Work Document 3

Digitalisation impact on Liberal Professionals Firms

Task 3 Digitalisation impact on Liberal Professions

Introduction

The logical relation between digitalisation and social partnership

The project assumption is rooted on the role of social dialogue in designing and delivering, through collective bargaining, social protection services to both professionals and employees of the liberal profession firms.
In an eve where social partnership is weak, stronger reasons justifying this assumption are sought in the digitalisation process and its impact on business and society.
As a result, three dimensions are described as follows:
a) the impact of digital economy on liberal profession sector
b) the future of work;
c) the future of professionals.
The review seems convincing to resort to social dialogue as the coherent response. Social Dialogue here is considered the means to achieve common results (common to both professionals and employees), not and end in itself.
Social dialogue, in turn, is the common tools towards sustainability measures in the liberal professions' sector, in terms of social protection schemes.
This is a new paradigm beyond the liberal profession sector since the outcome of social partnership replace services provided by the state in the Fordism model.
Professional sector counts more than 5 million professionals, 27 million employees and 1.300 billion euro as gross-added value. On a country-by-country basis, the high number of liberal professionals in Italy is particularly noticeable, with more than 1 million professionals, followed by Germany (970.000) and United Kingdom (717.000) [1].
The number of professionals with own employees fell from 1.48 million in 2008 to 1.45 million in 2012. The decline of the share of professionals with employees, fallen from 32.3% in 2008 to 28% in 2012, highlights the trend reported in the overall economy and the related redundancy issue.
Around two thirds of the employees in the liberal professions are employed in the sector of health and social services. The lowest proportion of employees as a share of overall employment was found in 2012 in Bulgaria (7%), while the highest share was recorded in Denmark (25%).
The role of professionals in the European society goes beyond its economic value.
Liberal professions provide jobs, contribute to economic growth and fulfil important social-welfare functions. They typically provide services that are of high importance for the performance of core state functions.
These tasks carried out for the common good and in the public interest include ensuring legal protection for citizens, ensuring the rule of law within the tax and social levy system and a functioning market economy, as well as providing health care for the population.
In all these areas, members of the liberal professions serve as particularly qualified service providers (e.g. as lawyers, auditors, accountants, engineers, medical practitioners).
The general public places a great deal of trust in their activities aimed at promoting the public interest, which is why the liberal professions can also be referred to as "trust" professions.
As stated in the opinion of the European Economic and Social Committee on "The role and future of the liberal professions in European civil society 2020", the system of liberal professions makes a significant contribution to the society providing high-quality social goods, safeguarding civil rights and increasing economic prosperity.

[1] European Economic Social Committe, The State of Liberal Professions, 2014

Liberal professions are recognised as a core component of any democratic society and offer significant potential for growth in terms of employment and GDP. The opinion also points out the role of professionals' organisations and associations in representing the interest of their professions and supporting the State regulation in the specific legal framework.
The problems lie in the vulnerability of this sector which leads to the redundancy in specific categories such as architects and lawyers, due to the economic downturn and technology advancements.
In particular, liberal professions are involved in a remarkable change due to the digitalisation of services and the impact of artificial intelligence on professional tasks previously carried out by employees of professional firms.
In parallel with this, the decrease of the demand of services experienced in the architectural, accountability and legal professions leads to the expansion of the "self-employed" and "nonstandard work" as highlighted in the study of the European Commission on "Access to social protection for people working on non-standard contracts and as self-employed in Europe".
Finally, professionals themselves are threatened by new forms of Internet-based service provision and automation as documented in the recent literature on the future of professionals where it is claimed that machines are becoming increasingly capable and are taking on more tasks that were once the exclusive competence of professionals.
The aforementioned business environment of professionals urges to face the vulnerability of those professional categories, such as architects and lawyers and related staff, where the risk is higher.
In this respect, social dialogue and collective bargaining support employees at risk but at the same time encourage professionals to play their societal role with responsibility and knowledge-based approach.
Aforementioned causal relationship can be summarised below:
• the digitalisation of professionals' tasks entails less routine work to be covered by humans and therefore less employees in the professional firms at large;
• the lack of demand in specific services' sector leads to a pattern of self-employed categories without social protection;
• professionals themselves are displaced by the increasing power of artificial intelligence, with effects on related staff.
• social dialogue, collective bargaining and current welfare schemes introduced in European Member States represent the response to the digitalisation of professional tasks and the means to a new model of professional firm based on sustainability principle.
Aforementioned logical framework leads to the description of above mentioned realms, starting with megatrends which are transforming the future.

