American commentators[21].

Estimates of the quantitative effects of automation on employment are uncertain and highly contentious. The available estimates are still very uncertain and differ widely both in academic and non-academic reports. They range from the risk of computerisation of 47% jobs in the US estimated by Frey and Osborne[22] to only 9% of job loss in OECD countries projected by Arntz et al[23]. Or from 57% of job losses in OECD countries according to Citi Bank and Oxford University[24], to the 14% estimated by OECD researchers[25]. Recent compilations[26] of estimates on the effects of automation on jobs renders this variability very clearly, with a difference of an order of magnitude. For example, worldwide estimated jobs losses by 2030 range from between 400 and 800 million according to McKinsey[27] up to the 2 billion projected by futurist Thomas Frey[28]. At the same time, one can see growing shortages in digital skills across the economy.

Current trends towards fragmentation of work may be compounded by the further digitisation of economic activities. From the 1990s until the start of the Great Recession in 2007-2008 in OECD26 (excluding the USA for which data is not available and including EU21) non-standard forms of employment accounted for about 50% of all job creation extending to 60% from the crisis year until 2013. On average 33% of total employment in OECD countries is in the form of non-standard work with wide-ranging differences among countries: as low as 20% in Eastern Europe to up to 46% in the Netherlands[29].

Automation and digitisation risk polarising work and exacerbating labour market inequalities. On polarisation and inequality Guellec and Paunov have shown empirically how digital innovation is strongly associated (statistically) with increasing inequality: market rents extracted from digitalisation accrue to top managers, capital investors and employees of dominant firms, whereas income of average workers is stagnant and declining[30]. In summary, the effects of automation and digitalisation of work may exacerbate patterns that have been witnessed in the last twenty years, leading to several patterns that may support the emergence of a more worrying scenario such as: a) de-industrialisation; b) stagnant wages and divergence between productivity growth and wage growth, c) declining labour force participation, d) soaring inequality and job polarisation; e) growing fragmentation and casualisation of work.

# CHALLENGES

**The trends described above result in several societal and economic challenges and consequences of the digital transformation of the European industry.**

## ECONOMY

The balance between labour and capital within manufacturing firms, given how companies will specify their set of tasks in view of emerging technological innovations (i.e., automation, robotisation, digitisation). Can interventions spur innovation without radically disrupting employment or create neutrality in the choice between machine and labour without hampering innovation? What effect can these instruments have on the market structure and geopolitical competition (also in relation to platformisation)? What interventions can preserve diversity, competition, and innovation and reinforce Industry 4.0 in Europe? Is there a danger that the combination of robotisation and platformisation may profoundly erode the tax base?

## SOCIETY

Is social cohesion threatened, for example by polarisation in access to employment, two-tier labour markets with sharp gaps between workers in standard work and those in non-standard work, wage differentials and inequality and access to welfare benefits?[31] Will expenditure for social protection become unsustainable due to lower tax and social security contributions from a smaller work force?[32] Can interventions mitigate crises in the regulatory set-up that may be produced by technical change? Can one increase fairness in our socio-economic systems? What are the implications for political stability and related risks, including geopolitical and global competition aspects of current and future digital transformation and innovation? Can policy interventions with the chosen instruments mitigate such risks?

# POLICY CHOICES

**While governments have a wide range of policy instruments at their disposal, in the scope of the digital transformation of the industry there are two categories that clearly stand out: policies regarding labour regulation and policies regarding taxation.**

## LABOUR REGULATION POLICY

A first possible approach is to focus both on unemployment and all forms of non-standard work. To do so effectively workers rather than jobs should be protected. One approach to this challenge is called 'flexicurity' (labour flexibility in the regulation of contracts plus social security)[33], ensuring eligibility to disability, pension, and other benefits are independent from the employment status of the person[34]. Flexicurity regimes, of course, can provide either more or less generous social protection[35]. One needs to ensure that flexicurity is implemented in coherence with the emerging flexibility of labour contracts. This will need what can be called (extended) Flexicurity 4.0. In this concept, social protection includes all domains of social benefits (incl. general education and health care), training and active labour market policies that promote labour market transitions and avoid crystallisation of two-tier labour markets. It would include labour contracts, though flexible, being reliable and incentivising formalisation (i.e. for those countries with sizeable informal economies) and transition toward open-ended contracts.

