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Contents

Introduction

A new debate is causing ferment not only in academia but also in politics and the world of labour in both the United States and Europe. This debate, symbolised by the irruption of Uber in the passenger transport sector, signals – according to some – an end to waged labour, the total liberalisation of services, and the extension of worldwide competition far beyond any of the Bolkestein directive's proponents' wildest dreams. It will put an end to social models as we know them in Europe: no more labour law or working time regulation; no more hours' schedules or offices; no dismissal procedures (but instead internet accounts disconnected by decision of some start-up somewhere); and no more collective labour action.

Others regard this vision as exaggeratedly pessimistic; they see the onset of a digitalised economy as a harbinger of new opportunities, whether in the services sector – where the emergence of collaborative projects will be facilitated, with a premium on use value rather than ownership (shared use of costly goods such as cars, housing, tools), on repair rather than replacement, on local or shared financing rather than bank loans – or in industry where increasingly intelligent production lines will volatise worker input to produce a new form of cooperation between humans and machines. Here we have a new economic model entailing zero marginal cost that in no time at all will become the driver of powerful economic growth and strong job creation.

How are we to see with any clarity what is entailed by such a rapidly evolving scenario? In the following paragraphs we will attempt to establish the current state of the debate using some of the main publications that have appeared in the last two or three years in the United States and Europe.

In a first part, we sketch out the general context: what is meant by the digital economy, by Big Data, or internet platforms? And what are the new possibilities thereby opened up?

In the second part we tackle some of the specific questions raised by these developments in the world of labour in particular:

— regarding the labour market: does the digital economy destroy more jobs than it creates? Do we have any way of predicting the net outcome?
— concerning the status of workers: are we all about to become self-employed? Is this the end of wage labour or the beginning of new and more flexible forms of employment more in keeping with the wishes of workers themselves?

— with regard to working conditions: will it still be possible to enforce social regulations such as limits on working time, protection of health and safety in the workplace (will workplaces continue to exist?), collective defence of workers' interests, and so forth?
— in the field of training: are we all going to have to train as computer engineers? What new forms of training is this 'digital revolution' going to require? Will we witness the emergence of new fracture lines among different categories of workers?

Finally, in an appendix, we will deal with the trade union world as such: what is the trade unions' attitude to the emergence of this digital economy? What are the main initiatives already taken at European trade union level to oppose/adapt to/go along with/promote this digital economy?

1. Setting the scene – the general context

In April 2014, Uber, a start-up created barely five years earlier, inundated the European transport market using its shared transport app. Within a few months, as this decision shot like lightning through major European cities (Paris, London, Berlin, Brussels, etc.), it caused Europeans to become aware of the tremendous stakes concealed behind the technological progress largely underway in the United States and symbolised, *par excellence*, by Uber. With a simple mobile app and a few algorithms, anyone at all can now become a 'cabbie': without any training whatsoever, without the need to pay taxes or social security contributions, and without regulatory constraint (insurance, MOT, etc.), these self-appointed drivers can, from one day to the next, choose to compete with traditional taxi and minicab firms. An established and extensively regulated form of provision appears all of a sudden to have been overtaken by an American start-up that has not a single owned vehicle to its name.

The phenomenon is emblematic of such a complete break with practice to date that current talk is of an 'uberisation' of the economy: 'businesses now fear being "Uber-ed". (…) From taxi drivers to television networks, from filmmakers to restaurants and banks, the ways in which individuals and companies do business is metamorphosing so quickly that many companies find it hard to keep pace' (*Financial Times* 2015a).

As well as Uber we have Airbnb, Wonolo, Lending club, Taskrabbit, Upwork, etc. These are companies of a new kind whose emergence has been made possible by three recent developments:

— internet and the development of high-speed networks;
— Big Data, that is the merging by internet platforms of colossal masses of directly exploitable commercial, personal and geographic data;
— the explosion of new forms of mobile device – mobile telephones, tablets, etc. – that give consumers, workers, and service providers access to mobile internet at all times and in all places. Today it is possible to buy for 400 dollars a smartphone with a performance equivalent to that of a super computer that cost 5 million dollars in 1975 (MGI 2013).

These three forms of development have had the effect, in a few years, of obliterating distances and frontiers thanks to networks; of creating new raw materials – data – that are directly exploitable by platforms, companies or start-ups; of erasing the frontiers between workplace, leisure venue, or home. The conditions for performance of a professional or otherwise lucrative activity

have been overthrown and transformed. The changes in question affect services and industry, manual and intellectual labour, salaried workers and the self-employed.

1.1 A new world economy?

In a sort of recent combination of new industrial revolution and gold rush, innumerable young firms have been rushing in to develop applications designed to monetise the new areas of potential opened up by these trends. In the areas of transport, delivery, accommodation, financing, repairs (plumbing, electricity, etc.), hiring services, and so forth, new initiatives are seeing the light every day.

According to Christine Balagué, vice-president of the French *Conseil national du numérique* (*Le Monde*, 23/08/2015), any individual equipped with a mobile phone can now 'become a producer, create services, or at least place services on offer' for the purpose of earning a little spare cash, making it through to the next salary payment, or topping up their benefits. In parallel, ownership that previously seemed to confer entitlement to the exclusively private and part-time use of an expensive asset (car, apartment, tools, etc.) has come to represent for the owner a capital that can be exploited in a number of different ways for the purpose of generating income. This sudden transformation gives rise to numerous questions about the 'person/worker' but also the 'platform/employer', about the location of profits (and of taxes), about monopoly and competition, about financing and social models, about land use and development, about individual and collective responsibilities, etc.

The phenomenon is in essence international and reflects social inequalities with, on the one hand, the unemployed or precarious worker who will seek to top up meagre wages or benefits by offering to work for Uber and, on the other, the dynamic executive who will arrange for a personal assistant in India to manage his accounts and his appointments diary. While this image may be a caricature, it illustrates the two ends of the chain whose links are the three components of internet, Big Data and smartphone.

These three components have today come to form the underpinnings of a new economy and, hence, of a new world labour market[1]. The accompanying discourse used to describe this emerging reality is still very tentative: digital, collaborative, sharing, on-demand economy… It is interesting to observe that this new economy 'has been undetected in statistics for the most part, largely because the economics of 21st century digital technology is quite different from previous technologies that have impacted the labor market at a broad scale.

1. In the framework of this limited study we will not deal with other aspects of 'disruptive' technologies such as genomics, advanced materials, 3D printing, etc. for which we refer the reader to, in particular, McKinsey Global Institute : 'Disruptive technologies : Advances that will transform life, business, and the global economy' (Manyika *et al.* 2013).

The unique nature of digital goods makes it very hard for us to track the actual impact of these innovations and developments. Our current measure of national output, GDP, does a poor job of measuring the Internet and generally struggles to track the true value of tech-enabled services. This leaves us without a clear picture of the true effects of technology' (The Open Society, 2015: 10).

Nor is there unanimity when it comes to interpreting the emergence of this 'new economy'. Some players see in it no more than a new trend development, one that has gathered speed with extreme rapidity, admittedly, but that is nonetheless not revolutionary in the same way as, for example, the generalisation of electricity at the end of the 19th century or access to running water both of which represented genuine revolutions such that it is today pretty hard to imagine daily life without electricity or running water. These authors, from the standpoint of this extended historical perspective, consider that we are today merely trying to grab, with ever greater difficulty, a few possibilities for economic growth by means of innovations such as 3D printers, robots, and so forth, which are in fact barely more than gadgets compared to the true revolutions represented by the introduction of electricity and running water (Cowen 2011; Gordon 2014). According to Cowen, after gathering the *low hanging fruit* of growth, economic development and technological innovation have now reached a plateau. There is no point, in other words, in relying on these techno-gadgets to supply any kind of growth spurt in the coming years.

Other authors, by contrast, do not hesitate to speak of a 'disruptive' stage of evolution insofar as they see the new developments as representing a complete break with firms' current modes of organisation. 'Adopted technology becomes embodied in capital, whether physical or human, and it allows economies to create more value with less input. At the same time, technology often disrupts, supplanting older ways of doing things and rendering old skills and organizational approaches irrelevant' (Manyika *et al.* 2013). In line with Schumpeter's notion of 'destructive creation' (1942), this is taken to mean that it is not a question of adapting to new practices but of breaking with the old model to enter an entirely new model in terms of production methods, resource management, etc.

Technology is seen as the ultimate factor of optimisation: zero marginal cost (Rifkin 2014); the second machine age (Brynjolfsson and McAfee); even as the solution to scientific controversy (Babinet 2015: 100 ff.) in that it puts paid to sterile polemics (concerning the causes of climate warming, the evolution of biodiversity, etc.). Big Data will contribute, it is argued, to an optimised society and to rational governance, devoid of managerial error or waste.

Even better, these technological innovations will provide the engine of future growth. In the opinion of the 'techno-optimists', there can be scarcely any doubt that these disruptive technologies represent progress that will transform 'life, business and the world economy' (Manyika *et al.* 2013). 'It is not totally misguided to think that data can, on its own, bring about a more powerful break than that represented in its time by the advent of the industrial era' (Babinet 2015: 22). According to this author, we are about to make the

transition from a society in which energy was the engine of progress, innovation and productivity to one where data and the information technologies that underpin it will be the engine of progress[2].

In the world of labour, therefore, it would be inappropriate to expect that it is a question simply of 'training' for the 'new digital economy' or of investment in skills and qualifications (European Commission 2015: 32). Rather the need will be to enter a new world of work in which everything will be different. 'What Europe needs is first and foremost a shared European vision of the direction in which digitalisation should evolve' (Kowalski 2015). In the services sector, what will change is the relationship between the worker or rather the provider and the employer or rather the algorithm that supplies the work, calculates the pay and prepares the pay slip; the employment contract, wage bargaining, dismissal procedures or deactivation of the account will change also; as will social security, occupational health and safety standards, etc. In the industrial sector too, modes of production are changing, interaction between the worker and the (intelligent) machine is being altered, monitoring and control of the worker are being stepped up, managerial practices bring an increase in pressure, not to say oppression.

1.2 Big Data

In order to properly understand the magnitude of the dynamics and rationales at work, it is necessary to refer to the workings of this economy, for they are what will indicate the possible degrees of freedom/enslavement, of sharing/deregulation, or of collaboration/ precarisation to be found in this digital economy, as well as the foreseeable consequences for labour markets, labour law, collective agreements, trade unions, the balance of power between employers and employees – in short, the potential consequences for the European social model.

Big Data can be defined, schematically, as being the combination and sum total of the data (personal, commercial, geographical, behavioural) available on digital networks – internet, mobile phone, satnavs, etc. – and exploitable as raw material, particularly in the framework of mobile applications. The digital economy and its start-ups seeking to monetise this raw material rely on a handful of giant-sized platforms – including Google, Facebook, Apple, Amazon, IBM, etc. – which 'produce, accumulate and manage a huge volume of data on their clients and use algorithms to convert this data into exploitable information. The growth of such data is exponential: 90% of the data now circulating on the internet was created less than two years ago (…). The Big Data sector has growth of 40% a year, seven times higher than that of the information data market' (European Commission 2015).

2. Though there is one dampener here: according to a GESI (Global e-sustainability Initiative) finding, the internet causes as much pollution as does air traffic, in particular with regard to the cooling of servers and super-computers (GESI 2012). This does cast a different light on the claim that we have moved beyond the industrial period when energy served as the engine of growth.

According to the International Data Corporation (IDC), 'the Big Data technology and services market represents a fast-growing multibillion-dollar worldwide opportunity. In fact, a recent IDC forecast shows that the Big Data technology and services market will grow at a 26.4% compound annual growth rate to $41.5 billion through 2018, or about six times the growth rate of the overall information technology market[3].

The three characteristics of Big Data are summed up in what have been called the 3Vs: *Volume*, *Velocity* (speed at which the data are created), *Variety*. Management of this data can allow formerly hidden information (for example, the impact of weather forecasts on sales) to be revealed[4]. We are thus speaking about unprecedented opportunities to combine, at virtually lightning speed, immense stocks of the most highly varied data. This in turn enables, in a wide range of fields, reaction to or anticipation of the behaviour of a consumer, a driver, a salesman and – why not? – a worker.

In this way Big Data become intelligent and can be turned into 'learning machines'. Brynjolfsson and McAfee, two fervent supporters of this new digital economy, describe a 'second machine age' characterised by the explosion of digital data and the robotics market. They tell us that digitalisation of almost everything – documents, information, maps, photos, music, personal data, social networks, request for information and answers to these requests, data transmitted by all sorts of sensors, etc. – is one of the most important phenomena of the last few years. As we enter the second machine age, digitalisation continues to expand and accelerate, translating into some absolutely stupefying statistics' (Brynjolfsson and McAfee 2014: 78). The learning machines, fed by this data, are now beginning to perform tasks that were formerly unimaginable: diagnosing sicknesses, driving vehicles, drafting press articles, forecasting epidemics, restoring sight to the partially blind, and much more.

To take a single example, it is perfectly possible to imagine that soon, at the moment you enter a restaurant your smartphone will show you the menu, suggest what dishes are most likely to give satisfaction depending on the time available for your meal, your budget, your dietary constraints, etc. (Babinet 2015: 55). Similarly, a car rental firm would be able to forecast how many vehicles need to be available at the airport on the basis of the number of vacant hotel rooms.

Intelligent data shake up and overturn retailing procedures, forms of corporate and industrial organisation, understanding of the stakes not only within companies but also in fields as wide-ranging as health, agriculture, the environment, energy, transport, town planning, in short, all forms of

3. https://www.idc.com/prodserv/4Pillars/bigdata

4. According to Babinet, it was the interconnection and synchronisation of financial markets at the beginning of the 1980s that triggered the movement of globalisation: once the financial markets were interconnected, they began to demand from governments the deregulation of financial trade, free movement of capital, etc. (Babinet 2015: 213). This is seen as the birth of the first 'digital platform', that of finance.

organisation. Some authors have thus described a 'second economy' distinct from the 'traditional' physical economy for the production of goods and services (Brian Arthur 2011).

For the world of labour in general, as we shall see in more detail in part two of this study, these developments entail both risks and opportunities. To give just a few examples:

— the technician on-the-move who is followed by management at every step by means of a connection box, whose every action and gesture is recorded and evaluated in real time (journey time, client intervention time, etc.);
— the production line worker with an RFID (Radio Frequency Identification) chip transmitting in real time his every move to the robots with which he is interacting (and to the management);
— the farmer to whom the tractor manufacturer John Deere boastfully recommends its connected tractors that are 'more accurate than the best drivers'[5];
— or the employee who, with a few sensors and an app[6], will be able to assemble more accurately than the medical centres wide-ranging information on occupational disease factors or other health problems linked to the inhalation of chemicals; etc.

1.3 New corporate forms of organisation and new management

The digital revolution promises intelligent factories, intelligent work organisation, intelligent management, as well as intelligent cities, intelligent shops, intelligent energy production systems, intelligent transport infrastructures, etc. But what about the manual worker, the office worker, the service provider? Will their only role be to execute tasks decided by algorithms? Or, in the words of Head (2014): Will smart machines make dumber humans?

We are moving out of an economy where it was the master of infrastructures who created (and captured) value and into an economy where it is the master of data who creates (and captures) value. Until very recently numerous industrialists in Europe wrongly believed that the industrial nature of their activity spared them the 'digital threat' that seemed to weigh more heavily on services (Uber, Airbnb, Booking.com, etc.).

However, as declared by European Commissioner Gunter Oettinger at an industriAll conference, 'the motor industry plays a key role in Europe and it is

5. As emphasised by this company's advertisement: 'Yes, I'm connected. Even my best driver cannot work for a whole day with the precision of Autotrac'. https://www.deere.fr/fr_FR/regional_home.page, consulted 22 September 2015.
6. For example, Apple's Healthkit.

in the process of digitalisation (…) Apple has decided to make cars. (…) It is true that the batteries, the plastic, the tyres, and so on, will be ordered from suppliers. But it is Apple that will design the car and incorporate its information system into it (…) Others will be no more than suppliers of metal parts (…). This represents a fatal threat for the European motor industry'[7].

In reality, the car is becoming the extension of the computer (or of the smartphone); it is being turned into a computer on wheels. So it is indeed the master of data who will create and capture the value –entailing all the geopolitical stakes that we have no room to study here. Big Data is not content with changing the management of stocks or flows; it is the whole production paradigm that is subjected to change. Thus, while it may be asserted that the motor industry has, over many decades, improved the car, this is no more than a peripheral consideration; for the car in question remains stuck in traffic jams. Whereas the digital, intelligent car (see the Waze app that proposes the fastest route in real time[8]), but also the new transport services such as car-sharing or car-pooling, improve the actual function of the vehicle, namely the transport service.

This will have an impact on corporate organisation and production methods. New functions are already appearing: 'Business strategies now must be seamlessly interwoven with ever-expanding digital strategies that address not only the web but also mobile, social, local and whatever innovation there may be around the corner. To help meet these challenges, companies are increasingly looking for a Chief Digital Officer (CDO) who can oversee the full range of digital strategies and drive change across the organization' (Grossman *et al.* 2012). The CDO may himself come to be surrounded by other new posts such as the *data miner*, the *data analyst*, *data manager*, etc. This data-led management necessitates erasure of silo-based organisation methods in favour of a horizontal and open form of organisation within which the flows of information will circulate.

Within a company like Amazon, the platform is governed by simple principles that apply to all teams: all data from all teams must be made accessible on the platform; all communication among teams must past through it; the programming interface of apps must be conceived to be externalised and accessible to developers throughout the world, etc. (Babinet 2015: 130).

These information platforms become, so to speak, the factory of the 21st century' (The Open Society 2015: 11).

As we shall see below, the stakes and repercussions of these new modes of corporate organisation are tremendous, in particular in terms of:

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7. industriAll, European Trade Union Conference, 'The digital transformation of industrial products and processes : social consequences, trade union action' (Brussels, 5 November 2015). Personal notes.

8. https://www.waze.com

— the monitoring, control, evaluation of workers' performance (this aspect will be examined in part 2 of this study);
— the function of those workers (employees, self-employed workers, undeclared workers) who lack mastery of the data: will they be reduced to a role of mere tool? Are we to witness a 'servification' of employment (a neologism used by Bourdoncle 2014);
— the standardisation of a data-led company or even of a whole society led by data and rational efficiency;
— the use of personal data: as workers and citizens we produce without realising it millions of octets of information every day via emails, social networks, satnav itineraries, research engines, passwords, forms, but also surveillance cameras, electronic sensors, etc. Increasingly, our private and professional documents are stored in 'clouds' whose physical location is sometimes thousands of miles away.