The impact of digital economy on the Liberal Professions Sector

'Digitization' and 'digitalization' are two conceptual terms that are closely associated and often used interchangeably in a broad range of literatures.
Scholars across disciplines use the term *digitization* to refer to the technical process of converting streams of analog information into digital bits of 1s and 0s with discrete and discontinuous values [2]. The first contemporary use of the term "*digitalization*' in conjunction with computerization appeared in a 1971 essay first published in the North American Review. In it, Robert Wachal (in Sanders, 1974: 575) discusses the social implications of the "digitalization of society" in the context of considering objections to, and potentials for, computer-assisted humanities research. From this beginning, writing about digitalization has grown into a massive literature—one concerned less with the specific process of converting analogue data streams into digital bits or the specific affordances of digital media than the ways that digital media structure, shape, and influence the contemporary world. In this sense, digitalization has come to refer to the structuring of many and diverse domains of social life around digital communication and media infrastructures. In this section, we focus on a few prominent works that address the implications of digitialization that scholars have traced across some of the many different domains of social life.
Discussions about digitalization often invoke 'information' as the organizing mode of many domains of social life. Although the scholarship on 'the information society' is incredibly vast and

[2] S. Brennen, D. Kreiss, Digitalization and Digitazation, Culture Digitally, September 2014: http://culturedigitally.org/2014/09/digitalization-and-digitization/

varied, much traces its roots to early work by Fritz Machlup and Daniel Bell that noted broad shifts in national economies and occupation patterns. Within this framework, many scholars have argued that that "computer technology is to the information age what mechanization was to the Industrial Revolution" [3]. Digitalisation, therefore, has impact on knowledge production, in political participation, collective action, and social structures definition.
This part of the evolution of the digital economy has the aim to highlight the impact of the digital world on reshaping working environment.

The future or work

At first sight more appealing to Trade Unions, this issue is attractive even for Professional Association involved in providing new services to professionals.
The issue is covered walking through ILO documentation on changes in the global employment trend due to digitalisation. If the main impact of digitalisation is on the so called "gig economy", greater enough to justified the term work without labour, explaining the increase of workers without social protection and employment contract. If it is not the case for Professional firms, the phenomenon poses great challenges for those professionals who have not contract coverred by collective bargaining and exposes to risk and vulnerability. The session of digitalisation of the labour market provided enough evidences of work organisation changes. Jobs are now susceptible to computerization in a way to redesign the labour market of the future.
Since the business model intrinsic to liberal professional firms represents a good practice to be extended to professionals tour court, not only statutory professionals, the entire social dialogue mechanism in the professionals sector offer a scheme to be mainstreamed.

The future of professionals

Finally, the core argument is discussed to raise the importance of the business model change within the liberal profession sector. Digitalisation reshapes the knowledge of professionals and ways through which it is generated. Examples of displacement effect of technology in the liberal profession sectors are provided to document the radical changes occurring and the need to organise a coherent response: social protection appears as the right answer obtained by social dialogue mechanism.

This Work Document stems form different sources and aims to provide a general picture supporting the Focus Group on Social Mechanism for the Sustainability of the Liberal Profession Sector.
Section 1 is derived from the European Commission publication on Employment and Social Development in Europe. This section includes a literature review on digitalisation megatrends, while Section 2 deals with the impact of digitalisation on labour market so that the employment pertaining the liberal professions occupations is understood.
Finally, Section 3 enter into depth highlighting the impact of digitalisation on liberal professions.