A second approach is to pay citizens an unconditional basic income that would guarantee access to basic necessary goods. This idea was first promoted twenty-five years ago by Philippe Van Parijs[36]. Recently, Soete after reviewing the current labour market developments related to technological innovation, has supported the introduction of a basic income to be financed through the introduction of a 'bit tax'[37].

A third approach amounts to a return to more fixed and guaranteed jobs and increasing the cost of firing labour. In this approach labour market regulation and taxation overlap.

## TAXATION POLICY

Recently, 'robot tax' entered the political debate as a result of a proposal presented to the EP by MEP Mady Delvaux[38]. The public reaction to this proposal has been overwhelmingly negative for practical as well as ideological reasons, with the notable exception of Bill Gates, who endorsed it[39]. Eventually in early 2017, the EP voted it down citing concerns over stifling innovation[40]. But increasing attention is now being given to the tax side of AI[41]. In June 2017 South Korea announced limits on tax incentives for businesses investing in automation. In OECD countries there are substantial tax incentives (i.e., credits)

in support of R&D and innovation and/or of technological infrastructure[42]. They include, among others, R&D tax credits, allowances, payroll withholding tax, social security contributions or accelerated depreciation of R&D capital. Some incentives are directed to the labour side rather than to equipment and infrastructure, although these are less widespread. If measures would restore tax neutrality between machines and people, it might improve efficiency by allowing firms to decide on use of workers or machines without tax-based bias. If tax policies encourage innovation through automation, this gives firms an incentive to replace workers with robots, even when workers might otherwise be better[43].

Other forms of tax can be based on a levy on: (i) online advertising, (ii) seller/buyer fees transacted via online intermediaries and marketplaces and (iii) the sale of user data. One could call such a tax a Digital Intermediary Tax (DIT). It would be due by firms with significant digital presence in a Member State based on revenue, numbers of users and contracts. The EC proposed in March 2018 two directives aimed at a similar tax[44]. These proposals have been rejected by the Council in December 2018. A DIT would bear some resemblance to the 'bit tax' proposed more than twenty years ago by Soete and Kamp[45]. The bit tax idea was simple: levy an excise duty on the use of digital infrastructure just as is done for the fuel of motor vehicles using our roads. The argument that this would be already covered by VAT is flawed since revenues from advertising accrue to large platforms mainly from digital services provided for free. The bit tax focused on all uses of digital communication, whereas the DIT can be read as implicitly targeting the large global social media firms and platformisation.

# SCENARIOS

**Labour policies have two extremes. The Labour-friendly scenario comes with extensive social protection and social investments (i.e. a strong emphasis on skills and training), and considers labour as an active factor of digital transformation. The Labour-neutral scenario includes full labour market flexibility without extension of social protection. Labour is treated residually and entirely as a commodity.**

Tax policies have the following extremes. Corporate-friendly - Lower taxes include retaining R&D tax incentive for investments in machinery, but also a cut in corporate taxes. Corporate-neutral - along the dimension of corporate taxes, higher taxes concern only introduction of a DIT but not of a capital (robot) tax, while R&D tax incentive for investments in machinery are retained. Matched by tax measures that can introduce neutrality in the choice between workers and robots (cut of tax wedge and introduction of human side R&D tax incentives).

Based on the combination of the extreme labour and taxation policy options four possible future scenarios can be identified.