1.4 Will Europe become marginalised?

Other forms of corporate challenge are the virtually monopolistic position maintained by the financial resources and innovation capacity of companies such as Google, Facebook, Apple, Amazon, LinkedIn, Microsoft, and so on. These companies are relatively small in terms of staff numbers; yet they are immense in terms of capitalisation – a reflection of the faith placed by investors in this new economy – and global in terms of their users (Roubini: 3). Their financial power enables them to buy up, in the digital ecosystem, all the start-ups likely to improve, strengthen, develop their own services (Instagram and WhatsApp bought up by Facebook; Youtube, Dropcam, Uber, Waze, etc. bought up by Google; Siri, Embark, etc. by Apple; Twitch by Amazon, etc.). They have a tendency to expand into increasingly diversified sectors – motor cars, health care, finance, education, music, etc. – while at the same time radically calling into question the business model of the giants. They are in a position to suck up productivity gains and to capture economic rents on a planetary scale.

On account of this tremendous financial and lobbying power, they can allow themselves to operate on the frontiers of legality: Google and the digitalisation of books without authors' or publishers' agreement, reproduction and circulation of press articles without any payment to editors or journalists; Apple and the attempt to provide an online music service without payment to musicians; Airbnb and its refusal to sanction the high numbers of Californian accommodation providers who fail to observe the obligation to register with the municipality[9]; Facebook and the violation of European consumer protection rules[10]; Uber and the assumed illegal exercise of passenger transport

9. *Le Monde* 5/11/2015.
10. *From social media service to advertising network - A critical analysis of Facebook's Revised Policies and Terms.* https://www.law.kuleuven.be/citip/en/news/item/facebooks-revised-policies-and-terms-v1-2.pdf

services; etc. As pointed out in a quote in the *Financial Times* (2015b): 'The culture at Uber is both super aggressive and incredibly naïve. The executives are very young … they just buy into the "change the world" thing and they were not thinking about the consequences'.

As pointed out by Jain (2015), 'These companies have chosen to grow first and ask compliance-related questions later, and so far their strategy has worked. Their massive war chest of funding has bought them loads of lobbying, litigation and PR power.' As we shall see, these *fait accompli* strategies are likely to have a major impact on the traditional payment and regulation models directly affecting workers.

More broadly, for the European economy as a whole, one of the questions arising ever more acutely is the following: from where, in this new context, will European growth come?[11] What will be the future of the European industrial fabric? 'Will German SMEs turn into slaves of a digital platform they can no longer control? Will we see the rise of unassailable digital monopolies, immune to competition due to strong network effects? Will value creation for the most part quit Germany because of the platformization process?': these are some of the questions asked by Ansgar Baums (2015). Having itself deindustrialised by relocating to Asia, will Europe now make itself dependent on data held in the United States?

This is a very real risk according to Sohnemann's rather trenchant line of argument: Europe is on the point of becoming marginalised in the race for the digital economy. 'Of course, there are many European start-ups but they often do not have the same funding as American companies, nor the same deep technological approach and support' (Sohnemann 2015), on account in particular of the excessive fragmentation of the European market on both the cultural and linguistic front as well as from the financing standpoint. Setting this observation in a medium-term perspective, Atkinson is quite categorical: 'After a long period during which Europe was closing the productivity gap with the US, since 1995 that gap has widened every year and shows no signs of narrowing. (…) One key reason productivity has not grown as fast as in the US is that European nations have not been able to take as much advantage of the ICT revolution as has the US' (Atkinson 2015).

Finally, the European states, and the European Union itself, do not seem equipped to confront the dazzling flare-up of this digital economy. To return to the emblematic example of Uber, whereas some EU member states seek to exhibit a form of national, or even regional, defiance to the challenges launched by this company that is itself prepared to remain on the offensive in the large numbers of legal battles already underway (in France, Spain, Germany, Belgium), other member states are cooperating fully with it (see in particular the example of Estonia).

11. In this literature review we will not deal with questions of the content of this growth or of its environmental or climate impact.

How will states adopt their tax policies to the digital economy? Will they still find ways of financing their social security systems? And how will they manage to regulate this completely trans-nationalised sector? And what is Europe doing about all this?

2. The digital economy and the labour market

In discussions of the digital economy a distinction is generally made between traditional firms that seek – with a greater or lesser degree of success – to adapt to the new technologies (teleworking, mobile working, community buildings) and the 'digital natives' which are firms that came into existence with and as a result of the new technologies and are characterised by a fundamentally different form of work organisation that is 'more agile, structured in project mode, more open on to an ecosystem, and much more efficient, in particular with regard to the spread of innovation: open space, co-working sites, etc. (Mettling 2015: 8). This 'agility' relates to workplace, to working hours, and also to the relationship of subordination between employer and employee. As will become apparent, the 'agility' in question is not necessarily or exclusively synonymous with greater freedom for the employee.

This has an impact on management, as well as on the new forms of non-salaried work, i.e. the self-employed and freelance workers whose numbers are steadily increasing in the United States, the Netherlands, Germany, France, and elsewhere.

If – as was reaffirmed by the ETUC Congress in 2015 – the notion of quality employment includes a decent wage, occupational health and safety provision, acceptable working conditions, opportunities for training and promotion; and if a full-time and open-ended contract 'for all' is to remain the norm, then the impact of the digital revolution on labour markets triggers numerous concerns.

2.1 What will be the overall impact on the economy and labour markets?

While all studies point out that this 'revolution' will entail a major impact on the labour market, they also stress that this impact will be differentiated according to sector and that the emerging new jobs will take many forms (see 2.2 below). It is accordingly very difficult to effect any precise measurement of specific future consequences over all occupations, all jobs, all sectors.

A general overview of the various areas of impact would be as follows:

— job creation: new sectors, new products, new services;
— job change: digitalisation, human/intelligent machine interface, new forms of management;

— job destruction: automation, robotisation;
— job shift: digital platforms, crowd sourcing, 'sharing' economy.

These four impacts of digitalisation are shot through with macroeconomic stakes deriving from developments in labour markets, pay, social inequality, quality of newly created, changed, or 'shifted' jobs, etc.

The following pages will examine the principal existing studies, first for the various sectors of industry and then for services.

One initial comment is, however, in order: it is increasingly apparent from a reading of the literature that the traditional split between 'industry' and 'services' is becoming ever less relevant. The 'Fourth Industrial Revolution' seems to be making the frontier between the two sectors much more porous: an emblematic case of this characteristic merging of industry and services is the so-called intelligent car, potentially a 'computer on wheels' (industriAll 2015), incorporating all the services that mobile applications are increasingly able to offer the user.

It is significant that a major German car manufacturer boasts not only the technological features of its vehicles (performance, comfort, etc.) but also 'a new form of mobility for a more dynamic way to get around' (car2go by Daimler[12]) and that it is already at work devising the different services that it might offer the passengers of its future driverless cars: entertainment, virtual reality, historical or tourist information on the places through which it passes, etc.[13]

Similarly, the International Automobile Federation (FIA) recently revealed to what extent the cars of today collect for their manufacturers all sorts of personal data about car owners. Thus certain models of BMW send to their manufacturer data concerning the driver, her/his location, routes taken, last hundred parking spaces, manner of driving, mobile phone synchronisation data, etc. (FIA 2015). According to *The Economist* (2015b), 'a high-end car, for instance, has the digital horsepower of 20 personal computers and generates 25 gigabytes of data per hour of driving'.

By contrast, it is equally significant that a company like Google should be investing in the construction of autonomous vehicles that are the product of its geolocation and online route calculation services, etc. This development is also reflected in the adjective 'smart' increasingly used to describe these vehicles and which, according to our hypothesis, simply reflects the combination between industry and digital services: after the 'smart' phone we now have the smart car, the smart factory, the smart watch, smart clothes and even smart cities. At the same time, and in a manner that is better documented, this development corresponds to the emergence of an economy based on services and no longer solely on ownership. Does one need to be a car owner or to have ready access to services that provide mobility? Does one need to own

12. https://www.car2go.com
13. *Le Monde* 19.11.2015.

a washing machine or to have one's clothes cared for by an efficient cleaning service, etc. (Hebel *et al.* 2012).

This increasingly shifting two-way frontier between industry and services, and between private ownership of items and access to services, seems to give substance to Jeremy Rifkin's intuition of an 'access economy', or what he has called the transition from an industrial production economy to a cultural production economy (Rifkin 2001).

However this may be, we will – for the sake of clarity – in the following pages retain the traditional distinction between industry and services, bearing in mind that this distinction is increasingly porous.

2.1.1 In industry

Today there is talk of a Fourth Industrial Revolution: the First was that of the steam engine, the Second that of electrification and mass production, the Third that of computer, and the Fourth is the digital revolution (Kowalski 2015) consisting of developments in information technologies combined with robotisation, automation of tasks, the internet of things, 3D printing, driverless cars, and – in the field of defence and the fight against terrorism – drones, cyber-weapons, surveillance, etc.

Thus, the image of the IBM intelligent robot Deep Blue that beat world champion Garry Kasparov at chess remains in the collective imagination even though this 1997 performance is today completely out of date. Deep Blue's successor, named Watson, is a robot capable of understanding (almost) all the subtleties of language, of speaking and answering (almost) all questions, on culture, science, politics (Ford 2015). In the United States Watson is already beating all his human opponents in TV general knowledge quizzes. The prospect of such 'intelligence' being incorporated into a mobile device – endowed with skills that increase by the day – itself connected to a super-powerful computer hub (a process described by Ford as 'cloud robotics') gives some idea of the extent of the revolution underway.

IBM was not slow in engaging Watson in the real world, and some of the fields in which he excels are medical diagnosis, consumer services, technical support, the financial industry, etc. Such highly developed and diverse artificial skills are bound to revolutionise business organisation. 'While innovations in robotics produce tangible machines that are often easily associated with particular jobs (a hamburger-making robot or a precision assembly robot, for example), progress in software automation will likely be far less visible to the public; it will often take place deep within corporate walls, and it will have more holistic impacts on organisations and the people they employ' (Ford 2015: 105).

Similarly, 3D printing, which might be mistakenly regarded as a gadget, is another component of this revolution, one that could in the not-so-distant future pose a whole set of new questions for society. 3D printers are

unquestionably gaining ground. 'Consumer adoption of 3D printing, though still in its infancy, is evolving very rapidly. Industry observers such as Gartner Research remark that while the mass adoption of this technology by consumers is at least 10 years away, growth has entered a new phase and shipment of 3D printers intended for the mass consumer market is expected to double every year until 2018: the total number of printers shipped in 2014 was just over 100 thousand. This is expected to exceed 200 thousand by the end of 2015, more than 400 thousand before the end of 2016, and 2.3 million units by end of 2018. Many of the new users will be students and teachers, spurred on by public policies to boost adoption of the technology as well as by aggressive campaigns by companies in the domain to help educators adopt the use of 3D printers in the teaching of new and traditional curricula' (Robertshaw 2015: 17).

3D printing could end up posing some daunting problems, particularly in terms of the regulations governing manufactured goods. A recent innovation, for example, is firearms that can be printed in 3D on the basis of a model that was downloadable (before it was banned) on an internet site in the United States[14]. Similarly, it is – or will very soon be – possible to download and print models of medical devices, chemical reactors, food products, even cars[15] (Robertshaw 2015). Traditional methods of regulating the production of manufactured goods will have to be adapted to meet these new forms of production.

All these innovations that are now being combined contribute to the strong impression that we have reached a tipping point, a moment in the curve when a large number of technologies that belonged yesterday to the world of science fiction are becoming the reality of today (Brynjolfsson and McAfee 2014). In industry in particular, this revolution is marked by recent advances in Machine Learning and Mobile Robotics (Frey and Osborne 2013; Ford 2015). It translates into 'the digital integration of all process: design, manufacturing (the 'industry 4.0' concept) and administration, and thus to massive gains in productivity, reliability, adaptation to customer needs and speed' (industriAll 2015).

In several European countries (Germany, Italy, France, the Nordic countries, etc.) factories already boast new production lines characterised by integration, robotisation, the ongoing exchange of data and information, and interaction with the shrinking numbers of workers, sometimes equipped with RFID tags, who interact with the machines and concerning whom it is possible to wonder who is the tool of whom. Some examples given by industriAll are the following:

— digital integration of the design process: full digital design and testing of the Falcon 7x airplane (Dassault Aviation);
— digital integration of manufacturing process: multi-product assembly line for hydroelectric valves (Bosch Rexroth), real-time factory network connecting machine tools (Maschinenfabrik Rheinhausen), real-time management of workers' time shifts using mobile phones (BorgWarner Ludwigsburg GmbH);

14. https://defdist.org
15. https://localmotors.com

— digital remote maintenance of machine tools (Trumpf AG);
— digital integration of logistics: RFID tracking of garments in warehouses and retail stores (Inditex – Zara brand).

According to Roubini (2015), 'in the years ahead, breakthroughs in robotics and automation will boost productivity and efficiency, which will translate into economic gains for manufacturers. This wave of development will also benefit software developers, engineers, research scientists other workers with the skills and education necessary to operate in the brave new manufacturing era'.

While productivity gains are emphasised by all the authors referred to in this study, their consequences in employment terms are characterised by rather marked differences in approach. Several authors have a rather pessimistic vision of the consequences of this revolution on the labour market. Again according to Roubini (2015), 'The risk is that workers in high-skilled, blue-collar manufacturing jobs will be displaced by machines before the dust settles at the end of the Third Industrial Revolution. We may be heading toward a future where factories consist of one highly skilled engineer running hundreds of machines – with one worker left sweeping the floor… until that job is given to an industrial-strength Roomba Robot.'

Ford is quite convinced that this is where the future lies, describing also the phenomenon of offshoring in which highly skilled professional jobs (lawyer, radiologist, tax expert, software programmer, etc.) are increasingly relocated to cheap-labour countries, for example India where there are now tax experts specialising in US tax law. Yet this does not apply to highly skilled jobs alone: 'virtually any occupation that primarily involves manipulating information and is not in some way anchored locally (…) is potentially at risk from offshoring in the relatively near future and then from full automation somewhat further out. Full automation is simply the logical next step' (Ford 2015: 118).

Erik Brynjolfsson and Andrew McAfee (2011) also insist on the role of the acceleration of technologies which, in the coming years, will change the income and the jobs of millions of workers. 'Computers (hardware, software, and networks) are only going to get more powerful and capable in the future, and have an ever-bigger impact on jobs, skills, and the economy. The root of our problems is not that we're in a Great Recession, or a Great Stagnation, but rather that we are in the early throes of a Great Restructuring. Our technologies are racing ahead but many of our skills and organizations are lagging behind. So it's urgent that we understand these phenomena, discuss their implications, and come up with strategies that allow human workers to race ahead with machines instead of racing against them'.

Viewed in a historical perspective, one of the questions at the heart of this revolution is the extent to which it will be characterised by the creation or the destruction of jobs. In the 19th century English cotton mills the appearance of machines was seen by workers as a threat to their jobs. This is why some of these workers – the Luddites – fought and destroyed the machines which, as economists are generally agreed, in reality contributed to the creation of

numerous new jobs and to a reduction in repetitive and routine jobs. 'As technological innovation increases productivity, real wages tend to rise over time ; and as the income for labor and capital rises over time, greater demand for goods and services — both old and new — leads to an increase in demand for labor in the old and new sectors' (Roubini 2015).

Are we too on the eve of a revolution that will create large numbers of new jobs while getting rid of repetitive tasks? In the view of several authors, the reply must be, 'no, this time it is different' (Frey and Osborne 2015). The threat is of a jobless future (Ford 2015), of an economy characterised by tremendous productivity gains but requiring ever fewer workers.

According to Brynjolfsson and McAfee (2011), in a long series of cognitive tasks (and not simply routine and manual ones), computers are increasingly representing a challenge to human labour. The new technologies can indeed bring about a radical change in the economy, creating jobs, but at the same time unemployment in the less- or medium-skilled occupations that can be replaced by algorithms and robots (including, for example, driving a car or cooking). The following anecdote indicates the speed of change: 'Although Levy and Murname wrote in 2003 that driving in traffic could not be automated because of the complexity of human perception, Google announced its autonomous car in 2010' (Valsamis *et al.* 2015). The tendency is clear: while there will be winners, there will also be losers and the split will be between the highly skilled and the low skilled, between the 'superstars' (the '*winner takes all effect*', Hacker and Pierson 2010, also stressed by Ford 2015) and the ordinary people, as well as between capital and labour (Brynjolfsson and McAfee 2014).

Irani (2015) offers, for her part, a somewhat critical reading of this 'second age of the machine'. Allowing themselves to be blinded, according to her, by the engineers of Google, Facebook, etc., authors fail to see that algorithms do not replace labour but displace it. 'McAfee and Brynjolfsson ignore the labor of cultural data workers, as if algorithms trained, tuned, and augmented themselves, like magic'. Thus, she observes, there exist armies of workers in the shadows, about whom the big platforms do not say a word: 'Google's self-driving car doesn't simply go anywhere its passengers please. For this car to drive "itself," a human worker has to drive around, scan, and map the car's world—including everything from curb heights to intersection angles. Machine-learning algorithms that partially automate data processing still need to be trained for every new form, or every new kind of topic the algorithm might deal with'. Algorithms will not, according to this author, replace labour but, rather, will displace it internationally.

Frey and Osborne (2013), in a frequently quoted study, take a look at the United States labour market and try to define the probability of seeing jobs in 702 types of occupation replaced by computers and machines. The variables to be taken into account to define this 'computerisation'[16] are much more

16. Defined as the automation of a job by means of computer-controlled equipment.

complex than the over-simplified notions of repetitive work, or routine tasks not requiring thought. The decline in employment in these repetitive tasks has been documented in the literature (Charles *et al.* 2013; Jaimovich and Siu 2012, quoted in Frey and Osborne 2013), with some authors seeing this factor as a probable explanation for economic growth without employment growth (Brynjolfsson and McAfee 2011 and 2014). This background trend is likely to be accompanied by a strong polarisation of the labour force with, on the one side, highly skilled and highly paid workers and, on the other, very low-skilled manual tasks, with the gradual disappearance of the routine jobs that required medium-level skills and offered middling-level pay (i.e. the phenomenon of the 'hollowing out' of the middle class).

In future the algorithms and Big Data combined with the increasing skills of robots will, in an increasing number of spheres, be able to replace the jobs of workers, since these machines will be capable of carrying out increasingly complex and non-routine tasks. The conclusions of Frey and Osborne's study (2013) are alarming: 'according to our estimates around 47 percent of total US employment is in the high risk category. We refer to these as jobs at risk – *i.e.* jobs we expect could be automated relatively soon, perhaps over the next decade or two'. It is true, the authors explain, that this prediction must be envisaged with caution: developments will depend, in particular, on political decisions. For example, will the circulation of driverless lorries be allowed? And if so, subject to what new highway-code regulations? Nonetheless, the concern raised by this trend is to be taken seriously.