April 2018

[3] Quoted in the S. Brennen, cit.

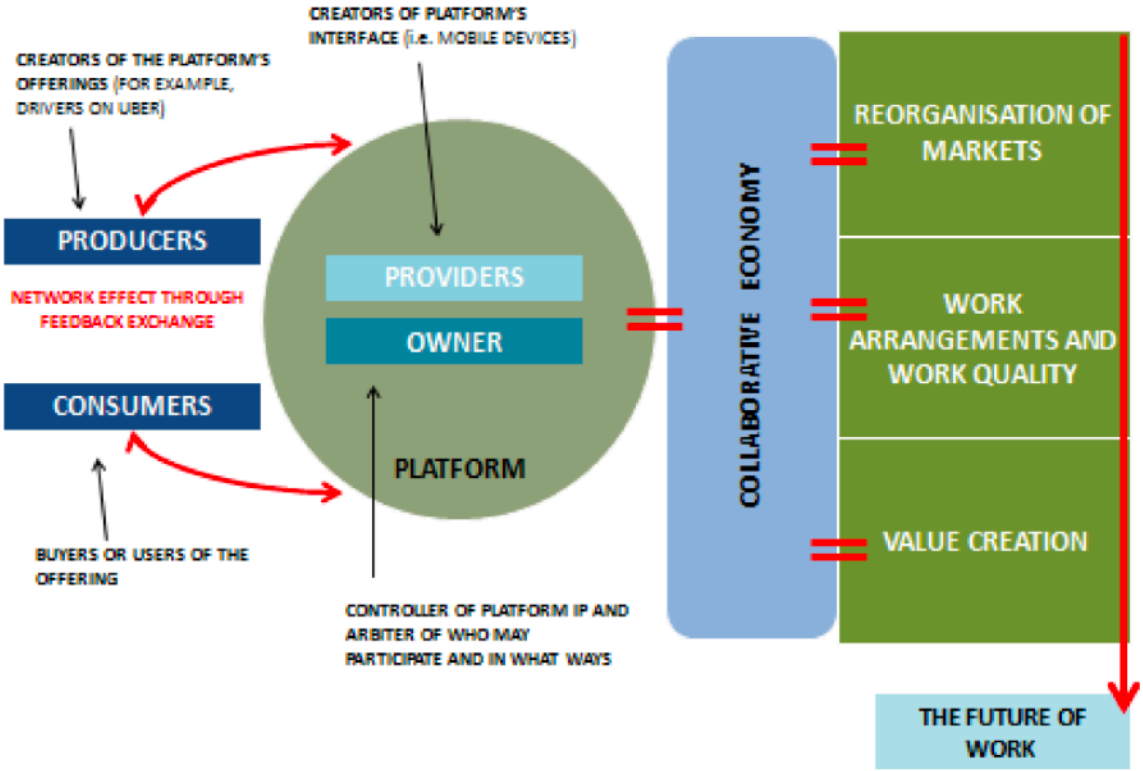
1.The impact of Digital economy on liberal professions sector

1.1 Determinants of digital growth

In the Employment and Social developments on Europe [4], general features of the relationship between digital economy and employment and business are highlighted.
To better understand better how digital technologies impact on employment and business, it is useful to look at key technological development that has changed the economic model of many companies and generated a new typology of jobs is the use of new types of algorithms. The 'algorithmic revolution' has allowed the development of digital platforms for the exchange of services and goods including labour. It has also transformed traditional companies by enabling them to manage their business using digital processes. This has cut costs and facilitated the entry of newcomers into the market.
More specifically, three factors combined can explain the recent transformation: 1) the falling prices of IT tools such as Cloud computing; 2) the fact that ICT can boost labour productivity and increase efficiency; and 3) the increased usability of ICT over the last decade.
Users of technology (individuals, SMEs, start-ups and bigger corporations) have benefited from a reduction in monetary and non-monetary barriers to the use of ICT. These processes have fostered business innovation, the production of new goods and therefore job creation, and have increased labour productivity. They have drastically changed the way in which people communicate and exchange information and knowledge.
According to the European Commission, the existence of digital platforms is an example of the potential of ICT and digitalisation. Digital platforms are a mixture of different technologies (related to the internet, computation and data usage) and their success lies in the ability to connect software, hardware, operations and networks. Digital platforms can also facilitate the growth of other digital platforms. Many of the current internet platform firms use Amazon Web Services. The ecosystem generated by digital platforms is a source of value in itself and regulates the terms by which the different actors can take part in it.
The use of computable algorithms and data clouding has initiated a profound reorganisation of sectors as diverse as service, manufacturing, consumption and leisure. These technologies have led to drastic cost reductions for businesses and lowered barriers to accessing services, thus creating the infrastructure needed for this new ecosystem to grow.