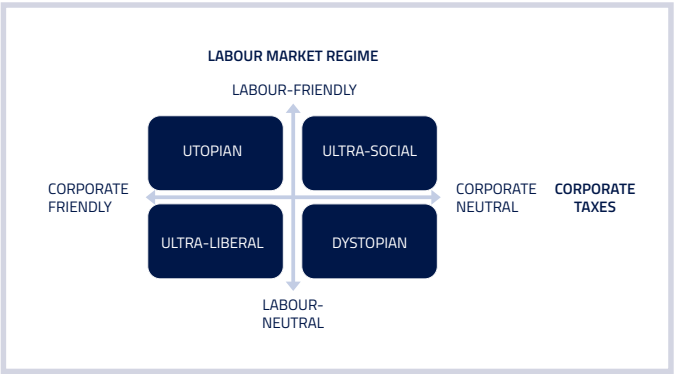


**Figure 2:** Possible future scenarios based on labour and taxation policy choices

## **UTOPIAN** SCENARIO

The utopian scenario will lead to a dire financial crisis of public finances as it would at the same time lower taxes and increase spending. It would, most likely be perceived as fair and be welcomed by a large spectrum of social groups and stakeholders. This is a source of political risk in that it could achieve wide support and then fail to deliver leading to political instability. Given the high negative effect on public finances, this scenario will not be investigated further.

## **DYSTOPIAN** SCENARIO

In the dystopian scenario higher taxes would not be used to increase social protection. It would strengthen the support to technological innovation for machinery-related R&D without any investment in human capital. The tax incentive would lead firms to substitute more workers by machines without extension of social protection. High corporate taxes may slow down significantly economic growth. Non-standard work will increase with lower wages and without improved access to welfare benefits, leading to exclusion of a large group of workers. Without any real attempt to seize opportunity and manage risks, political instability would increase. Given the negative effects on economic growth, jobs and social cohesion this scenario will not be investigated further.

## **ULTRA-SOCIAL** SCENARIO

The ultra-social scenario attempts turning technological into social innovation by fully transforming the mix between technology, economic incentives and the social fabric. A Digital Intermediary Tax (DIT) is introduced while retaining R&D machine-related tax incentives, at the same time as a new labour market regime is defined including Flexicurity 4.0 together with social investments and a cut of tax wages. In addition, human-side R&D tax incentives and incentives for re-standardisation of the labour contract could be applied to selected sectors (i.e., those facing shortages) and gradually. A DIT has no effect on the productivity of manufacturing firms and limited effects on digital platforms and company, as it is compensated by R&D tax incentives for machinery. Considering also the incentives to attract qualified workers and the social investment in human capital, one can expect a positive effect on productivity and economic growth.

Increased tax revenues from a DIT and growth are used to finance Flexicurity 4.0, the cut of the tax wedge, and incentives for human-side R&D. Reduced labour supply (effect of more jobs in industry and flexicurity) will reduce the share of non-standard work and increase wages, so increasing inclusion and reducing polarisation. Under this scenario, there would be three level playing field effects: a) on platformisation by way of a DIT; b) increased neutrality in the man-machine race through the labour-oriented tax measures; c) less of a two-tier and more inclusive labour market through Flexicurity 4.0. The perceived fairness of the system by a majority of the citizenry will increase and no strong political risks and opposition are expected. The budgetary sustainability is moderate and will depend on the size of tax revenues from a DIT, the extent of productivity and growth, and on the actual costs of Flexicurity 4.0.

Nevertheless, this scenario entails instability risks at the geopolitical level, globally and within Europe. Globally, strong opposition and lobbying by giant intermediary platforms may cause retaliation by key geopolitical competitors. The risk of tax competition from geopolitical competitors and capital outflow exists but is much lower than in the case of introducing a capital tax. It also requires strong coordination at European level to avoid tax competition between Members States and labour migration for social protection. In addition, it will require strong unity of the EU in global or OECD negotiations.

This scenario stimulates further social cohesion and is expected to have a positive effect on productivity and economic growth.

## **ULTRA-LIBERAL** SCENARIO

The ultra-liberal scenario focuses on stimulating technological innovation and providing economic incentives. The scenario entails cuts in corporate taxes and retaining or even enlarging machine-related R&D tax incentives. No new taxes are introduced, and social spending will not increase given the labour market regime. There will be no major social reform comparable to the Flexicurity 4.0. The combination of lower corporate taxes and R&D tax incentives for machinery would spur innovation and efficiency boosting productivity. Productivity can be expected to increase more than in the ultra-social scenario. Capital becomes relatively less expensive and profits after taxes will increase. Hence, manufacturing firms would heavily invest in technology and substitute workers with machines. Employment in industry would decrease and the supply of (non-standard) labour outside industry will increase. This will produce a larger share of non-standard work and also at least some level of technological unemployment, while wages will decrease.