By aggregating the data put forward by these various authors and anticipating somewhat on the next chapter, the situation can be summarised as in Table 1.

Table 1 **Jobs in the digital economy**

Jobs at greatest risk of automation/ digitalisation	Jobs at least risk of automation/ digitalisation	New jobs
Office work and clerical tasks	Education, arts and media	**'Top of the scale'**
Sales and commerce	Legal services	Data analysts, data miners, data architects
Transport, logistics	Management, human resources management	Software and application developers
Manufacturing industry	Business	Specialists in networking, artificial intelligence, etc.
Construction	Some aspects of financial services	Designers and producers of new intelligent machines, robots and 3D printers
Some aspects of financial services	Health service providers	Digital marketing and e-commerce specialists
Some types of services (translation, tax consultancy, etc.)	Computer workers, engineers and scientists	
	Some types of services (social work, hairdressing, beauty care, etc.)	**'Bottom of the scale'**
		Digital 'galley slaves' (data entry or filter workers) and other 'mechanical Turks' working on the digital platforms (see below)
		Uber drivers, casual odd-jobbing (repairs, home improvement, pet care, etc.) in the 'collaborative' economy

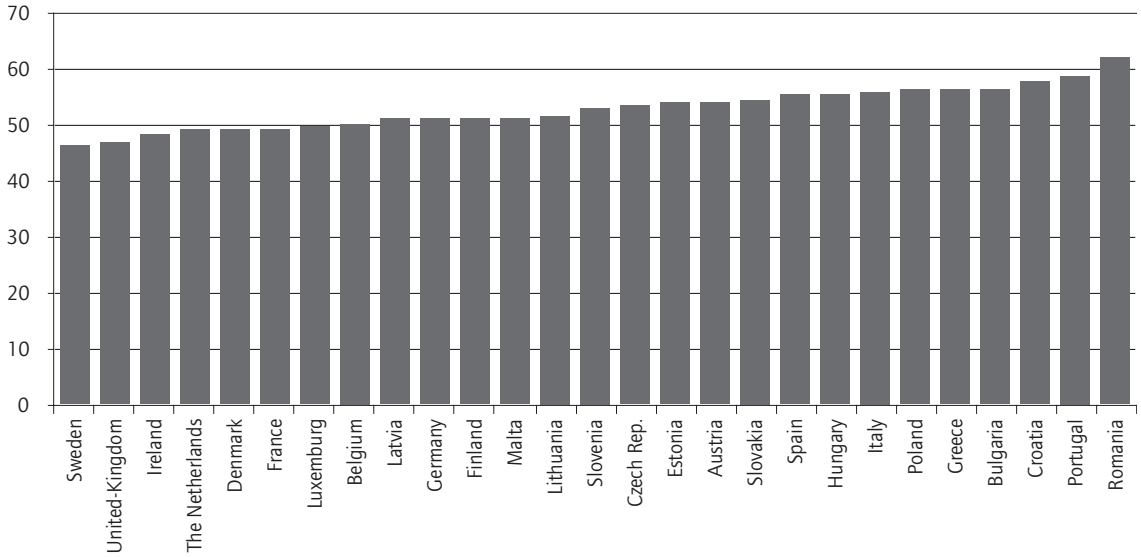
Source: Christophe Degryse (ETUI 2016) on the basis of data from Frey & Osborne, Ford, Valsamis, Irani, Head, Babinet

And what about Europe?

In debates in Europe we frequently hear the figure of 'around 40%' to indicate the numbers of European jobs that 'will be lost'[17]. The Brueghel think-tank set out to apply to the situation in Europe the same methodology used by Frey and Osborne. It emerges from the resulting study that 'the proportion of the EU work force predicted to be impacted significantly by advances in technology over the coming decades ranges from the mid-40% range (similar to the US) up to well over 60%' (Bowles 2014).

It is interesting – or rather alarming – to note that behind a European average of 54% jobs 'at risk', it is the peripheral countries that would be the most affected by this computerisation of employment[18] – Romania (61.93%), Portugal (58.94%), Bulgaria (56.56%), Greece (56.47%) – whereas the 'centre' and north of the European Union would be less affected – Germany (51.12%), Belgium (50.38%), France (49.54%), the Netherlands (49.50%), the United Kingdom (47.17%), Sweden (46.69%). This comes to look very much like just one more fracture line between the centre and the periphery of the EU.

Figure 1 **Percentage of EU jobs at risk of computerisation by country**



Source: Bruegel calculations based on Frey & Osborne (2013), ILO, EU Labour Force Survey

Similarly, it is striking to observe that this classification corresponds quite closely to that of the Digital Economy and Society Index (DESI) used by the European Commission (Valsamis 2015). In other words, the higher up a country's position in the DESI (broadband infrastructure development,

17. Statement by Commissioner Oettinger at the industriAll conference, 5 November 2015.
18. http://bruegel.org/2014/07/chart-of-the-week-54-of-eu-jobs-at-risk-of-computerisation/#republishing

workers' e-skills, use of internet, digital public services, etc.), the less its jobs will be threatened by digitalisation. This applies to the Nordic Countries, the Netherlands, and the United Kingdom. By contrast, the lower a country's position in the DESI, the more at risk its jobs will be (Romania, Bulgaria, Greece, Croatia).

However, the response of researchers to these studies is far from unanimous. From some quarters come claims that there is no reason to imagine such 'horror scenarios'. Such, at least, is the analysis from the Hans Böckler Foundation (HBS 2015). Contesting Frey and Osborne's calculations and on the basis, in particular, of findings reported by researchers at the *Zentrum für Europäische Wirtschaftsforschung* (ZEW) and by the University of Hohenheim, the HBS maintains that, while machines will undoubtedly alter the nature of work in the future, this does not necessarily mean the wholesale disappearance of jobs. Though some tasks will indeed be very much subject to automation, this trend will above all enable workers to devote their efforts to new tasks.

According to the ZEW, in Germany the proportion of employees whose jobs are under threat from automation is likely to be no more than 12%, far less than forecast by Brueghel. Similarly, according to a study conducted by the job search institute, German industry could lose 490,000 jobs between now and 2025, but is likely to see the appearance of 430,000 new ones. It is true that the new jobs would require higher skills, so that the greatest risks are incurred by the least skilled workers (HBS 2015). These studies relating to the situation in Germany show at least that, in spite of relatively similar economic structures, it is not possible to carry out for Europe a simple copy-paste of the situation in the United States.

But the case of Germany, the industrial driver of Europe and hence the main victim of the 'moral threat' referred to by Commissioner Oettinger above, is interesting on more than one count because this is probably the EU country whose government has invested most in the new digital economy. This led, in particular, to the 'Industrie 4.0' initiative, an important section of which, on employment ('Arbeiten 4.0'), was launched on 22 April 2015 by German social affairs and employment minister Andrea Nahles (SPD)[19]. The minister expresses a degree of 'social voluntarism' designed to accompany the digital revolution, particularly by stressing the importance of developing 'Decent, secure and health work; finding new ways to combine a high level of employment with participation in work; taking seriously workers' changed individual preferences regarding their work and developing policies which enshrine a life-phase approach; ensuring that fair wages and social security in our social market economy also apply to new forms of work; finding good solutions regarding initial and continuing training which enable us to shape technological change and to help workers cope in a world of work characterised by greater diversity, discontinuity and uncertainty; ensuring that companies

19. http://www.bmas.de/SharedDocs/Downloads/DE:PDF-Publikationen/arbeiten-4-0-Green-paper.pdf?_blob=publicationFile

find the skilled workers they need and embrace good corporate governance because of the many advantages it brings them.' (Bundesministerium für Arbeit und Soziales 2015). The affirmed intention to involve the social partners in this new digital economy is characteristic of the German approach and is not without consequences upon the manner of tackling this question.

In a similar vein, industriAll points out in a discussion paper that the digital revolution 'can significantly improve the comparative advantages of European manufacturing, and protect or even bring jobs that have been moved to countries outside the European Union back to the European Union'. This is why 'all the existing tools need to be fully mobilised to cope with such a large-scale shift: anticipation of change, reskilling and upskilling workers, a renewal of social dialogue and potentially a reflection on working time' (industriAll 2015).

But it is to be noted that such determination to involve the social partners in the digital transition is, for the time being, characteristic of only a tiny minority of EU countries: Germany, France, Luxembourg, Sweden, and, more recently, the Netherlands. For more details on the trade union initiatives conducted in this context, readers are referred to the appendix of this document.

2.1.2 In services

The aspect of this Fourth Revolution that is currently receiving greater media attention is the services sector. 'The same forces that have shaken up the industrial sector – globalisation and labor-saving technological innovation – are now starting to be felt in the services sector, increasing the odds of a marked employment crisis – an outcome that has so far been avoided' (Roubini 2015).

The numbers of sectors concerned are increasing every day: transport, delivery and sales services, guest accommodation, small repairs and plumbing, tool-hire services, but also finance, publishing, estate agents, professional coaching, accounting, translation, child care and personal care, secretarial services, healthcare, etc. It suffices to observe our daily lives: nowadays it is through apps on our smartphones or tablets that we read the news, consult train timetables, read our mail, contact clients and suppliers, call a taxi, leaf through catalogues, order and pay for purchases, consult the weather forecast, check our bank balance, pay our taxes, and so forth.

These services have been developed by traditional firms that find digitalisation helpful to extend the services placed on offer, to facilitate access, and simplify users' habits and modes of consumption: online newspapers, public transport timetables, purchase of fully digital tickets, management of bank accounts, and so forth.

In these digitalised services offered by 'traditional' companies, the employment stakes are hardly new, the essential issue being the replacement of employees

by these digitalised services. For a long time now the cashier at the bank has been replaced by an automat for the vast majority of transactions; shops circulate digital versions of their catalogue via internet and enable consumers, in the absence of personal contact with sales employees, to order and pay for their purchases directly on a website; department stores have developed home shopping apps; newspapers offer the news online, and so forth. In these sectors, 'digitalisation' has taken place gradually, whether or not accompanied by job losses and/or a worsening of working conditions (the press sector is emblematic of this deterioration with journalists notoriously subject to increasing levels of pressure, Bittner 2011). About these kinds of development, much has already been written.

In the following paragraphs we will be looking above all at the *new* services of the digital economy – what we might call the 'second wave' of digitalisation, or the platform economy – which entail radically different stakes for the economy, the labour market, the social model, the law (national or European), taxation and the financing of social protection.

The new digital economy

Alongside the services that have already become 'classic' we are seeing the development of new services put in place by new actors on the market – the platforms – 'parallel' actors who seem for the time being to be steering clear of the various regional, national and European regulations, both administrative and technical, but also taxation and social security. The example of the American company Uber in Europe is emblematic, but other examples of online services raise other types of question depending on whether we are speaking of accommodation services among private individuals (Airbnb), hotel reservations (Booking.com, etc.), innovative financing (LendingClub, etc.), virtual assistants, consultants or marketing experts (Upwork, etc.), removal assistance, cleaning or babysitting (Taskrabbit, etc.) or electronic sales (eBay, Amazon)[20].

An internet site gives some idea of the range – which is increasing by the day – offered by these new players (www.collaborativeconsumption.com). Available services may range from renting a friend for an evening[21], exchange of children's toys or clothes[22], walking a dog[23], alternative loans[24], etc. A quick glance at these services prompts the realisation that the excessively mediatised services like Uber are merely the tip of the iceberg, for Uber is in actual fact only one of the 118 car services listed under transport services (in November

20. To go even further, a list of 200 start-ups in the 'sharing economy' is available at: http://www.web-strategist.com/blog/2013/02/24/the-master-list-of-the-collaborative-economy-rent-and-trade-everything. See also: http://www.collaborativeconsumption.com/directory

21. http://rentafriend.com. At the time of writing (November 2015), no less than 526,000 friends are available for renting all over the world.

22. http://www.kinderado.de

23. https://dogvacay.com

24. https://www.zopa.com

2015)[25]. Some of these services have been developed, what is more, by 'traditional' firms (car hire or motor car manufacturers).

The diversity of the actors on this market provides an indication of just how difficult it is to apprehend this new service economy and its implications for society at large. To take just one example, Daimler's car2go does not pose the same kind of threat to traditional taxi systems as does Uber.

The 'sharing economy' or a radical liberalisation of services?

If the vocabulary used is designed to give a positive image of this new market for services ('community', 'exchange', 'sharing', 'neighbourhood', etc.), it is nonetheless important to distinguish its various characteristics. How are we to structure our approach to these new services with a view to drawing out more clearly their social stakes and implications?

In the current literature there exists considerable semantic confusion among terms such as the so-called 'sharing economy', the 'collaborative economy', the 'on-demand economy', the 'service-based economy', and so on. Their sole common feature is limited to the apparently and – misleadingly – non-mediated match between an offer of and a request for a service. Such terms are a reflection, to borrow Rifkin's intuition, of the age of universal access to planetary services into which we have entered (Rifkin 2001).

Though the expression has entered common usage, several authors refer to the need to be wary about the notion of a sharing economy. Eckhardt *et al.* (2015) alert us to this: 'Sharing is a form of social exchange that takes place among people known to each other, without any profit. Sharing is an established practice, and dominates particular aspects of our life, such as within the family. (…) When "sharing" is market-mediated — when a company is an intermediary between consumers who don't know each other — it is no longer sharing at all. Rather, consumers are paying to access someone else's goods or services for a particular period of time. It is an economic exchange, and consumers are after utilitarian, rather than social, value'.

In a similar vein, Michel Bauwens takes the argument even further: 'The "sharing economy" which I call "peer-to-peer", in which individuals organise to create common assets, has an important emancipatory potential. But Uber is not part of this "collaborative" or "sharing" economy; it is much more a question of placing on the market resources that were not previously used. The difference between "peer-to-peer" production and Uber is the fragmentation of labour, the placing of workers in competition to obtain a service, without

25. On the other hand, some of these start-ups turn out to be quite ephemeral; several of those referenced among the top 200 in the sharing economy no longer existed when we consulted them in November 2015. Paradoxically, Eckhardt maintains that the start-ups that place too much emphasis on the consumer's supposed desire to share are those that experience the least growth. Uber, for example, makes no attempt to dress up its ads with these notions of sharing but is content with the claim that it is 'better, faster and cheaper than a taxi' (Eckhardt *et al.* 2015).

their having access to this service, this "common good", which in this case is the algorithm controlled by the company. This leads to imbalances and, at the same time, precarity for some. When Uber sets up in Paris, its profits go to the shareholders in the Silicon Valley' (*Le Monde* 2015).

In the fairy tale of the sharing economy, sharing most often entails payment, collaboration may resemble dumping, and partnership exploitation. As for the consumers of services such as Uber or Airbnb, they 'are more interested in lower costs and convenience than they are in fostering social relationships with the company or other consumers' (Eckhardt *et al.* 2015). Even though, as we will see below, some of the less often quoted writers such as Michel Bauwens or Saskia Sassen, do believe in the strong socially innovative potential of the new technologies.

In order to gain a clearer idea of this confused mix of services, Edgar Szoc has suggested three distinguishing criteria that can be useful as a starting point, even if they stand in need of some refinement:

— a monetisation criterion: are the services on offer available free of charge or subject to payment?
— an investment criterion: in order to take part in this market as a service provider, is it necessary to own capital?
— a location criterion: can the services proposed be delocated? (Szoc 2015)

The first criterion appears, at a first glance, self-explanatory: Wikipedia offers the greatest multilingual encyclopaedia in the world to every internet user. While it is true that it requests private donations and is built up on the basis of open and voluntary cooperation, the service is not offered on a monetised basis. CouchSurfing offers, via its online service, a form of temporary free accommodation from person to person. Streetbank encourages the inhabitants of a neighbourhood to give or lend one another items and to supply neighbourhood services via its app. By contrast, Ebay services entail payment, as do those of Airbnb, even though the services on offer are similar in kind to those provided by Streetbank and Couchsurfing (Stokes 2015). Payment of service providers and share investors is a core feature of the operation of platforms such as Uber or Airbnb.

This criterion of monetisation is doubtless relevant in order to properly distinguish the sphere of the genuinely collaborative – or sharing – economy, in which the intention of the 'actors' is not to make a profit on the market but to offer a service based on giving and reciprocity. Taken alone, however, this criterion appears to us inadequate for moving beyond this simple distinction, for we could place in the category of free services other social services such as Facebook, Twitter, Google, etc. whose shareholders do expect returns on their investment. In reality, as stressed by Brynjolfsson and McAfee (2014), most of the most popular sites in the world are free sites whose content is fed and managed by the users themselves even though the intention of their founders is not giving or voluntary service but profit (see the list of top sites: www.alexa.com/topsites).

And so it is clear that the difference is less between a free or a paying service than between mediation aimed at making a profit (even via a service that is actually provided free of charge) and genuinely disinterested mediation (the aim being, for example, to strengthen social relations within communities by means of solidarity and an exchange of services). This difference is more subtle, because the consumer of services is not always clearly aware of it. Facebook is presented as a service that is free – and that will always remain free – but not a word is said about the tremendous profits it derives from the information supplied by its members, who are simultaneously consumers of the social network and producers of data that Facebook can use to make money. These Facebook users are what are sometimes today known as 'prosumers'[26]. A network valued at close to 300 billion dollars, approximately equivalent to General Electric, cannot but give rise to some suspicion concerning its 'social' or 'collaborative' character. This is why some authors, in Germany in particular, prefer to speak of 'Plattform-Kapitalismus', or platform capitalism (*The Economist* 2015b; Szoc 2015) to designate this type of platform that, as a result of the network effect, has become so dominant in such a short time[27].

The second criterion suggested by Szoc is the investment of capital. In order to offer a transport service, it is necessary to own a vehicle; to offer accommodation, in principle one needs to own (or to be renting) a property. In both these instances, the service allows the person who owns the capital to increase its marginal utility. It has been established that a vehicle is in use on average only 10% or 20% of the time; a peer-to-peer personal car or transportation rental service enables profit to be derived from increasing this use time. These services enable each individual equipped with a mobile phone to exploit his/her sleeping capital by becoming a producer of services and, in this way, generating regular income, earning a little bit on the side, coping with the end of the month, or topping up benefits – always provided he is the owner of the capital.