Firms' choices between man and machine will be further biased in favour of the latter through taxation. Polarisation and social exclusion will increase not only in terms of wage differentials but also because of larger corporate profits. Low social protection for non-standard work will further undermine social cohesion. This scenario will be perceived as unfair by a majority of the citizenry, which weakens social cohesion and creates political risks. Without a DIT and under no changes in competition and consumer protection policies, there is no global level playing field on platformisation and a high risk that the market power of existing giant digital platforms increases and expands into Industry 4.0.

Risks in the relations with geopolitical competitors should not arise; actually, capital inflow from outside Europe may take place given lower corporate taxes. The budget sustainability seems higher compared to the Transformation scenario. There are less revenues from tax cuts and R&D tax incentives, but little additional social spending and more revenues can be expected from economic growth and capital inflows.

# CONCLUSIONS

**The two scenarios, namely the ultra-liberal giving growth-enhancing innovation and the ultra-social giving social cohesion enhancing fairness highlight trade-offs as shown in Figure 3. What was presented in a narrative fashion in the previous section is here rendered into a quantitative scale. The scenarios are at the two extremes within a continuum of possible approaches. Dependent on the political consensus achieved, a balanced combination of elements from both scenarios can be constructed, creating a labour-friendly environment with technical and social innovation, leading to economic growth and social cohesion.**

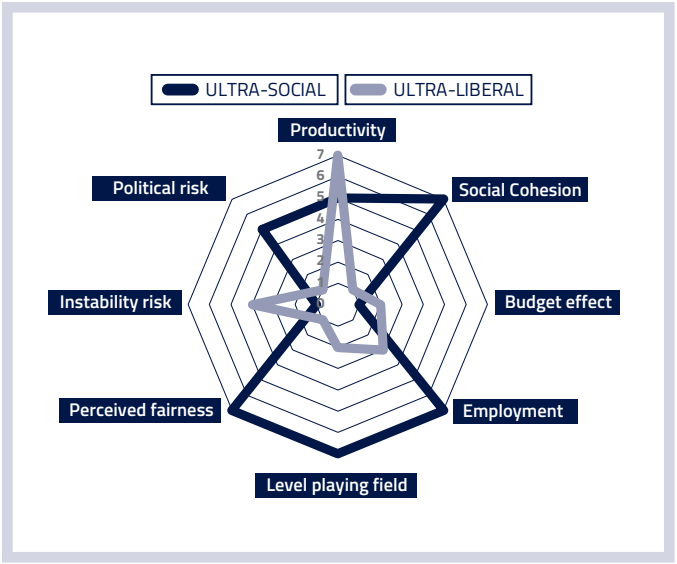


**Figure 3:** Comparing various aspects of the ultra-social and ultra-liberal scenarios

In Figure 4 the diagrams point out limits and trade-offs of specific individual measures in that each maximises only certain aspects and is insufficient to strike the best balance between seizing opportunities and managing risks, or between the two scenarios: the ultra-liberal giving growth-enhancing innovation and the ultra-social giving social cohesion enhancing fairness.

The diagrams suggest that a good and balanced policy mix, that brings Europe's social, economic and strategic autonomy interests together, can be achieved by fine tuning and intelligently combining elements from both the ultra-liberal and the ultra-social scenario, complemented with policy measures in other areas (competition and consumer protection law, measures influencing labour cost, data sharing regulation, public procurement, industrial policy and other incentives).

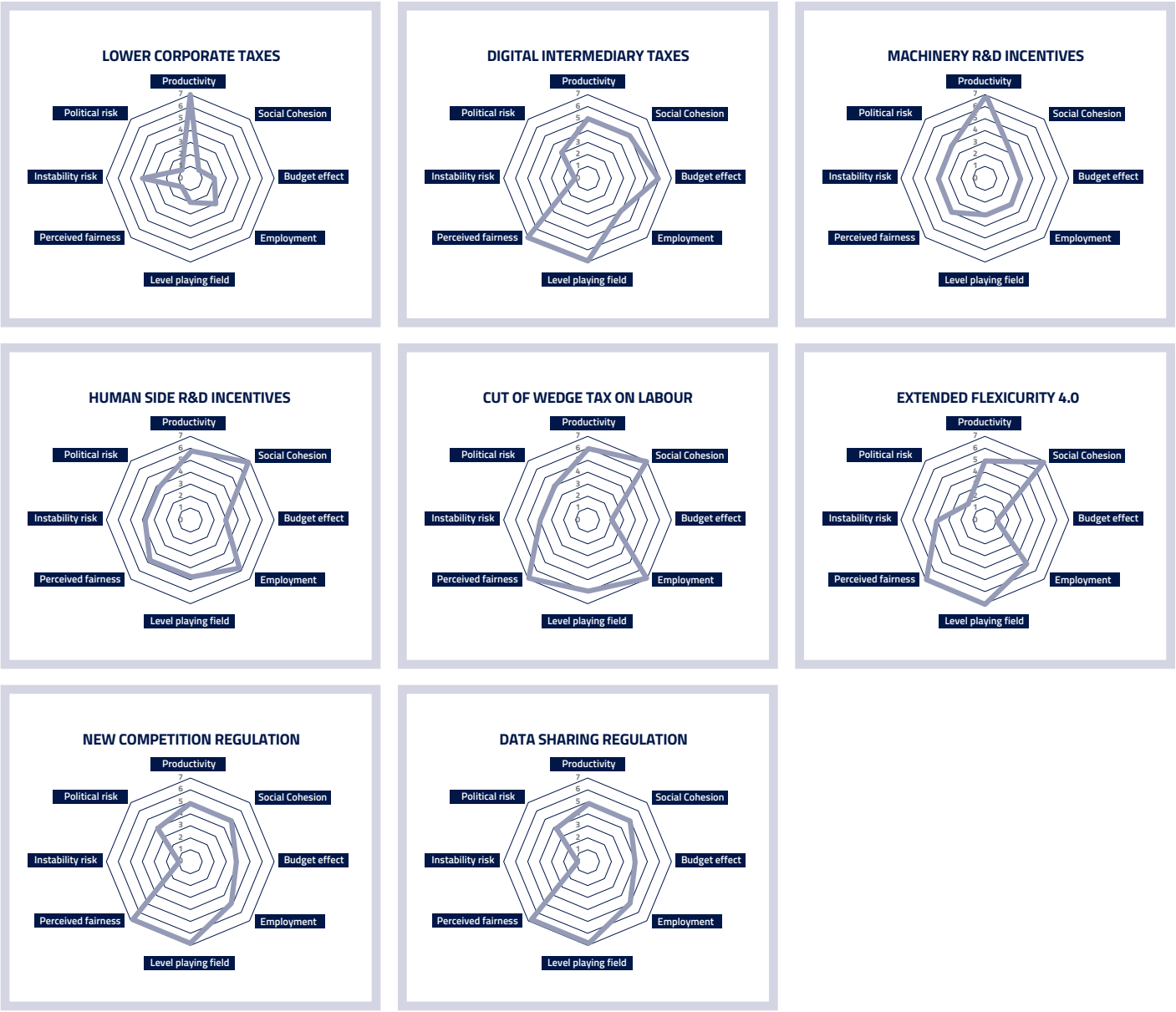


**Figure 4:** Assessment of various policy measures

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[3] Direct network effects are where more users generate more users, as in more Facebook. Indirect network effects are where more users of one side of the platform attracts more users on the other side of the platform as video game users attract developers.