In this 'sharing economy' innumerable other services are henceforth on offer that do not require any major investment while nonetheless – as the economists would say – enabling an increase in marginal utility. This ranges from the provision of relatively unskilled labour – lending a hand during a removal, repairing a dripping tap, decorating a hall for a party – to the supply of highly specialised services: consultants, accountants, lawyers, doctors, etc. Thus listminut.be – the Belgian equivalent of Taskrabbit – offers (persons willing to perform) do-it-yourself services, gardening, transport, pet care, household jobs, computing, tuition, organisation of events, health and beauty

26. This term is defined by Robertshaw (2015) as follows: 'A conflation of producer and consumer. It happens when some entity occupies both roles in a system. In this case citizens, who formerly consumed data, now become producers of it as well. They become prosumers and their data becomes an asset or a commodity to trade'.

27. The network effect expresses the rule according to which the more people who use a network, the more the utility of the network increases. Facebook is a fine example of the network effect, one of the important consequences of which is that a relative advantage (to have more members than the competitors) ends up becoming absolute domination. This is also one illustration of the 'winner-takes-all' effect.

care, or babysitting. For between 15 and 20 euros an hour, the user can find in his/her locality a gardener, a computer engineer, or electrician ready to carry out the work required.

On the matter of concern to us in this study, this second criterion of capital investment is interesting in that it indirectly poses the question of responsibility for the labour relationship. Thus Taskrabbit – and others – do not offer services but supply persons who offer *their* services (using their own tools). We will see below some of the consequences of this displacement of the employment relationship.

Finally, the third criterion proposed by Szoc, undoubtedly the most loaded in terms of social implications, is the delocalisable nature of the services. Some services are by definition tied to a location, or at least a bounded geographical area. The babysitter or electrician is in principle not delocalisable. On the other hand, accounting, consultancy, tax advice, writing texts, professional coaching, data entry, virtual assistance, translation, design, development of apps, marketing, distance sales, etc. are all fully delocalisable services.

This third characteristic enables us to tackle the phenomenon of computerised platforms that creates a parallel labour market, entailing such tremendous stakes for European labour markets.

The 'platforms' economy

Let us begin with an example. The search for a virtual assistant for administrative support, secretarial or data-entry work on the American site Upwork gives a result of 9088 candidates offering their services from 40 different countries[28]. It is possible to find workers from developed countries (United States, Canada, France, Belgium, United Kingdom, Netherlands, Spain, etc.), from emerging countries (Brazil, China, South Africa, Russia, India) and from developing countries (Philippines, Bangladesh, Vietnam, Pakistan, Algeria, Kenya, etc.)[29].

The rates requested by these workers start at 3.3 dollars an hour. The site offers an hourly rate filter enabling us to calculate that the vast majority of these workers (73%) offer their services for less than 10 dollars an hour; 24% of them work for between 10 and 30 dollars; 1.7% charge between 30 and 60 dollars; 0.24%, finally, charge above 60 dollars an hour for specialised services like data mining, professional consultancy, business coach, etc.

Upwork does not define itself as an employer but as an 'online workplace for the world', a 'platform for top companies to hire and work with the world's most talented independent professionals'. At the time of writing (December 2015) this platform has 10 million registered freelancers prepared to set to

28. https://www.upwork.com/cat/administrative-support/ consulted on 1 December 2015.

29. The full list is even longer: Czech Republic, Slovenia, Jamaica, Australia, Egypt, India, Kenya, Hungary, Panama, Romania, Sri Lanka, Bosnia-Herzegovina, Portugal, Costa Rica, Macedonia, Ukraine, Nepal, Croatia, South Korea, Morocco, Armenia, Saudi Arabia, etc.

work on request, the equivalent of the whole population of Belgium, for example, with 4 million 'employers'.

On this virtual market one does not find on the one hand the workers from rich countries and on the other hand those from developing countries – except for the 2% most expensive who are in their majority (but not exclusively) North American or European. In the cases of the vast majority of candidates, the Americans and Europeans offer their services at prices aligned on those of world competition. There is no longer any great difference between the Canadian or British virtual assistant and the Filipino or Brazilian in search of a job.

As Szoc poetically comments, this phenomenon de facto places the workers in these fields in situations similar to those of the dockworkers in Elia Kazan's film 'On the waterfront', lined up on the quayside while the employers either call them to work or leave them standing there. Except that, lined up on these new globalised digital quaysides, the dockers of the 21st century face competition that is no longer local but global. For any task placed on the platform, there are, side by side, workers living in countries with high social protection levels and high labour costs and others living in developing countries (Szoc 2015).

These platforms might also be considered to create a form of virtual immigration. 'I find it somewhat ironic that many conservatives in the United States are adamant about securing the border against immigrants who will likely take jobs that few Americans want, while at the same time expressing little concern that the virtual border is left completely open to higher-skill workers who take jobs that Americans definitely do want' (Ford 2015: 117). A very similar logic is at work on other platforms such as the Amazon Mechanical Turk (see section 2.2.2 below).

What this digital economic platform model offers is therefore a radical liberalisation of delocalisable services; and, given the rapidly growing number of these services, the platform economy, still relatively marginal today, could become central in the future. Just as the military drones in war zones are piloted by soldiers in command rooms in the United States, what, tomorrow, would prevent a Californian transport service provider from 'telepiloting' a fleet of vehicles in Europe? Science fiction? The digital economy is indeed taking us into a science fiction world, as Brynjolfsson has already warned us.

2.2 The social stakes

As we have seen, the stakes in industries, services and platforms are different but in some cases not so very different. In this section, we will consider some of the big questions that are going to arise in these sectors.

2.2.1 New forms of employment

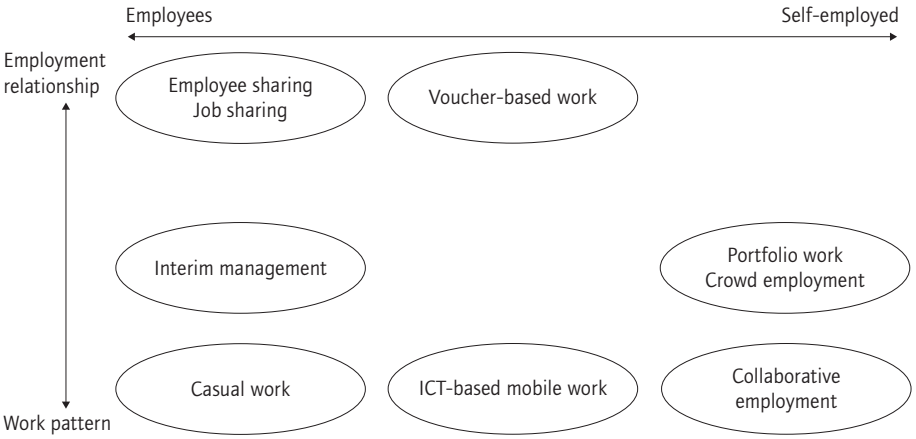
Will we all have turned by tomorrow into different kinds of freelancers and self-employed workers? Is it the end of the wage-earning economy? The European Foundation for the Improvement of Living and Working Conditions (Eurofound 2015) has analysed the 'new forms of employment' that are developing in Europe and that are more or less radically transforming the traditional relationships between employer and employees. On the basis of a case study, it defines nine major trends in these new forms of employment which have important implications in terms of working conditions and labour market:

— employee sharing, where an individual worker is jointly hired by a group of employers to meet the HR needs of various companies, resulting in permanent full-time employment for the worker;
— job sharing, where an employer hires two or more workers to jointly fill a specific job, combining two or more part-time jobs into a full-time position;
— interim management, in which highly skilled experts are hired temporarily for a specific project or to solve a specific problem, thereby integrating external management capacities in the work organisation;
— casual work, where an employer is not obliged to provide work regularly to the employee, but has the flexibility of calling them in on demand;
— ICT-based mobile work, where workers can do their job from any place at any time, supported by modern technologies;
— voucher-based work, where the employment relationship is based on payment for services with a voucher purchased from an authorised organisation that covers both pay and social security contributions;
— portfolio work, where a self-employed individual works for a large number of clients, doing small-scale jobs for each of them;
— crowd employment, where an online platform matches employers and workers, often with larger tasks being split up and divided among a 'virtual cloud' of workers;
— collaborative employment, where freelancers, the self-employed or micro enterprises cooperate in some way to overcome limitations of size and professional isolation.

Eurofound has proposed a classification of these new forms of employment so as to emphasise the emergence of two variables: intensity of the work relationship and status of the workers. The result can be visualised in Figure 2.

In this section, where we are looking more particularly at new start-ups in the demand-based economy, it is observed that these are today causing an explosion in mobile forms of employment that are based on new technologies and the absence of work schedules or working hours. These forms of employment are not confined within the framework of a contract that specifies terms of employment and a corresponding wage or salary; rather they are carried out within a framework of activation of an account on an internet site: 'Rather than controlling fixed resources, on-demand companies are middle-men, arranging connections and overseeing quality (*The Economist* 2015a).

Figure 2 **Classification of nine new forms of employment**



Source: Eurofound (2015)

Platforms without legal or social security responsibilities

For the user of these services, Upwork is the perfect illustration of this radical simplification of the labour relationship, described as follows:

1. 'post your project;
2. choose from top talent;
3. hire and collaborate with ease;
4. pay only for work approved.'

The same logic is applied at Uber where there exists no form of employment contract for service providers: 'Drivers get paid only when they work and are responsible for their own pensions and health care. Risks borne by companies are being pushed back on to individuals' (*The Economist* 2015a).

At Airbnb legal and social security risks and liabilities are even more radically cast aside. The general terms and conditions specify that 'you understand and agree that Airbnb is not a party to any agreements entered into between hosts and guests, nor is Airbnb a real estate broker, agent or insurer. Airbnb has no control over the conduct of hosts, guests and other users of the site, application and services or any accommodations, and disclaims all liability in this regard to the maximum extent permitted by law' (Airbnb 2015).

These companies concentrate exclusively on their core business which consists in linking up supply and demand, disclaiming all other types of responsibility or commitment. As we have seen, Upwork offers the services of more than 10 million workers but refuses to regard itself as an employer. Similarly, Airbnb (or Uber) has become one of the largest accommodation (or transport) services in the world without owning a single room (or fleet of vehicles), without exercising the least contractual, legal or penal liability in its mediation service, and with a minimum of salaried staff. Airbnb, Uber, Upwork have no more than a few hundred direct employees.

In this platform economy, the stakes exceed the question of labour markets; they overflow to include the role – and the power – of states. In causing frontiers to 'disappear', this economy overrules all national regulatory frameworks and voids taxation of its substance by using delocalised intermediaries[30].

2.2.2 Working conditions: flexibilisation and individualisation

In terms of working conditions, the stakes are radical: the platforms are currently developing a parallel labour market that is ultra-flexible, with employment being governed by no form of contract whatsoever. Within this form of employment there no longer exists either labour contract, or wage standards, or working time regulations or standards relating to working hours, workplace, training, access to trade unions, or collective action. The worker – or rather the 'partner' – belonging to this virtual community, is left to manage, on the basis of a contract of self-employment, his/her own social protection (unemployment, retirement pension, occupational sickness provision), work health and safety protection. Alternatively, s/he fails to declare this work, opting for informal labour status – 'in the black' – as a 'partner' who, should s/he for any reason prove no longer acceptable, may see her/his account suddenly deactivated by the platform managers, without any prior notification or other formality (in the absence of any kind of legal or regulatory support designed to defend the 'worker').

A point to be stressed from the outset is that this form of a-contractual employment is gaining ground extremely fast. Tens of thousands of new freelance workers register on Upwork, or on Uber, or Airbnb, etc. every single day. As we saw in the first part of this study, these platforms' strategies paid little attention to whether or not their activities were within the law, their preferred tactic being that of the *fait accompli*. Accordingly, the rapid development of these platforms has, with its total disregard for labour standards, brought the law up short – legislators being notoriously slow on the uptake – and could, accordingly, have a major impact on the European labour market as a whole.

Status of workers

The key question here is the following: are the providers of digital services on platforms really self-employed or do they operate in a relationship of subordination – or dependence – vis-à-vis the company or the platform? Do they have the right to refuse a task? Do their rates of pay take account of the fact that they use and have to maintain their own equipment, that they pay their own insurance, that they should be paying social security contributions, and that they lack cover in the event of sickness or accident?

30. We will not be examining these other stakes in the framework of this study. The question of how to finance social security systems will require particular attention.

In the face of this increasingly widespread atomised labour market participation, in 2015 in the United States a class action was launched against Uber by workers regarding themselves as employees of the company rather than as self-employed. Their demand, accordingly, is for entitlement to the social security cover normally provided by employer contributions (healthcare, etc.). According to these workers' lawyers, 'Uber controls so many aspects of the drivers' experience – from setting fares to determining when and why they can be terminated – that they are more like employees than independent contractors' (WSJ 2015). Uber considers, by contrast, that the vast majority of its workers prefer the flexibility provided by self-employment status. The case is ongoing, but it starkly reflects the tensions and opposition between a 'business model' and a 'social model'.

Crowdworkers: the digital galley slaves

Yet these are not the only workers to be marginalised. The 'data janitors' – so designated by Irani (2015) – make up armies of workers existing in the shadows and tasked by big companies like Google, Amazon or Twitter with checking, classifying, filtering and encoding enormous volumes of data in real time. We will refer to these workers as the digital galley slaves.

In the wake of Robertshaw (2015), crowd sourcing can be defined as 'the practice of obtaining needed services, ideas of content, by soliciting contributions from a large group of people and especially from the online community rather than from traditional employees or suppliers (Merriam-Webster). This technique is heavily exploited by Internet giants like Google, Facebook and Apple, who harvest data about individuals (…) and aggregate information about them to analyse patterns and trends in society that form the basis for valuable services'.

These crowdworkers, according to Irani (2015), 'never showed up in the lavish, celebrated spaces where Googlers drank, ate, and brainstormed. They didn't ride the Google shuttle, eat the Google food, or attend beer-filled all-hands Friday meetings. In fact, Google's abundantly productive, non-hierarchical, and playful workplace seemed to rely on hidden layers of human data work: subcontractors who were off the books, out of sight, and safely away from both central campus and technological entrepreneurship's gleaming promise of job creation. (…) The human-fueled automations I saw at Google are also largely out of sight in current international debates about the relationship between digital technology and the future of work. Will technology produce new jobs, new industries, and new forms of comparative advantage? Or will technology take away jobs and concentrate wealth among those who own the machines?'.

It is interesting to note that crowdsourcing is akin, *mutatis mutandis*, to a certain form of digital Taylorism: it is a matter of breaking down the job, or the production process, into tiny simple and repetitive tasks that will be offered to the 'community' of crowdworkers: data entry, filing, etc. 'The largest part of today's crowd work is based on designating a small aspect of a task to each worker. Individually, these are mainly small, independent and homogenous tasks that don't even require a high skill level. Crowd work does however have

the potential to increasingly replace skilled labour, by decomposing work into even smaller pieces and by attracting workers with very specific skills' (Valsamis 2015).

Amazon, with the launching of its Amazon Mechanical Turk (AMT)[31] undoubtedly reveals itself as one of the most cynical of these companies. The 'Mechanical Turk[32] is an app designed to link up engineers with workers, frequently low-skilled, who will carry out all sorts of jobs that cannot (yet) be correctly performed by software systems: moderation of images in forums, classification of sound or video files, dealing with requests submitted on search engines, surveys, etc.[33] All over the world these workers wait at their computers for job requests to come through, for which they are then – insofar as the employer is satisfied with their work – paid on a piece-work basis. 'Work conditions for these data workers are what "the market," or workers, will tolerate. As contractors, AMT workers are excluded from the protections of minimum-wage laws. Amazon also allows employers to decide whether or not they want to pay. The intention is to let employers set standards. The effect is that unscrupulous AMT users steal wages. Although workers share information to avoid these thieves, they report that Amazon will very rarely step in to arbitrate disputes when an employer and worker disagree about work quality or where the fault lies for bad work' (Irani 2015).

It is worth noting that, at the initiative of Lilly Irani and Six Silberman[34], a website was set up as early as 2009-2010 to enable the crowdworkers of Amazon Mechanical Turk to become organised. This site, ironically named Turkopticon[35], allows the downloading of a small extension on to internet navigator that will add a function when the worker visits the AMT site. This function is a button that enables a worker to visualise the evaluations of the employer ('requester' in AMT language) left by preceding workers. In this way turkopticon 'helps the people in the "crowd" of crowdsourcing watch out for each other – because nobody else seems to be. Almost half of the Mechanical Turk workers who wrote their Bill of Rights demanded protection from employers who take their work without paying. Turkopticon lets you REPORT and AVOID shady employers'[36]. This system has inspired the setting up of other forms of defence for crowdworkers, in particular in Germany (see Appendix).

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31. https://requester.mturk.com

32. According to Wikipedia, the name Mechanical Turk comes from 'The Turk', a chess-playing automaton of the 18th century. It was later revealed that this 'machine' was not an automaton at all, but consisted in fact of a chess master (a dwarf) hidden in a special compartment from where he controlled the operations. The AMT workers are, likewise, dwarfs concealed behind Amazon.

33. One example : 'BinCam, for instance, places a camera in your garbage bin, tracks everything you throw away, and then automatically posts the record to social media. The idea is, apparently, to shame you into not wasting food and not forgetting to recycle (…). Virtual recognition (of types of garbage in this case) remains a daunting challenge for computers, so people are employed to perform this task. The very fact that this service is economically viable should give you some idea of the wage level for this kind of work' (Ford 2015 : 125).

34. Lilly Irani is an assistant professor at the University of California, San Diego. Six Silberman is a graduate student at the University of California, Irvine.

35. A reference to Jeremy Bentham's panopticon.

36. https://turkopticon.ucsd.edu

Tools?

Some authors stress the risk of '*servification*' of a range of jobs filled by those who depend on the data from the platforms insofar as these workers are turned into simple tools in the service of algorithms. The computerised data platforms are inserted between the final client and the producers of goods and services, making the latter extremely dependent on the platforms that 'employ' them.

Similar situations and concerns arise also in the world of industry, even if there the question of the form of employment and status of the worker is in principle more clearly defined. Thus industriAll (2015) observes in a working paper that 'digitalisation also has specific effects:

— it concentrates power and wealth along the value chain in the digital marketplace platform or the owner of the communication standard, thereby depriving all other companies of the capacity to invest, to innovate and to provide good wages and working conditions;
— it challenges the foundations of the (permanent, full-time) employment relationship, because all functions of this relationship (including the control of the task) can be performed remotely. Consequently, workers are placed in a worldwide competition on price, and the amount of precarious work is exploding (e.g. numbers of freelancers, bogus self-employment work situations, crowdsourcing, etc.);
— it opens up new possibilities for control over workers but also for cooperation between them'.

At the industriAll seminar held in October 2015, Holger Kroekel (IG Metall) described the Bosch Rexroth intelligent factory in the following terms: the production line is fully integrated; it includes all aspects of the product, and assembly is carried out on a just-in-time basis. All elements of the production line are placed in a network, everything is communicated intelligently through the various infrastructures. This environment ensures the interface between worker and machine. Quality and performance are evaluated in real time. Each assembly station has separate operations, enabling any one of them to be stopped at any time and production to be carried out on another line. The products are transported and arranged by artificial intelligence and the worker is informed of the process and of what he has to do via the RFID tag that identifies him to the machines. The machine knows in advance in which language it has to address each worker.

The following are some of the questions posed by this evolution:

Will human workers in the smart factories be turned into tools of tasks decided by robots and their algorithms? Or are the machines the workers' partners?

Will we witness a reduction in physically demanding tasks, entailing benefits in terms of ergonomy for older workers? Or, on the contrary, will work paces become increasingly inhuman and the demands of the work environment ever more hellish?

Will we see an 'emancipation' of workers from routine and repetitive tasks? Or a restriction of workers' room for manoeuvre or even freewill?

Will the smart machines also be given the supervisory role of monitoring workers' behaviour?

With regard to mobile workers such as maintenance technicians, will the new forms of preventive maintenance spare technicians the unpleasant demands posed by on-call services or non-scheduled emergency calls? Or will they contribute above all to an obliteration of frontiers between work and private life, requiring technicians to make themselves permanently available?

Will the specific qualifications of these technicians be marginalised by the development of computerised maintenance and repair procedures? Will they have to be content with a job that requires them to follow up the diagnoses and carry out the repair procedures dictated by these machines? To paraphrase Head (2014), will smart factories make for dumber workers?

2.2.3 New managerial approaches

The possibilities of control offered by 'digital management' represent another challenge and potential threat to the world of labour and in particular the trade unions. The example of maintenance technicians well illustrates some of the risks associated with these new methods of control. As pointed out by Pelle (2015), 'Whereas these technicians generally enjoy a relatively high degree of autonomy in their work and are in a position to manage their route planning and organisation of visits, the companies now have a catalogue of arguments for equipping their company vehicles with geolocation devices. The arguments invariably include the safety of vehicles and workers, optimisation of routes, or improved management of the fleet of vehicles and of fuel'.

For the technicians, however, this is akin to a loss of trust on the part of management. They will fear penalties inflicted on grounds of a detour, a vehicle that remained too long in one place, a stop somewhere other than where they were supposed to be working, or the presence of several vehicles on the same job. In Pelle's words, 'this wariness will lead to a loss of trust on the part of technicians towards management, causing workers to become 'disaffected'. In order not to have to justify themselves continuously, employees will tend to remain strictly within the confines of whatever rules are defined by the law or by collective agreements'.

The maintenance technicians of the lift manufacturer Kone are an example in this respect. Their driving times, working hours, repair and maintenance activity and other actions are all automatically recorded by their professional mobile devices. On this subject, André Légaut (CFE-CGC) reported as follows at the aforementioned industriAll seminar: in the past, technicians were equipped with a telephone and a small computer containing a limited technical data base. Today they carry around a box housing, in addition to the telephone,

access to all technical data, as well as a geolocation system, a camera, etc. The management knows precisely when the technician switches on his system and what route he takes to reach the premises where he is to carry out the repairs or maintenance. Using his box, the technician can take photos that will give him access to explanatory instructions and nomenclatures. He can also consult the lift's history, its most recent breakdowns, the latest maintenance, and can order directly whatever parts are needed. Again using his box, he can present an estimate to the client who will sign electronically, which will automatically trigger the subsequent dispatch of an invoice. At the end of the day's work, the box counts up the hours worked and fills in the worker's pay slip including details of working hours, overtime, etc. This type of system also enables the establishment of predictive maintenance: analysis of lift traffic, stops at different floors, doors that are defective. If and when necessary, Kone can, for example, neutralise one particular floor if, for instance, the door is not working properly. The technician receives all this information and knows what repairs it will be necessary to carry out.

Apart from the fact that the technician may be said to have become the tool of his 'box', the question arises of the risk of his being placed under observation and 'policed' in real time. One thing to emerge from this account is that older technicians are not at ease with these technologies, so that they entail difficulties and additional stress for this category of workers. Yet it is still difficult to get company managements to supply clear undertakings and acceptable guarantees in relation to such means of keeping tabs on their employees.

The European Data Supervisor pointed out, in our view rightly, the contrast between these 'secret' practices and the efforts of firms to gain virtually total consumer transparency: 'Those responsible for handling personal information should be much more dynamic and proactive and move away from the co-called 'Black Box' tendency of secrecy and opacity of business practices while demanding ever more transparency of customers' (European Data Supervisor 2015). When we go on to read that 'violations of dignity may include objectification, where a person is treated as a tool serving someone else's purposes', it is just one step to applying this risk to the whole world of work.

The phenomenon is of course present also in the services sector. 'Managers use algorithms to steer employee workflows. They can track workers' typing at their keyboards and their movements through body-worn GPS. They can monitor fulfilment rates or success at sales and cut workers who cannot meet targets. By manipulating information screens, managers never have to confront workers, who might push back, or observe workers' circumstances' (Irani 2015).

Irani goes on to note, in the wake of Head (2014), 'Amazon's algorithms take incoming orders and develop scripts to direct a worker around the warehouse. The worker has to follow the script, gathering items into carts and meeting travel times set at management whim. Like with AMT, employers set the script and workers have to meet it or leave. Warehouse workers are hired on as temps, so management can let go those who cannot keep the pace: older

workers, sick workers, or just tired workers. Call center workers, ticket agents, and delivery people all work under similar scripts and under comparable surveillance' (Irani 2015).

The conclusion reached by Head is that the smart machines, by dictating their tasks to human workers, could indeed end up deskilling workforces. Yet, while such a risk exists, he himself believes in a different approach to technology and cites the Treuhand workshop in Chemnitz, Germany, as presenting one possibility. 'The shop uses advanced machining systems to manufacture components, but strong trade unions facilitate worker control over their labor. Managers send specifications to workers trained in craft apprentice traditions and those workers decide how to use machine tools to design the component. The Treuhand workers augment their craft with technology without falling under managerial microcontrol from a distance.'

The role of the trade unions is, therefore, in this case, to ensure that the technology is the tool of the worker and not the other way round.

2.2.4 Blurring of the frontier between working life and private life

Another feature of the spread of new technologies is their irruption in both the working environment and in private life. This is a development likely to gradually erase the frontier between working life and private life (reading emails at the weekend, replying, surfing on internet in the evening, etc.) and to alter the balance between working life and family life, for example. Thus 'the intensification of work and excessive connection to work-linked devices are likely to damage the balance in life, and even to harm employees' health' (Mettling 2015).

What, in the workplace (and here we are no longer speaking of the digital platforms), is the likely impact on working time of this blurring phenomenon? It is still very difficult to conduct an analysis because there seems to be a paucity of data on this subject. That an impact does exist, however, seems certain. 'In increasing numbers of cases, the workload is not always best measured by the working hours. It is therefore desirable to develop alternative approaches' (Mettling 2015: 18). How, indeed, in a world of distance-connected working, is it possible to enforce the provisions of the European working time directive 2003/88/EC – provisions on maximum working hours, on daily rest periods, etc.?

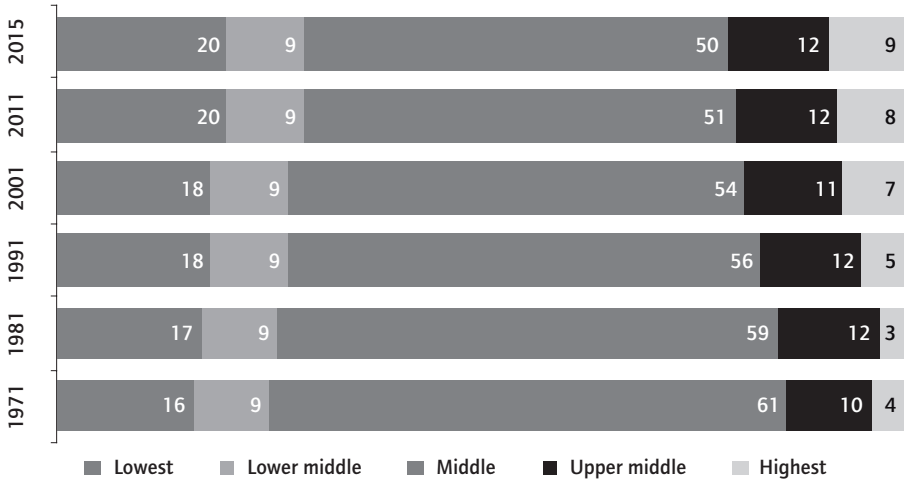
Employers retort that the irruption of new technologies within working life has also contributed to an irruption of private life within working life, e.g. the consultation of private emails or of Facebook page, etc. during working hours.

2.2.5 Inequality and wage stagnation?

Is technology a factor of wage stagnation? While this is a burning question for the world of labour, opinions on the matter diverge. As noted by, among others, The Open Society Foundation (2015: 3), the new technologies 'hollow out' the low-skilled jobs of the middle classes so that we may well see an increased polarisation of the labour market with an increase, on the one hand, of very low-skilled and ill-paid jobs and, on the other, very highly paid top-level jobs.

One of the main aspects of this polarisation is the hollowing out of the middle class that can be observed in the United States. The Pew Research Center published, in December 2015, a study from which it emerges that the income of the middle classes has been falling over the last forty years: 'Since 1971, each decade has ended with a smaller share of adults living in middle-income households than at the beginning of the decade, and no single decade stands out as having triggered or hastened the decline in the middle' (Pew Research Centre 2015).

Figure 3 **Share of adults living in middle-income households in the United States (%)**



Source: Pew Research Center analysis of the Current Population Survey, Annual Social and Economic Supplements

This evolution could not, of course, be attributable solely to the information and communications technologies; it is clear that other factors, notably demographic, have to be taken into account. But it is nonetheless striking to observe the parallelism between this long-term evolution and a form of precarisation of employment among the middle classes.

A similar trend is also described by Robert Reich (2015): 'The so-called "share economy" includes independent contractors, temporary workers, the self-employed, part-timers, freelancers, and free agents', a situation which, on the United States labour market, plunges increasing numbers of workers into precarity. 'A downturn in demand, or sudden change in consumer needs, or a personal injury or sickness, can make it impossible to pay the bills. It eliminates

labor protections such as the minimum wage, worker safety, family and medical leave, and overtime'.

Although our statistical analysis of the Upwork platform (see above) cannot be regarded as proof of this development, such a polarisation is clearly observable, with a very great majority (three quarters) of very low-paid job offers, a minority of 'averagely well paid' offers (a quarter) and a tiny minority (less than 2%) of very well paid offers. This could be seen as confirming, to some extent at least, the 'hollowing out' of the moderately well paid jobs of the middle classes.

Stiglitz (2013) considers that the role played by technologies in the increase of inequality, while not absent, should not be overestimated insofar as other factors also play a role, such as, on the one hand, tax breaks for the super-rich, financialisation of the economy, and, on the other hand, a reduction of investment in education, infrastructure, or health care (The Open Society Foundation 2015:4). It has been observed by Dean Baker (n.d.), what is more, that technologies have contributed to the weakening of the labour market institutions.

If inequalities are being hollowed out from below, it appears today perfectly obvious that the same thing is happening 'from above' as well illustrated by Brynjolfsson and McAfee. On traditional labour markets, pay is calculated on the basis of absolute performance (for example that of the building workers who lay the bricks), while on the digital markets it is calculated on relative performance (for example, the programmer who creates a slightly better mapping app than the others will win the whole market). Unlike in the case of the bricklayers, the relative advantage leads in this case to absolute domination, the result being that in the digital economy the winner takes all. This is the superstar effect: 'the digital technologies have fostered the transition to markets where the winner takes all, even for products that seemed unlikely to lend themselves to the appearance of superstars' (Brynjolfsson and McAfee 2014: 178; see also Ford 2015). Yet an economy of superstars is one where 'inequality is much greater' because it increasingly profits a few billionaires while the median income of households shows no increase. This is what the authors call the 'reign of abundance but at the same time of dispersion'.

Another trend to which these authors draw attention is that today in the United States we are witnessing a decoupling of employment from productivity. Job numbers are falling while productivity continues to rise (Jared Bernstein, quoted in Brynjolfsson, p. 188 ff.). This kind of a trend, were it to be observable also in Europe, would of course be a major issue for the world of labour. Would it not, as predicted by Keynes (1930), enable a relaunching of the debate on the reduction of working time?

2.2.6 Health and safety

It is generally claimed that mobile work based on new technologies offers a certain level of flexibility, autonomy and greater responsibility for workers. '(Winners) are Western workers who value flexibility over security, such as women who want to combine work with child-rearing. (…) But workers who value security over flexibility, including a lot of middle-aged lawyers, doctors and taxi drivers, feel justifiably threatened' (*The Economist* 2015).

This division among women wanting more flexibility in work so as to be able to bring up their children, and older workers valuing security above all, is not, however, always relevant. As noted by Morsy and Rothstein (2015), 'Recent developments in employment practices have increased the prevalence of non-standard work schedules – non-daytime shifts in which most hours do not fall between 8 a.m. and 4 p.m., when shifts rotate, or when schedules vary weekly or otherwise. For example, computer software now enables retail, restaurant, service and other firms to predict hourly customer demand and delivery schedules with precision, encouraging employers to create "just-in-time" schedules in which workers are called in or sent home on short notice. By preventing many parents from adequately caring for their children, such practices adversely affect child and adolescent development'. The combination of working and family life can thus be seriously disrupted by the new flexible forms of employment.

What is more, one of the risks of this flexibility and this autonomy is the danger of work intensification, of an increase in stress levels and working hours. New forms of employment indeed risk requiring the worker to be available at all times and in all places because the new technologies blur or obliterate the traditional boundaries of professional time and space (office and working time schedules). Such 'work without frontiers' (Valsamis 2015) is likely to generate stress and burnout. According to Eurofound, 'ICT-based mobile work offers some flexibility, autonomy and empowerment, but also incurs the danger of work intensification, increased stress levels and working time, and blurring of the boundaries between work and private life. It may also outsource traditional employer responsibilities, such as health and safety protection, to workers' (Eurofound 2015:2).

Turning to the question of stress, Mettling observes that 'in 2014 an employee receives on average 85 emails a day and sends 36. What is more, the 2010 report on wellbeing and effectiveness at work points out the risks associated with a virtualisation of relationships and a confusion between what is urgent and what is important. The Boston Consulting Group identifies rapidity of change, blurring of frontiers between private and working life and virtualisation of human relations in the workplace as potential triggers of occupational diseases such as burn-out or FOMO (Fear of Missing Out), a form of social anxiety leading to an obsessional relationship with professional communication tools. Germany, for example, saw a 40% increase in absenteeism between 2008 and 2011' (Mettling 2015: 35).

Another aspect is that of control. As mentioned above, the new forms of management, including continuous real-time evaluation of worker performance on smart production lines, can become important sources of stress. It has also been observed that older workers (aged 45 and above) have a more tense relationship with new technologies that can contribute to a decrease in occupational wellbeing.

More generally, it is possible to observe that a series of tasks that were previously performed by professional workers have today become task that every 'citizen-worker' has to perform for him- or herself: carrying out bank transactions, booking train tickets, comparing energy suppliers, choosing a telecommunications operator, selecting the best 'pack' corresponding to the (self) analysis of his/her behaviour as a consumer. 'Now we do most of those things ourselves. We are doing the jobs of ten different people while still trying to keep up with our lives, our children and parents, our friends, our careers, our hobbies, and our favourite TV shows' (*The Guardian*, 18 January 2015, quoted in Valsamis 2015).

2.2.7 Other aspects of inequality

There exists another aspect of inequality, little touched upon in the literature, and yet very clearly of interest. This is the inequalities between extremely affluent and low-income households. Saska Sassen maintains that there exists an inequality between low-paid and 'high-end' workers in terms of 'capacity to connect', whenever necessary, to the main areas of life constituted by work, family work and the environment. According to her findings, there is an under-use of digital tools and mobile apps among low-income families.

At the same time, most of the digital applications developed do not aim to help or to solve the problems of low-income workers, their households and their limited resources. 'For instance, there are long lists of apps for contacting or finding spas, high-end restaurants, and a long list of other such pricey luxuries. But there are few if any apps that give you information about a health food shop in a modest-to-poor income area in a city. In short, what is absent is applications that address the needs of low-income individuals and households' (Sassen 2015: 4).

It would be possible, in Sassen's view, to develop applications that would have real usefulness on the local level or the level of collective action and that would enable people to meet the needs of local communities with low earnings: for example, applications enabling the neighbours of a sick or handicapped person to be informed in case of distress, facilitating organisation within the community, or the delivery of first aid. There do exist, as we have seen above, some platforms aimed at strengthening neighbourhood links by donations and helping one another, for example Streetbank. But such instances are few and far between; indeed they represent the exception in this new digital ecosystem.

More broadly, this lack of applications geared to socially beneficial action shows that the worker is regarded as being 'at work' or 'at home' but that the collective dimension of relations maintained with the social environment is not – or barely – taken into account. In other words, the awareness that the worker belongs very much also to a neighbourhood and takes part in social relations seems absent from this digital world. Yet Sassen goes even further than this, for she shows that, with the development of teleworking, there emerges the risk of increased competition within communities of low-income workers (downward spiral of working conditions).

Her own hypothesis is that use of digital innovations would, on the contrary, strengthen these communities, reinforce their collective actions and their power of collective negotiation which would 'slide' to some extent from the workplace towards these communities of organised online workers; and that this would become the locus for collective action.

Michel Bauwens (n.d.) sees in the peer-to-peer or P2P major opportunities for such social emancipation. 'When the labour movement arose as an expression of the new industrial working class, it invented a host of new social practices, such as mutual aid societies, unions, and new ideologies. Today, when the class of knowledge workers is socially dominant in the West, is it a wonder that they also create new and innovative practices that exemplify their values of cooperative intellectual work?' According to this writer peer-to-peer is the 'new spectre haunting the world' for it has the potential to revolutionise our ways of producing, of thinking, and of living together. This new model is leading us towards a post-capitalist society where the market will be compelled to become subject to the rationale of the common good. The wide-ranging potential opened up by the – genuinely – collaborative economy, the P2P networks, open source, micro-factories, urban agriculture, etc. will outperform the current capitalist model and open up a model for the relocation of production, new methods of working and of collaborating on a world level (Bauwens and Lievens 2015).