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[5] See Guellec, D., & Paunov, C. (2017). Digital Innovation and the Distribution of Income. NBER Working Paper No. 23987). The authors explain and document empirically how digital innovation enables massive economy of scale (scale without mass), network effects, and reduction to zero of marginal costs. The initial production and launch of digital service, being it a software or a successful digital platform, requires large investments. Yet, after this investment is done, the cost of producing each additional unit of the service (in technical term of marginal cost) is zero or close to zero. Once a new version of a software is produced, producing and selling one copy or 1000 copies is hardly different. This also means increased fluidity and reduction of frictions and barriers. But digital non-rivalry and fluidity may have opposite effects: 'more market entries' versus 'winners take all effects'. The authors bring empirical evidence showing that the second effect has prevailed so far, and that digital innovation often produces concentration of power, extraction of rents, and is associated with the rising inequality of the last three decades. The non-rivalry means that a good can be consumed by one consumer without preventing consumption by others. Knowledge and information are non-rival goods par excellence. Digital innovation is fully intangible and non-rival and is not physically constrained. Digitalised innovations are easier to handle. Beyond the initial cost to produce the original they have very low or zero cost for reproduction, communication, lower search costs, and more fluidity with low friction costs.

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[10] Digital innovation and transformation they may impact the equilibrium of our free market democratic social fabric and order. In other terms, what the French School of Regulation calls the Mode of Regulation (MR). A MR is that ensemble of institutional, normative, cultural, and regulatory components that ensure the reproduction of economy and society. In complex modern systems there are forces at work that keep such systems together and thick, make them grow despite rapid and profound modifications of their industrial structures, social relations, techniques of production, patterns of consumption. We probably live in the first social structure where constant technological, social and economic change is a fundamental feature of its functioning. Changes and transformation are by nature

dis-equilibrating. There must be factors and mechanisms that maintain relatively ordered configurations of the system and allow a broad consistency between the conditions of material reproduction (including income distributions, accumulation, available techniques, patterns of consumption) and the thread of social relations.

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[26] See the table comparing various estimates reported in Winick, E. (2018). Every study we could find on what automation will do to jobs, in one chart. MIT Technology Review, January 25 (https://www.technologyreview.com/s/610005/every-study-we-could-find-on-what-automation-will-do-to-jobs-in-one-chart/ ). The data produced by Winick are rendered into a telling graph in Ghaffary, S. (2018). Why no one really knows how many jobs automation will replace. Recode, October 20 (https://www.recode.net/2018/10/20/17795740/jobs-technology-will-replace-automation-ai-oecd-oxford ).

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[30] Guellec, D., & Paunov, C. (2017) Digital Innovation and the Distribution of Income, op. cit. The line of argumentation, fully backed by empirical data, can be summarized as follows. Digital non-rivalry creates rents from market power and economies of scale in highly concentrated 'winner takes all' markets. Yet, as digital innovation is fluid, less costly, and faster it also increases risks. Even only marginally superior offerings can displace incumbents and take all the market, so moving not to a more competitive equilibrium but rather from one winner to another. As risk increases and market share is unstable, market premium is expected by investors and higher revenues. So, the extraction of market rents is needed to compensate costs, incentivize innovation, and repay capital risks. Beyond a certain level, though, and when the winner is consolidated this rent extraction turn into rent-seeking that substitute innovation and business strategy. As a result, the extracted rents accrue mostly, if not only, to capital investors, as well as to top executives and key employees of the "winning firms" who often own capital and hold managerial and leading positions in firms. Data presented Guellec & Paunov show that the share of capital compared to that of labour has increase especially in economic activities where digital innovation is relatively more intense.

[31] Rather than talking about the classic intra-capital fractures (i.e., financial versus industrial, big versus small) the main line of cleavage emerging is that between capital vs data services, in a capitalism without capital, see Haskell, J. (2018). Capitalism without Capital: The Rise of the Intangible Economy. Princeton: Princeton University Press.

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[39] See Gates interview with Quartz published 17 February 2017 (https://qz.com/911968/bill-gates-the-robot-that-takes-your-job-should-pay-taxes/ )

[40] See Reuters "European parliament calls for robot law, rejects robot tax", 16 February 2017 (https://www.reuters.com/article/us-europe-robots-lawmaking/european-parliament-calls-for-robot-law-rejects-robot-tax-idUSKBN15V2KM ).

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In the context of its activities in its strategic innovation area of Digital industry, EIT Digital decided to launch a study focusing on the main policy challenges emanating from the digital transformation of the European industry. The study followed a scenario-based approach to structure and assess the potential impacts of policy measures with a main focus on taxation and labor market regulation. Digital Enlightenment Forum was contracted to execute the study under the guidance of EIT Digital senior staff.

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