2.2.8 Training

The issue of training is presented as central in the debate on the digital economy. In Europe the Commission has made this a priority. 'Demand for digitally skilled employees is growing by around 4% a year. Shortages of ICT professionals in the EU could reach 825,000 unfilled vacancies by 2020 if no decisive action is taken' (European Commission 2015 a). Training is envisaged simultaneously from the economic standpoint – the digital economy needs workers trained in new technologies – and the social standpoint: 'Digital skill levels need also to be raised among employees in all economic sectors and among job seekers to improve their employability'.

Several authors have indeed shown that in the United States the Second Industrial Revolution forced workers into a race between education and training and technical advances. This race was finally won by workers of the

20th century according to Claudia Goldin and Larry Katz (2007), enabling them to obtain good and sufficiently well-paid jobs.

A quite natural deduction from this point is that, in the current context of the Fourth Industrial Revolution, it is necessary to improve workers' skills in order to enable them, as in the last century, to win the new race that has already begun. This race against the machine is described by Brynjolfsson and McAfee (2011) in their first joint book, which recommends investment in human capital: 'we need not only organizational innovation, orchestrated by entrepreneurs, but also a second broad strategy: investment in the complementary human capital – the education and skills required to get the most out of our racing technology'.

But is it not different this time? Several analyses stress that the jobs that are going to disappear will do so definitively, and that there will no longer be a refuge for the losers in other segments of the labour market (Roubini 2015). As already pointed out, there will be tremendous job losses among some sections of the population, in particular among low- and semi-skilled workers. Some commentators even speak of a 'jobless future' (Ford 2015).

Yet, according to Roubini, even a massive effort at education and training in the new technologies and the new digital world might well not suffice to include these segments of the population in social progress and the promised affluence. This scepticism leads him to suggest that other solutions might prove indispensable, such as permanent income support, a strengthening of basic social services (health care, pensions, etc.) for persons definitively excluded from the labour market by machines and algorithms. 'A most fragile balance – between the freedom of markets and the prosperity of workers – must be sought and found' (Roubini 2015).

But this question is even more complex. For what is really concealed beneath the idea that 'the worker of tomorrow has to be trained in new technologies'? What will the new kinds of training required by the digital revolution actually look like? Will we all have to become information technology engineers and programmers? Or will the vast majority of future jobs be performed by the digital galley slaves who will be given the tasks of classifying data, filtering images and cleaning up forums?

Or again, as suggested by Head, in their role as tools of machines and algorithms will not workers be increasingly less required to use their own know-how, their own skills and their own experiences? Will the technicians working for the lift company Kone still need a specialised form of training when their magic boxes will be able to tell them what parts need replacing, in what order and according to which detailed procedures? Will the workers on the Bosch Rexroth intelligent production lines still need training in order to perform actions dictated by the infrastructures?

These are some of the questions that show that the topic of training is not as straightforward or unequivocal as one might have thought. We have seen in

this study that the implementation of certain technologies led to a deskilling of workers. We have also seen that the labour market was becoming polarised between the highly skilled but not very numerous jobs and the large majority of jobs requiring low skills and paying low wages. At the same time, medium-skilled jobs are regarded as those most likely to be threatened with extinction.

In spite of these ambiguities, most authors insist on the need to step up training as a means of improving employability in highly and very highly skilled jobs. But this is likely to be a lifeline that is not accessible to older workers and those whose educational level is no higher than upper secondary (Valsamis 2015).

At the same time, the European Commission considers that one in every two workers in the EU lacks the requisite digital competences (e-skills), and that this situation risks triggering, in the near future, a lack of skilled labour in relation to the demand for it, not only in fields linked to new technologies but also in other fields where these technologies are beginning to be introduced. This is why, according to Valsamis, 'Supplying all required skills requires changes in vocational education and training. Investments in ICT infrastructures and broadband support the use of new learning methods like Massive Open Online Courses (MOOCs). Yet Eurostat data underline the importance of workplace training for learning e-skills, since formal educational institutions mainly only reach young people. Content-wise, education and training programmes particularly focus on science, technology, engineering and mathematics (STEM) in order to close the skills gap.'

It remains nonetheless the case that the increasing numbers of workers who supply services on platforms such as Upwork, Uber, ATM, etc. are not required to submit proof of qualifications, or training completed, or any kind of experience at all. Most of the time what counts for the client is the rating of the service provider supplied by the most recent 'user', a state of affairs that, what is more, leads some service providers to develop an obsession with evaluation rather than with training.

2.2.9 Digitalisation, inequality and discrimination

To close this overview of the social stakes of digitalisation, we cannot omit all mention of the question of discrimination within the digital economy. As we have seen above, Szoc (2015) shows that 'platform capitalism accentuates in reality the gulf between owners and non-owners. From a theoretical standpoint, this accentuation can be expected to be particularly marked in economic sectors concerned by rents – in which it is not so much production costs as scarcity that determines exchange value. Thus in the field of real estate, the potential increase in returns from a property generated by the possibility of renting it (in whole or in part) on Airbnb should increase its market value, and the introduction of competition between on-demand rental on Airbnb and traditional rental would be expected to trigger an increase in rent levels'.

Indeed, in San Francisco (California) a lively debate erupted in 2015 about the consequences of Airbnb on the supply of accommodation (falling) and the price of rents (increasing), with increasing numbers of owners preferring the higher income to be derived from renting their property to tourists. The same phenomenon is beginning to be observed in certain European cities, in particular Paris.

What is more, this phenomenon is accompanied by what might be described as the emergence of digital discrimination, even though this aspect seems today to be very little documented. To our knowledge, there are extremely few studies available, but those which do exist show that the discrimination patterns of the real economy are being reproduced in just the same way in the digital economy.

In the same vein, an interesting study published by the Harvard Business School examines the question of 'digital discrimination' at Airbnb. 'Online marketplaces often contain information not only about products, but also about the people selling the products. In an effort to facilitate trust, many platforms encourage sellers to provide personal profiles and even to post pictures of themselves. However, these features may also facilitate discrimination based on sellers' race, gender, age, or other aspects of appearance' (Edelman and Luca 2014). It indeed emerges from this study that 'using a new data set combining pictures of all New York City landlords on Airbnb with their rental prices and information about quality of the rentals, we show that non-black hosts charge approximately 12% more than black hosts for the equivalent rental (…). These findings highlight the prevalence of discrimination in online marketplaces, suggesting an important unintended consequence of a seemingly routine mechanism for building trust' (Edelman and Luca 2014).

Thus, a study on peer-to-peer financing shows that 'loan listings with Blacks in the attached picture are 25 to 35 percent less likely to receive funding than those of whites with similar credit profiles' (Pope and Sydnor 2008) According to this study, the interest rates asked of Blacks in this mode of alternative financing are 60 to 80 base points higher than those asked of Whites.

Conclusion

Digitalisation of the economy is not a new phenomenon. Yet even though it has been underway for several decades, there is today a consensus that it has reached a tipping point. The marriage between Big Data and robotisation heralds a new economy and, hence, a new world of work.

But the consensus stops there. To what extent will this new digital economy create, destroy, displace jobs? Which sectors will be the most deeply affected? What new skills and qualifications will be required? How will the transition take place? There is no single answer to these questions.

Similarly, the global effects on the quality of employment, working conditions, forms of work, are difficult to evaluate with any precision. There seems to be an emerging consensus concerning an increased polarisation of the society of tomorrow, with a shrinking middle class, a strong increase in low-income workers and households, and the explosion of a tiny minority of 'superstars' whose wealth levels are literally exploding.

Numerous questions arise in particular concerning the emergence of a completely 'digitiglobalised' new labour market in which we find, working 'side by side', millions of digital galley slaves in America, the Philippines, Brazil, Morocco. These platforms and their crowdworkers represent a severe disruption to the organisation of national labour markets that have been in place in some cases for many decades with their regulations, their social dialogue, their social rights financed by their social contributions and their taxes.

In industry, the stakes involve the new race between the machine and the worker. Work paces, control of every action by the machine, managerial surveillance in real time, but also disappropriation of the worker's capacity to organise her/his work and the risk of becoming the tool of the robot and its algorithms.

The risk, or the dark side of the digital revolution that is announced to us with its 'agile' and 'cooperative' work organisation, is a labour market of 'digital galley slaves' on the one hand and of 'decision-making machines' on the other, all remotely controlled and placed in competition on the world level.

The digital revolution therefore seems to reveal tremendous inequalities between the masses of increasingly isolated low-income workers and the top-of-the-market workers who are in a position to take advantage of an ever richer

palette of digital instruments that enable them to indulge, on demand, whatever luxury whims or extravagances they may choose: a driver, a personal assistant, a meal delivered to the door whenever they feel disinclined to cook, someone to walk their dog if the weather is too unpleasant to venture outdoors. The digital revolution looks set to deliver greater freedom to indulge every whim to some and an existence more akin to slavery to others; more collaboration to some, more competition to others; more sharing to some, a more precarious livelihood to others. The need to combat this risk lies at the heart of the trade union stakes in the digital revolution and the social and labour battles of the future.

Table 2 **Summary of the main issues examined in this study broken down into 'strength/weakness' and 'opportunity/threat' categories**

Strengths	Opportunities
1. Connected world, open systems, knowledge economy	1. New jobs (computer engineers and scientists, network experts, etc.)
2. Networks, exchange, sharing and collaboration, with access based on functionality rather than ownership	2. More 'agile' work organisation; new forms of more flexible and more autonomous work
3. Integration of industries and services: intelligent factories, energy systems, mobility, transport and cities and 'optimised' governance	3. Abolition of repetititve and routine tasks
4. Automation, robotisation, learning machines	4. Better ergonomics, help in performance of heavy or complex tasks
5. Productivity, efficiency and profitability gains	5. New forms of collaboration and cooperation among workers
6. Zero marginal cost economy	6. Reshoring or onshoring (return of industries and new 'smart' factories – and jobs – to their country of origin)
7. Innovative products and services, proliferation of mobile apps to 'make life easier'	7. Possibility of new ways of distributing productivity gains (working time reduction)
8. New autoproduction capacities, micro factories	8. Possibilities of social emancipation, change of economic model geared to peer-to-peer and common goods ('post-capitalist' society)
Weaknesses	**Threats**
1. Jobless growth, jobless future	1. Massive destruction of medium-skilled jobs (computerisation)
2. Emergence of super powerful oligopolies, new world data masters	2. Intensification of 'anytime, anywhere' work; blurring of the boundary between private life and working life leading to stress and burnout
3. Concentration of power and wealth in value chains (equivalent losses for other companies, sectors and countries)	3. Loss of control by workers of their own expertise and know-how and free will (becoming the tool of a machine)
4. Frequent problems of (non)-compliance with regulatory, administrative, labour and taxation standards	4. Digital management, policing of workers, risk of mutual loss of trust between employees and management
5. Protection of personal data exposed to intrinsic risks	5. Precarisation of jobs and statuses, total dependence on 'data masters'; 'servification'
6. 'Algorithmisation' of individual behaviour, work and consumer habits, social and cultural preferences; normalisation and standardisation of the individual	6. Weakening of collective action and industrial relations
7. Hollowing out of the middle classes and polarisation of society between a reduced number of 'top-of-the-scale' workers and a mass of 'bottom-of-the-scale' workers	7. Skills and training/labour demand mismatch
8. Under-investment and under-utilisation of digital tools for the social emancipation of low-income sections of society	8. Exacerbation of inequality, wage stagnation
	9. 'Digital Taylorism' and emergence of a class of digital galley workers (crowd sourcing); world competition among workers for all jobs not requiring face-to-face contact
	10. Erosion of tax base and social insurance financing

Source: Christophe Degryse (ETUI 2016)

Appendix
Examples of trade union initiatives

It is not possible to refer here to all initiatives taken by national trade unions on the subject of digitalisation of the economy. As already mentioned, some countries have been paying more attention to this question than others. In the following pages, we will attempt an – incomplete – overview that should nonetheless, we hope, give some idea of how trade unions are thinking – and acting – in relation to this matter. Some initiatives are still confined to studies, analyses or conferences, while others have reached the negotiating stage and even, in some cases, gone as far as attempting to organise the workers on digital platforms.

It is to be noted that only very recently have the trade unions begun to focus on this topic, so that virtually all the initiatives mentioned in the following pages were launched in 2014 or 2015 – a clear indication that the coming months and years will be fertile in new developments and events.

1. General overview

As several authors have pointed out, there exists in European public opinion – and among labour forces – a natural tendency to resist technological 'advances' (McTernan and Reed 2015: 91). Just as globalisation brings, it is said, economic gains that nonetheless entail a redistribution of the winners and the losers, digitalisation will also enable gains (in terms of productivity) that will have the simultaneous effect of fundamentally reconfiguring the employment map. There will accordingly, as we have seen, be both winners and losers.

For the trade union world in general, the social and labour stakes may be summarised as follows:

1. Digitalisation of the economy will create but also displace and destroy jobs. What kinds of preparation can be made to tackle this prospect?

    — training: what kinds of training for new jobs? In what sectors?
    — restructuring: how are the productivity gains to be mutualised, socialised, distributed?
    — job losses: what can be done about the workers who will be definitively expelled from the labour market by algorithms? What (new) forms of social assistance can be put in place for them? What permanent income support and welfare services?

2. In offices and factories, the digitalisation of production systems will fundamentally change the nature of work by:

   — interaction with intelligent machines: how to avoid the worker becoming a tool of the machine? What principles can be devised to prevent the interaction between humans and machines from deskilling workers and subjecting them to an unbearable pace of work?
   — digital management: how to ensure that the worker does not become subject to permanent monitoring? What 'humane' systems can be devised to evaluate his/her work? How to prevent the worker from being reduced to a data set fed into algorithms?

3. Digitalisation creates a parallel and ultra-flexible labour market that has come to be referred to as crowdworking:

   — how is this new form of work to be regulated? By the creation of a new status, or a new form of employment contract? How to ensure the financing of social security budgets and social welfare provision in the context of these new forms of employment (wage, working time, taxation)? What forms of protection can be offered to workers and how are working conditions to be controlled (health and safety, paid leave, even child labour, etc.)?
   — how are collective forms of action for crowdworkers to be created? How is their collective bargaining power in the face of the digital platform 'employers' to be strengthened?
   — how is job-destructive competition between a regulated labour market and a non-regulated parallel labour market to be avoided?

4. In society as a whole what steps can be taken to ensure that digitalisation of the economy does not result in polarisation and growing inequality between highly skilled and low-skilled workers, between men and women, young and old, home country and immigrant workers?

2. Examples of trade union initiatives

The following pages list, in relation to several EU member states, initiatives taken by government and/or the business world in relation to digitalisation of the economy. The information supplied in boxes is based primarily on work done by the ETUC[37]. The information is supplemented by data collected by Mariya Nikolova, of the European Trade Union Institute, from the TURI network of research institutes[38]. This information gives some idea of the

37. Overview of national initiatives supporting the digitisation of manufacturing, ETUC note for the workshop of 2 December 2015.
38. http://www.turi-network.eu

research currently being conducted in six of these countries on the impact of digitalisation on the labour markets. The countries in which the trade unions are formally involved – a tiny minority of countries, according to our information (Germany, France, Luxembourg, Sweden and Netherlands) – receive more in-depth analysis. The author of this paper is very well aware that all trade union initiatives underway in the EU member states taken as a whole are not fully encompassed.

2.1 Germany

Industrie 4.0
https://www.bmbf.de/de/zukunftsprojekt-industrie-4-0-848.html
https://www.deutschland.de/en/dossier/industry-40

Digital Agenda 2014-2017
https://www.bmbf.de/de/die-digitale-agenda-relevant-auch-fuer-bildung-wissenschaft-und-forschung-206.html

TURI research on digital economy: WSI/HBS (Contact: Elke Ahlers, Elke-Ahlers@boeckler.de)
At the Hans Böckler foundation there are several studies and information (but mostly in German). For instance:
http://www.boeckler.de/46972.htm
http://www.boeckler.de/52614_61824.htm

At the beginning of 2016 we are going to conduct a large and representative survey of works councils on the issue of the digital economy. More than 2000 works councils in Germany are going to be asked about their experiences with digitalisation of the workplace. The findings are expected for summer 2016. There are several other future initiatives under discussion, but at the moment unspecific.

In **Germany** trade union initiatives are for the most part an extension of the federal government's 'activism' on this issue. The Merkel government has made a point of showing that it is well aware of developments in the digital economy with, in particular, its 'Industrie 4.0' initiative, the employment section of which, entitled 'Arbeiten 4.0', was launched on 22 April 2015 by German social affairs and employment minister Andrea Nahles (SPD). It is a 'Green Paper' that brings together the main challenges and issues raised by the current digital revolution (available in English under the title 'Re-Imagining Work – Green Paper Work 4.0')[39]. This Green Paper initiates a wide-ranging debate on the future of the world of labour, a debate that will involve economic, political and social decision-makers, experts, and also citizens. The solutions stemming

39. http://www.bmas.de/SharedDocs/Downloads/DE/PDF-Publikationen/arbeiten-4-0-green-paper.pdf?__blob=publicationFile

from this discussion will be presented in a 'White Paper' at the end of 2016 (Planet Labor 2015).

It is important to note from the outset the government's ostensible determination to involve the social partners in this process. As we have seen above, Minister Nahles has stressed the importance of developing 'decent, secure and healthy work. Finding new ways to combine a high level of employment with participation in work. Taking seriously workers' changed individual preferences regarding their work, and developing policies which enshrine a life-phase approach. Ensuring that fair wages and social security in our social market economy also apply to new forms of work. Finding good solutions regarding initial and continuing training which enable us to shape technological change and to help workers cope in a world of work characterised by greater diversity, discontinuity and uncertainty. Ensuring that companies find the skilled workers they need and embrace good corporate governance because of the many advantages it brings them' (Bundesministerium für Arbeit und Soziales, 2015).

During gatherings organised in the wake of the Green Paper, the German employers' associations developed, however, some extremely trenchant positions on what the labour market in this 4.0 industry should in their view look like. Thus the BDA and BDI federations stressed, in particular, the gains in terms of flexibility and a new regulation of the employment framework that should be settled at the European level; they insisted also on the need to limit trade union influence in relation both to the digitalisation of companies and to the question of developing protection through new forms of work status for crowdworkers' (Planet Labor 2015b). The employers consider that digitalisation will serve to step up specialisation and the division of labour, will increase the importance of services and sub-contracting and provide a wonderful opportunity for labour flexibility because these new forms of employment that are emerging 'must not be limited by an excess of regulation'. Trade unions' right to co-determination must not be exaggerated in matters relating to digitalisation of the workplace and the trade unions' potential to 'put on the brakes' in this area must be limited. Working hours must, in the view of the employers, be flexible and it would be a bad idea to draw up a specific status or form of protection for crowdworkers.

The German trade unions have warned the employer federations that there can be no question of diluting the German co-determination and labour protection system: when it comes to training, flexibility and future status of workers in the 4.0 new world of labour, the leader of the chemicals and energy trade union Mr Vassiliadis stated that 'we must not condone a situation in which every worker is turned into a mini-company with his work arranged via a service contract and he is required to take responsibility for his social security cover and training'. Reiner Hoffmann (DGB), meanwhile, pointed out that 'in the last 40 years we have made significant progress on matters like protection from noise, dust or hard physical labour. But today's problems are quite different, for they include burn-out, stress' (Planet Labor 2015b).

According to IG Metall, this 4.0 industry remains very much of a black box. Digitalisation, it states, will indeed change the world, but in what directions remains highly uncertain[40]. Many important social aspects have to be clarified (work organisation, training and skills, data security, working conditions, etc.). IG Metall, accordingly, has decided to define its own priorities[41] which may be summed up as follows:

Guaranteeing workers' social rights in the digital world:

— develop new forms of codetermination for the digital world, adapt and enhance codetermination rights;
— develop and implement comprehensive mobile working regulations;
— establish participation and protection rights for crowdworkers;
— enhance employee data protection.

Actively shaping technology and work organisation design:

— develop participatory company-level approach based on vision of humanely designed digital workplace;
— develop competencies of part- and full-time officials;
— encourage public debate, influence research policy;
— continue to develop occupational health and safety standards.

Participation in the digital work environment – equal opportunities for all employees:

— Training and CPD should become core strategic issues:
  – IG Metall should promote a visible and appropriate training policy publicly and at the collective bargaining table;
  – more active efforts should be made to promote training at company level.
— Use of new ICT workplace learning methods and certification of skills acquired in the workplace.

In April 2015 IG Metall set up an advisory body on the future of work (*Beirat 'Zukunft der Arbeit'*[42]) composed of experts from business, academia and politics. The council is to meet twice a year, its task being to examine and identify at an early stage the changes taking place in the world of labour, so as to be in a position to devise options and seek answers to the key questions on the future of jobs. This is one way of providing practical accompaniment to the initiative of the employment and social affairs ministry in favour of quality employment in industry 4.0.

With regard to crowdworkers – and by way of response to the employer federations that consider that these workers should not be subject to an excess

40. https://www.igmetall.de/plattform-industrie-4-0-16050.htm
41. 'The Digital Transformation of Industrial Work', Zukunft der Arbeit (ZdA), IG Metall, 2015.
42. https://www.igmetall.de/pressemitteilungen-2015-16019.htm

of regulation or specific status – IG Metall has decided to create an internet site entitled FairCrowdWork Watch[43]. The site enables crowdworkers to evaluate, in terms of working conditions and pay, the companies that use their services, to exchange views and experiences with one another, and to take advantage of legal advice supplied by IG Metall. This is one first attempt to organise these workers who are operating on a 'parallel' labour market that employs increasing numbers of totally atomised workers.

This example has the merit of showing that social movement organisations or trade unions can also take digitalisation of the economy into their own hands to place at the service of workers new tools for the protection of their rights and defence of their jobs and wages.

2.2 Austria

Produktion der Zukunft
Austrian institute for the funding of industrial research
https://www.ffg.at/produktion-der-zukunft

IKT der Zukunft
Austrian institute for the funding of industrial research
https://www.ffg.at/iktderzukunft

In **Austria**, a joint analysis has been conducted by the ÖGB, UNI-Europa and GPA-DJP (private sector workers' union). In September 2015, a conference was organised on the topic 'Digitalisation and its economic and social potentials'[44], at the end of which a joint statement was adopted ('Joint Declaration by ÖGB, UNI Europa, and GPA-DJP on Digitalisation, Work and Employment in the EU')[45]. This text places the main focus on social dialogue, protection of personal data, the rights and protection of crowdworkers, education and preservation of the European social model. Some extracts from the declaration are given below:

— (…) Using digital technologies can provide workers with a choice concerning when and where to carry out work. To take benefit from this, workers require clear rules respecting their work-life balance, as well as regulation that limits their availability outside of working time. Digital technologies should enrich working life, not degrade workers to assistants of 'the machine'. To this end, the introduction of digital technologies at work should be subject to meaningful social dialogue.

43. www.FairCrowdWork.org; www.cloudworker-beratung.de
44. http://ak-europa.eu/en/ak-europa-digitalisation-and-its-economic-and-social-potentials.html?cmp_id=7&news_id=2543
45. http://www.uniglobalunion.org/sites/default/files/public_shared/files/dsm_declaration_en_final.pdf

— A digital world of work requires high standards for the protection of personal employee data. Digital technologies produce large amounts of data. Clear rules are required to establish what data employers may collect and analyse. Strict protection must be given to worker health data, contents of personal communications, and involvement in trade union activities (…).

— Workers' rights and social protection for all in the digital age. The digital transformation enables substantial increases in non-standard employment, for example in the form of freelancing and work in the so-called 'sharing economy'. (…) Ways must be created to establish co-determination, collective bargaining, and worker protection rights for the entire workforce, as well as social security systems that are open to all in the workforce (…).

— (…) The digital economy (…) requires frequent re-retraining measures that are equally accessible to workers in standard and non-standard forms of employment. To meet this challenge, all workers (…) must have an enforceable right to paid educational leave and effective training schemes. To ensure that the cost of training is not borne by workers, both employers and governments must increase investment in education and training.

— (…) As digital change brings fundamental changes to EU labour markets, particular attention is required to preserve the European social model. Numerous sectors of the digital economy are dominated by a small number of big players, and the digital economy has a tendency to concentrate wealth while coring out medium-income jobs. This increases income inequality and threatens social cohesion. (…) Increases in unemployment may be the result of (technological breakthroughs), which threatens the sustainability of social security systems and public services that are financed by the taxation of labour income. The EU and Member States must react to this and devise effective strategies against rising income inequality and potential hikes in unemployment in times of digital change. In preparing such strategies, consideration should be given to redistributing the productivity gains that digital automation may foster through tax systems and reducing working time.

Meanwhile, Martin Risak of the University of Vienna has conducted a study of the major stakes of crowdworking. The conclusions of this study were presented at a conference held by AK Europa (Federal Chamber of Labour) in November 2015 on the topic 'Modern-Day challenges for the European Trade Union movement'. According to the presentation given by Risak, the main social and welfare issues affecting crowdworkers are the following:

— global competition;
— dislocated physical workplace;
— intense virtual control mechanisms;

— non-transparent 'digital reputation';
— lack of worker's organisation;
— oligopoly of a few platforms;
— legal insecurities;
— low remuneration and unfair terms & conditions.

And the strategic paths to be investigated to obtain better working conditions must be based on the following elements.

— The legal arena:
  – who are the contractual partners?
  – employment relationships or independent contractors?
  – 'homeworkers';
  – applicable law and forum;
  – terms and conditions of the platforms.
— Self-organisation:
  – unions and collective bargaining;
  – co-determination[46].

2.3 Belgium

Digital Belgium
www.digitalbelgium.be

Made different; Factory of the Future 4.0
http://www.madedifferent.be/

TURI research on digital economy: FTU Fondation Travail-Université (Contact: Patricia Vendramin and Gérard Valenduc, pvendramin@ftu-namur.org)
Project with ETUI on "Work and social dialogue in the digital economy"; our task is to prepare a paper setting out the challenges regarding the future of work and social dialogue in the light of the digital economy. This paper is aimed at supporting an internal brainstorming meeting of ETUC on this topic. Our task is to prepare the preliminary paper and to deliver a report of the brainstorming meeting.

'Digital Belgium' is the action plan of the minister of the digital agenda, telecommunications and post office, the Liberal Alexander De Croo (Open-VLD). Presented in April 2015, it sketches out a long-term digital vision of the country and presents it in terms of a set of aims and targets designed to ensure an improvement in Belgium's position in digitalisation.

46. http://ak-europa.eu/_includes/mods/akeu/docs/main_report_en_389.pdf

The action plan is based on five pillars:

— digital economy;
— digital infrastructures;
— digital skills and jobs;
— trust in digitalisation and date security;
— digital government powers.

Although, according to this plan, 'the digital revolution should create some 50 000 new jobs in a whole range of sectors', the trade unions – though normally accorded a high profile in Belgium – do not seem to be at all closely involved in the process. One of the principal aims of the government is to become one of the top three digital economies (Belgium is currently in fifth place, according to Valsamis 2015). According to Minister De Croo, 'with a focused strategy and sustained effort by 2020 it must be possible for Belgium to get into the digital top three of the European Digital Economy and Society Index, for 1,000 new start-ups to take root in our country and for the digital revolution to deliver 50,000 new jobs in a variety of sectors'.

A monitoring group entitled 'Digital Minds for Belgium' has been set up consisting of representatives of multinationals, telecommunications companies, start-ups, but without any trade union participation. It should be pointed out that relations between the current government coalition[47] and the national trade unions are 'difficult'.

2.4 Denmark

Manufacturing Academy
http://made.dk/welcome
MADE - Manufacturing Academy of Denmark - works to promote production in Denmark through research, innovation and education. It brings together companies, research and knowledge institutions across industries.

TURI research on digital economy: FAOS (Contact: Anna Ilsøe, ai@faos.dk)
A research project on the digitalization of the Danish labour market and its consequences is currently in progress.

47. A coalition composed of French-speaking and Flemish liberals, Flemish nationalists and members of the Flemish social christian party (CD&V). The latter is the only party in the coalition to maintain structural relations with one of the two large trade unions in the country, the CSC-ACV.

2.5 Spain

Agenda para el fortalecimiento del sector industrial
http://www.minetur.gob.es/industria/es-ES/Servicios/Paginas/agenda-sector-industrial.aspx
'Agenda for strengthening the industrial sector in Spain' is an action plan, consisting of a set of proposals for action, specific and clearly defined, which launched in the short term will allow improving cross conditions in which it develops industrial activity in Spain and help the industry to grow, be competitive and increase its weight in overall GDP.

TURI research on digital economy: Fundación Cultural 1º de Mayo
(Contact: Ramón Baeza Sanjuán, baeza@ccoo.es)
Digitalisation will be one of the guidelines of our foundation 2016 working programme. In any case we see digitalisation as a long-term issue that will remain in our agenda in the coming years.

2.6 Estonia

E-Estonia council
https://riigikantselei.ee/en/supporting-government/e-estonia-council
E-Estonia Council directs the development of Estonian digital society and e-governance, especially the implementation of national digital agenda. Five experts and ICT sector representatives and three ministers are members of the Council. It is chaired by Prime Minister.

2.7 Finland

Industrial Internet Business Revolution
http://www.tekes.fi/en/programmes-and-services/tekes-programmes/industrial-internet--business-revolution/
Industrial Internet – Business Revolution programme funds projects in which digitalisation is utilised for developing new services and business models to aim at international growth.

Finnish Metals and Engineering Competence Cluster
http://www.fimecc.com/
Accelerating engineering innovation into the market

2.8 France

Usines du futur
http://www.lesusinesdufutur.com/fr/home/homepage.jsp

'Transformation numérique et vie au travail'
Mettling report for the attention of Mme Myriam El Khomri, Minister of labour, employment, vocational training and social dialogue
http://www.ladocumentationfrancaise.fr/var/storage/rapports-publics/154000646.pdf

Smart industrie
http://smart-industries.fr/fr/

TURI research on digital economy: IRES (Contact: Odile Chagny, odile.Chagny@ires.fr) Ires launched, in the Spring of 2015 and in partnership with ASTREES, an initiative relating to the sharing economy. The initiative is entitled 'Sharers & Workers'. We have a twitter account, and are in the course of finalizing a small website. The initiative consists in a network of (mainly) French think-tanks or actors engaged either in the digital and sharing economy, and/or in social dialogue and trade unions : ASTREES, Ires, OUISHARE, FING, Cap Digital, Sémaphores, Institut de l' Iconomie. The main idea underpinning the project is to enable three relatively different 'populations' (researchers, trade union members, collaborative economy players) to discuss and contrast their points of view relating to the labour transformations associated with these new business models. A first participatory event will be held on 14 January in Bagnolet (close to Paris).

In **France**, digitalisation issues have been subject to considerable analysis and reflection by the trade unions, principally as from early 2015. What speeded up this process here too was a government initiative, somewhat less energetic than in Germany but which, even so, represents a starting point. In March 2015, the minister of labour, employment, vocational training and social dialogue (François Rebsamen, since replaced by Myriam El Khomri) asked Bruno Mettling, deputy director general of human resources at Orange, to examine the question of the effect of digital change on labour. A series of reports had already been commissioned by the government on various aspects of digitalisation (taxation, education, training, etc.) but this was the first time that the question of labour was targetted specifically.

Work on drafting of the 'Mettling report' took place throughout 2015 and was structured around a group of experts that included five trade union and employer representatives (CFDT, CFE/CGC, CGT, FO, and the director general of MEDEF) together with labour law experts and sociologists.

The report identifies, in particular, six forms of impact of this digital change (Mettling 2015):

1. The massive spread of new work tools;
2. The impact on occupations and skills;
3. The impact on work organisation;
4. The impact on management;
5. New forms of non-salaried work;
6. Managerial staff and their working environment.

It also presents 36 recommendations for taking digitalisation in our stride, some of the most important relating to questions of training, reclassification and reskilling, gender equality, tax instruments, investment, new forms of work, the right to disconnection, etc.

This exercise served as a catalyst for the French trade unions and prompted them to deepen their own analyses and strategies in relation to development of the digital economy; each one of them prepared a specific contribution, and these contributions are appended to the report.

In parallel, a series of initiatives were taken by individual trade unions. L'UGICT-CGT (the CGT's general union of engineers, managerial staff and technicians) held, in October 2015, a seminar in Paris on the topic 'How to ensure that the digital revolution is synonymous with social, economic and environmental progress?' At this gathering, Marie-José Kotlicki presented her report prepared for the Economic, social and environmental committee entitled 'the new relationships between industry and services in the digital era[48]. Then, on 26 November 2015 the UGICT-CGT organised another event to assess the progress of its campaign on the right to disconnection and the reduction of working time (CGT 2015) (see box below).

The CFDT too has been paying attention to new trade union practices and uses of information and communications technology. 'The emergence of internet and its democratisation over recent decades have speeded up the transformation of production systems in companies. Already the development of ICT, with the mechanisation and automation of production, had led to radically different ways of working. The new means of electronic communication reinforced this process and, in addition, enabled a structural transformation through a stress upon individuality: the introduction of managerial administration; acceleration of methods and procedures; individualisation of career paths and situations; and, above all, a radical transformation of social relations and interactions with a blurring of the frontiers between private and public (and professional) space which have a sizeable impact on the construction of forms of employee mobilisation' (CFDT 2015).

It is in this context that the CFDT, in collaboration with IRES, has published a report adopting, as its angle of approach, the relationship to different uses of digitalisation: 'its social anchoring, as a guide to understanding the reasons that can incline people to use or avoid digital opportunities, the expectations

48. http://www.lecese.fr/travaux-publies/les-nouveaux-rapports-industrieservices-l-re-du-num-rique

and the fears, the possibilities offered by networks and the social relations and links maintained both online and offline. After all, one prerequisite in the project of getting to grips with these new configurations and constructing the requisite balance of power among employees is that people should choose ownership of digitalisation, that they should actually wish to make use of it; the purpose of this study is therefore to grasp the way in which digital realities fit into and are used within the world of social interaction' (CFDT 2015).

FO too is analysing topics in this field, including the following: the Fourth Industrial Revolution; the stakes of digitalisation for the world of labour; the impact of the new digital economy on labour (FO 2015). Here can be found a set of demands such as the establishment of 'new forms of collective and individual protection', the right to disconnection, improvement of working conditions, new frontiers between working and family life, regulation of teleworking, regulation of crowdworking (the employer/employee relationship must not become a contractor/sub-contractor relationship in the commercial sense), etc.

Generally speaking, each of the French trade unions that took part in the Mettling report (2015) put forward a set of positions and demands in the face of the emerging digitalisation of society and these texts are included in the appendices to the report. The proposals, summarised in the enumeration below, focus above all on the following points:

— job creation;
— adaptation of taxation and social rights;
— universal high-speed connection service;
— conclusion of agreements on 'mobility working';
— reflection on changes in the position of managers and managerial workers;
— workplace information-consultation concerning digital strategies, training plans, etc.;
— increased autonomy of workers and the associated additional burden of work and responsibility;
— working time management and its reduction;
— the right to disconnection (cf. box);
— confidentiality and the protection of personal data : policing of workers;
— 'infobesity' (i.e. overload of information by which the worker ends up feeling oppressed);
— future of employees / the new status of employed labour;
— the dynamic of teleworking;
— the opportunity to improve staff representatives' means of communication;
— the digital fracture;
— participation in strategic company decisions;
— rights attached to the person.

The 'right' to disconnection for example

Volkswagen has put in place an arrangement whereby servers for professional smartphones go into sleep mode between 6.15 p.m. and 7 a.m. Daimler-Benz allows its workers to adopt an automatic reply arrangement for email messages sent during their holidays, a particular feature of which is to avoid a situation where the worker, on returning to work, in inundated by emails: either the messages received are redirected to another contact or the sender is asked to resend the message at a later date.

In France, the CFDT and the CFE-CGC signed, in 2014, a sectoral agreement on working time with the Fédération des syndicats des métiers de la prestation intellectuelle, du Conseil, de l'Ingénierie et du Numérique; this agreement too contains 'right to disconnection' provision.

2.9 Italy

Fabbrica Intelligente
http://www.fabbricaintelligente.it/
The task entrusted to the Intelligent Factory cluster is to propose, devise and implement an R&D-based strategy.

Growth from digital technology
http://www.crescereindigitale.it/
Available on the web: a training course free to all those enrolled in the 'Youth Guarantee'. Up to 3,000 traineeships to support digitalisation of Italian firms and accompany them into the digital world.

TURI research on digital economy: EURISPES (Contact: Marco Ricceri, eurispes.intl-dept@libero.it)
Since 2005 we have promoted a European Network on Regional Labour Market Monitoring. This network is a sort of bridge between academia and operators (at the moment we have around 400 members overall Europe). Every year we are promoting the Annual Meeting and the European Day, this year was in Milan, on last October. The main issue was the revolution of Big Data and ITC in the workplaces (documentation available). On the occasion of the Milan conference we also published a book with the main findings and best practices on the issue (Anthology 2015). As follow up of the conference we have also promoted a European working Group on this specific issue. Eurispes is one of the founding member of the network and at the moment my personal position is to be chairman of the Scientific Committee. The coordination and the management of this network is carried out by IWAK the Institute for Labour of the University of Frankfurt (Germany): Director Dr. Christa Larsen, Network Manager Sigrid Rand.

2.10 Luxembourg

Digital Lëtzebuerg
http://www.gouvernement.lu/4242265/digital-letzebuerg/4242280/intro
The purpose of the initiative entitled 'Digital Lëtzebuerg' is to strengthen and consolidate the position of this country in the firled of ICT and to raise Luxembourg to a position of 'high-tech excellence'.

2.11 The Netherlands

Smart industry
http://www.smartindustry.nl/eng/
TNO, the Ministry of Economic Affairs, VNO-NCW and the Chambers of Commerce and FME have taken the initiative to make a report on the meaning of Smart Industry for companies, knowledge institutions, and government in the Netherlands.

'De robot de baas'

'Mastering the robot'
http://www.wrr.nl/fileadmin/en/publicaties/PDF-Verkenningen/Mastering_the_Robot_Web.pdf
Report published by The Netherlands Scientific Council for Government Policy (WRR).

'De robot de baas' (Mastering the Robot) is a report presented on 8 December 2015 by the *Netherlands Scientific Council for Government Policy* (WRR) to the Dutch Vice-prime minister and minister of employment and social affairs, Lodewijk Asscher. The report is aimed at identifying the stakes of labour in the digital economy and is entitled 'The future of Work in the Second Age Machine'. The WRR is not a government institution but an independent think-tank whose task is to advise the government on social issues of medium- or long-term significance[49].

This report asks some of the questions that are being voiced by most workers and trade unions: 'The first is: Viewed from a labour-market perspective, which forms of robotisation (and digitisation) will we see, both now and in the future, and what are the contributing factors? The second question is: What do we know about the consequences of digitisation and robotisation for work? The third and final question is: Which issues should government be addressing in policy, and what action can be taken by researchers, employers and employees, their representative organisations, and other parties?' (WRR 2015). An interesting concept developed in this context is that of 'inclusive robotisation'.

49. www.wrr.nl/en

The main recommendations of this report deal with:

— an agenda of inclusive robotisation: robots must not impose themselves upon workers and/or replace these workers but must be regarded as supplementary tools that can be used to make workers more productive in the framework of a 'co-creation';

— the development of supplementary skills and qualifications at all levels of education: technical issues relating to digitalisation are indeed important but they are not the essential questions which, on the contrary, must be: 'What is typically human about the work we do? Which tasks, relationships and responsibilities will continue to require the human touch, or will we specifically want to entrust (or continue to entrust) to people?';

— ownership of work: numerous studies have shown that this level of ownership and autonomy is important for productivity. The question then becomes: how to get workers and machines to work together while allowing workers to retain responsibility for their own work;

— finally, the WRR report tackles the emerging question of inequalities in the digital society, an aspect that has not yet been clarified for it is impossible to predict which categories will be the worst affected by this trend. The recommendation to the government, accordingly, is as follows: 'Policymakers therefore need to create a portfolio of measures that will help and support people where necessary. It is also important to consider whether workers can (and should) become co-owners of robots and other machines, as we believe that co-ownership is one way in which workers can continue to master robots' (WRR 2015).

The report concludes with an appeal to involve all the live forces of society in this inclusive agenda: 'We therefore advocate an inclusive robot agenda for governments, employers and employees, their representative organisations, researchers and other stakeholders that will help us master robots in a variety of different ways'.

2.12 Poland

Innolot
http://www.innolot.avioaero.com/
Innolot program aims to finance scientific research on innovative solutions for the aerospace industry. It is a result of agreement between National Center for Research and Development (NCBiR) and the group of associations of the aerospace companies which represents Polish Aerospace Technological Platform.

2.13 Portugal

Produtech
http://www.produtech.org/about-us
PRODUTECH – Production Technologies Cluster - is an initiative promoted by the Portuguese Industry of Manufacturing Technologies. This Cluster comprises companies that are capable of addressing competitiveness and sustainability challenges by delivering innovative, flexible, integrated and competitive solutions in response to the manufacturing industry's needs.

2.14 Czech Republic

Platforma pro internetovou ekonomiku
http://www.internetovaekonomika.cz/
Platform for Internet Economy is an informal association of companies aiming to achieve growth and strengthen the Internet economy in the country.

2.15 United Kingdom

Innovate UK – Digital economy strategy 2015-2018
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/404743/Digital_Economy_Strategy_2015-18_Web_Final2.pdf

Government Digital Strategy
https://www.gov.uk/government/publications/government-digital-strategy

The digital strategy of the British government 2015-2018 is geared to achievement of five goals: encouraging digital innovators; focus on the users' needs; equipping the digital innovator; growing infrastructure, platforms and ecosystems; and ensuring sustainability.

The two principal, indeed sole, 'social' challenges to be identified in this strategy are:

— on the one hand, the question of skills: 'The forces that create a dynamic and fast-moving innovation culture also create skills shortages, particularly as innovation gains pace';
— on the other hand, the 'Digital inclusion': 'This tension in infrastructure investment leads to unequal internet access between affluent, urban populations and areas where the investment case is weaker. This is

compounded by social divisions to create an excluded population of the digitally disadvantaged. This is a significant emerging social challenge.'

Questions about jobs (creation/destruction/restructuring), working conditions, quality of employment in the new digital services, and of the involvement of the trade unions in the 2015-2018 strategy, would seem to be some of the dark corners where the government initiative fears to tread.

It is to be noted that the United Kingdom Government is deeply committed to a digital strategy for digital access to all public and administrative services : HM Revenue and Customs (HMRC), Department for Transport (DFT), Department for Work and Pensions (DWP), Ministry of Justice (MOJ), Department for Business Innovation and Skills (BIS), etc. This strategy is an extension of the reform of the Civil Service already underway[50], the fundamental idea being to create a 'digital platform' of all administrative services.

The trade unions have not failed to react on this topic. At its 2014 Congress, the TUC expressed some doubts as to the real intentions of the government: to improve public services or cut down on resources? 'Congress recognises that effective and efficient public services are a shared goal of citizens, governments and public servants. Public services are now in an almost permanent cycle of reform, both to deliver efficiencies and meet the changing expectations of the public. Digitisation of public services has become the new mantra of politicians but should be seen as an opportunity to improve services for the public, not solely as a further rationale to reduce resources (TUC 2014a).

The trade union fear is also that digital access to public services is likely to marginalise even further the poorest sections of the population (on account of the costs of computers, subscriptions to internet, and so forth) as well as disabled persons: 'The removal of face-to-face services in favour of telephone helplines and online-only services can have a significant impact on disabled people, especially those with mental health impairments. Conference is also concerned at reports that public service cuts are leading to a reduction of the availability of documentation in accessible formats'.

Thus, 'in the transport industries, digitalization and automation are leading to ticket office closures and staffing cuts that are making public transport less accessible to disabled people. For public transport to be fully accessible, disabled and other passengers need the opportunity to get face-to-face assistance from staff' (TUC 2014b). This is why the TUC Disabled Workers' committee is instructed to campaign:

— for public services to provide the option of drop-in face to face services and to ensure all information continues to be available in accessible formats;
— to publicise legal challenges to online-only transactions;

50. https://www.gov.uk/government/organisations/civil-service-reform

— to ensure digitalisation policies do not discriminate against disabled people; and
— for government action and funding to reduce the digital divide'[51].

This rapid overview of EU member states shows that the stakes of the digitalisation of the economy are perceived very differently in different countries. In some member states the government authorities play a major role in encouraging debate, whereas in others they display more of a tendency to stand back; in some countries the trade unions are strongly involved in implementation of – or, at the very least, reflection on – digital strategies, whereas in others they remain marginal to the debate; in some countries the social implications are tackled head on, with a commitment on the part of governments to involve them in the implementation of strategies; in other countries the social and labour aspects of these issues are barely mentioned, and may even be totally absent from the government agenda.

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Some resources to be found on the internet

CFDT (2015) Nouvelles pratiques syndicales et usages des TIC (https://www.cfdt.fr/portail/nous-connaitre/nos-publications/nos-etudes/nouvelles-pratiques-syndicales-et-usages-des-tic-srv1_241977)

CGT (2015) Révolution numérique : vers un nouveau modèle économique et social ? (http://www.ugict.cgt.fr/articles/actus/rencontres-numerique)

CGT (2015) Réduction du temps de travail : Un remède aux suppressions d'emplois annoncées par la révolution numérique (http://cgt.fr/Un-remede-aux-suppressions-d.html)

FO (2015) 'Numérique, quels enjeux pour le monde du travail ?' (http://www.force-ouvriere.fr/numerique-quels-enjeux-pour-le-monde-du-travail); 'L'impact du numérique sur le travail' (http://www.force-ouvriere.fr/l-impact-du-numerique-sur-le-travail); 'La quatrième révolution industrielle a commencé' (http://www.force-ouvriere.fr/la-quatrieme-revolution-industrielle-a-commence)

IG Metall, FairCrowdWork Watch (http://www.faircrowdwork.org)

IG Metall (2015) 'Gute Arbeit in der Fabrik 4.0' – Eine offene Plattform für die Gestaltung der Arbeitswelt von morgen (http://www.automationsnetzwerk.de/de/robotation-academy/events-seminare/konferenzen-kongresse/150415-plattform-gute-arbeit-4.0)

51. https://www.tuc.org.uk/sites/default/files/DisabledWorkersReport2014.pdf

TUC (2014a) Congress 2014, Final agenda, Motions and nominations for The 146th Annual Trades Union Congress, 7–10 September 2014, Liverpool (https://www.tuc.org.uk/sites/default/files/Congress_2014_Final_Agenda_All_LR.pdf)

TUC (2014b) TUC Disabled Workers' Conference 2014 - Report of the Disabled Workers' Conference 28-29 May 2014 (https://www.tuc.org.uk/sites/default/files/DisabledWorkersReport2014.pdf)

Ver.di (2015) Digitalisierung im Dienstleistungssektor - Für Gute Digitale Arbeit (https://innovation-gute-arbeit.verdi.de/themen/digitale-arbeit)

Ver.di - Gewerkschaft auch für Cloudworker (http://www.ich-bin-mehr-wert.de/support/cloudworking) www.cloudworker-beratung.de

3. At European level

The ETUC has entered the debate initiated by the European Commission on a European digital agenda (European Commission 2015). In June 2015 its Executive Committee adopted a resolution in the form of a first evaluation of this agenda (ETUC 2015)[52]. Generally speaking, the ETUC judges the Commission's approach to be too narrow, in particular excessively confined to matters – that are indeed important but not exclusively so – of training and qualification of employees, and to questions linked to the internal market and technical standards. 'Digitalization is not just a technological issue or a question of the market, it is also about just transition of traditional jobs to digital jobs in the industrial and the service sector; it is a question of future society and its cohesion. Digitalization is a megatrend for the world of work, one we must be involved in shaping' (ETUC 2015).

In its resolution, the concerns expressed by the ETUC relate essentially to the following:

— the protection of personal data as a fundamental right;
— the social impact of digitalisation on companies in general and on labour in particular, on labour law, working conditions, the life/work balance, social rights;
— the risks of development of precarious digital work;
— the improvement of digital skills;
— anticipation and management of transitions;
— the persistence in Europe of a significant gender gap and of an ICT skills gap.

52. https://www.etuc.org/documents/digital-agenda-european-commission-preliminary-etuc-assessment#.VmVj2XarR9P

In concluding its preliminary evaluation, the ETUC calls for 'a permanent European Forum composed of the European Commission, the European Parliament, and social partners, to discuss how such a European digital vision can be developed and how to shape the future digital Europe, how to design industry 4.0, workplaces 4.0 and smart digital services, on the basis of a clear roadmap (ETUC 2015).

The ETUC has also launched a series of three workshops, on 2 December 2015 (digitalisation and its impact on information, consultation and participation), in February 2016 (on the sectoral stakes of digitalisation), and in April 2016 (on legal aspects and academic research).

At the European sectoral level too, initiatives are underway or have been already taken, in particular:

— industriAll has published an informal discussion document (policy brief 2015-07) on 'Digitalising manufacturing whilst ensuring equality, participation and cooperation'. An official position was then adopted on 3 December 2015 by its executive committee entitled 'Digitalisation for equality, participation and cooperation in industry – More and better industrial jobs in the digital age' (industriAll 2015)[53];

— UNI-Europa organised on 15 September 2015, jointly with the ÖGB, a working seminar on 'Digitalisation and its economic and social potentials', following which a common statement was adopted entitled 'Digitalisation, Work and Employment'[54];

— EPSU held a seminar on 21 September 2015 on the topic 'Digitalisation of local authority services in Europe', followed by the publication in October of the report 'Identifying new forms of service delivery in municipalities, technological developments and the impact on the workforce and employers – the challenge of digitalisation[55]. This initiative is part of the CEMR-EPSU Joint Project 2015-2017;

— EFFAT published a position paper by the European tourism sector, entitled 'The "Sharing Economy" in Tourism', on 18 November 2015[56], which tackles the question of the emergence of new players such as Couchsurfing, Airbnb, Uber, BlaBlaCar, Greeters, etc. In the framework of their sectoral social dialogue, the European social partners also adopted a 'Joint EFFAT-HOTREC Statement on the "Sharing Economy" – For a level playing field and fair competition in hospitality and tourism', signed on 4 December 2015;

53. http://www.industriall-europe.eu/database/uload/pdf/2015929PositionPaper_2015-XX_DigitalisationOfIndustry_DRAFT-v1.pdf

54. http://www.uniglobalunion.org/sites/default/files/public_shared/files/dsm_declaration_en_final.pdf

55. http://www.epsu.org/IMG/pdf/Final_Report_21092015.pdf

56. http://www.effat.org/sites/default/files/news/14164/effat_tourism_sector_position_on_sharing_economy_en_final.pdf

— the European Journalists' Federation initiated an overall reflection on the impact of the digital economy on the occupation of journalist and on working conditions in this sector.

3.1 The *acquis* of the European social dialogue

Numerous agreements have been adopted at national or company level in the wake of the European social dialogue framework agreement on teleworking (16 July 2002), which contains points that can serve as a basis for reflection on teleworking, mobile work, or distance-working.

It is true that teleworking is no more than one aspect of the stakes that we have analysed in this study; and there exist, what is more, major differences between the context at that time (2002) and the current situation. Back in 2002 it was a question above all of practices encountered in the context of the traditional company, with a view to 'modernising the organisation of work'. As defined by the agreement, teleworking was to be practised in the framework of a contract or employment relationship[57] and this is today frequently no longer the case, in particular in digital economy companies (management, organisation, etc.) where the work is carried out by self-employed workers, freelancers, or even workers operating outside any kind of legal framework, i.e. on the 'underground' labour market.

Nonetheless, there remain a whole series of stakes for the world of labour. The following are some of the important areas in which questions arise:

— financing of work equipment;
— installation and maintenance of this equipment;
— utilisation costs (internet subscriptions, telecommunications);
— technical support;
— costs linked to the loss or damage of equipment (insurance);
— responsibilities in relation to health and safety during time spent working: sickness, accident, handicap, etc.;
— labour inspection;
— working time organisation;
— workload and output assessment criteria;
— access of workers to information concerning the company;
— relations with colleagues;
— access to training possibilities (designed, for example, to learn how to use technical equipment or to develop skills to improve one's performance, etc.);
— respect of private life (to what extent are service providers 'policed' and controlled?).

57. It should be noted that the follow-up agreement to this report (2006) mentions precisely that the definition of the teleworker is a question that has been dealt with differently in each member state.

Would it be relevant, possible and effective to negotiate with companies that use mobile workers, in whatever sector of activity (transport, personal services, deliveries, etc.), a set of principles and minimum European standards to be observed? What form should such an instrument take: code of conduct, framework agreement, recommendations? Would this enable achievement of an embryonic form of new status (self-employed supplier of digital or mobile services)? Should it take place at European or at national level? To what kind of labour inspection or control should such an initiative be subject?

While such reflections would gain from being tackled at the European level – in order not to compound the digital stakes with digital social competition stakes among member states – there is a need nonetheless to take into consideration also that the levels of protection or labour standards agreed at European level might only be very low. It is significant, for example, that the German employers' federations are calling for all new labour framework agreements to be set at the European level, while they are currently appealing for avoidance of excessive regulation. The strategy would therefore seem clear: the European level is likely to be preferred on the basis of the assumption that it is incapable of reaching any ambitious compromise.

Table 3 **Main joint texts of the European social dialogue on new technologies**

Trade union	Title	Date
ETUC	Déclaration commune d'intention UNICE-CES-CEEP sur le dialogue social et les nouvelles technologies	12 November 1985
ETUC	Joint opinion on new technologies, work organization and adaptability of the labour market	10 January 1991
Telecommunications	Draft proposal for a joint opinion on the social and labour market dimension in the information society - People first - the next steps. COM (97) 390 Final	20 November 1997
Telecommunications	Recommendatory framework agreement	20 November 1997
Telecommunications	Opinion on telework	23 November 1998
UNI-Europa	Guidelines for telework in Europe	7 February 2001
UNI-Europa Commerce	European agreement on guidelines on telework in commerce	26 April 2001
ETUC	Framework agreement on telework	16 July 2002
EPSU, EMCEF (Electricity)	Joint declaration on telework	13 November 2002
EPSU	CEMR-EP/EPSU Joint statement on telework	13 January 2004
ETUC	Implementation of the European framework agreement on telework	28 June 2006

Source: Christophe Degryse, ETUI, Sectoral Social Dialogue DataBase, 2015

4. New research paths: placing the digital revolution in the service of trade unionism?

We have seen above that some social movement or trade union organisations have succeeded in using the new technologies in the interests of workers, in the defence of their rights, of their organisation and, perhaps in the future, of their collective bargaining power.

An additional strategic reflection could follow on from this. The trade union movement could perhaps discover in these new technologies an additional tool for exchange, cooperation, mobilisation, action, visibility, etc. Might it be relevant to consider a European trade union platform that would enable the exchange of information in real time – for example on labour claims and industrial action, on pay developments within multinationals, on negotiations underway, on collective action in preparation, etc. – with a view to better information of workers and increased synchronisation of their strategies?

What is more, we have seen in this study that some authors see in the new technologies a strong potential for social emancipation. Would the world of labour benefit from investing in these technologies in order to create new collective tools, for example for the evaluation of employers, for the coordination of negotiations, but also for the creation of data cooperatives and collective platforms generating common goods, for the creation of incubators or accelerators with a view to a cooperative, social and solidaristic economy?

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