[4] European Commission, Employment and Social developments on Europe, 2016

This "collaborative system" is illustrated below.



Source: created by European Commission, DG Employment, Social Affairs and Inclusion

The label 'collaborative economy' covers various types of platforms that share a number of characteristics but can have widely different policy and regulatory implications (for market access, taxation, consumer protection and liability, protection of personal data, labour matters, etc.) Also, some have a user base of a few hundred or thousand individuals, others of millions of people. Even within a type of service, say, ride services, the way the service is provided and the implications can differ. Ride services (e.g. Uber) differ from ride sharing (e.g. BlaBlaCar) and car sharing (e.g. Turo, formerly known as RelayRides).
The collaborative economy involves three types of actors:
a) service providers who share assets, resources, time and skills (e.g. private individuals offering services on an occasional basis ('peers') or professional service providers);
b) users of these services;
c) collaborative economy platforms that connect providers with users and facilitate transactions between them, also ensuring the quality of these transactions e.g. through after-sale services (handling complaints), insurance services, etc.
While they are all labour-intensive, ride services usually involve financial remuneration and profit, while car and ride sharing may have a wider range of aims (e.g. company while driving), and is seen as a way of sharing costs rather than necessarily making a profit. In addition, ride services have raised the issue of market access (i.e. licensing) and have provoked strong protests from incumbents, while car and ride sharing have not.

1.2 Transformation of business models

There are three distinct but connected dimensions related to the potential transformative power of this economy model for both business and work: platforms are leading economic actors in the reorganisation of different markets and transform competition; platforms transform work arrangements and influence work quality; and their business models use strategies to secure value creation different to those of 'pipeline' businesses.
The comparison between Airbnb and Hilton provides a clear picture of the huge transformation induced by digitalisation:
Numbers of rooms managed: Airbnb = 1 million ; Hilton= 727.000
Market: Airbnb = 25 billion Euro; Hilton 9 Billion Euro
Real Estate Assest: Airbnb= zero Euro, Hilton= 741 million Euro
Founded: Airbnb= 2008;
As employment has only partially recovered from the prolonged EU economic crisis, a significant number of new jobs have already emerged around digital platforms. According to McKinsey Institute, global estimates forecast that the collaborative economy could be worth an additional 2.4 trillion EUR. Worldwide up to 540 million individuals could benefit from online platforms by 2025. Digital platforms and the collaborative economy in general might evolve and diversify further to take full advantage of this pool of talent. The presence of highly-qualified workers could lead to further innovation in services and products offered and a boom in small-scale entrepreneurs, in which individuals (rather than corporations) are the main economic actors.
Some trends can already be observed, as summarised below.

Job creation

Between 2003 and 2013 employment in ICT occupations grew between 16% and 30% for 25 European countries (OECD, 2014) and is expected to continue to do so.

Business innovation

In OECD countries, more than 95% of businesses have an online presence. ICT tools are increasingly used by companies to promote business processes and improve efficiency. They are changing business strategies and creating new opportunities for business.

Emergence of new services and industries

Both public and private services are benefiting from ICT development. New economic sectors are appearing, such as the app industry. Facebook apps alone created over 182,000 jobs in 2011. Some governments (e.g. in Moldova) have shifted their IT infrastructure into the Cloud and launched mobile e-services for citizens and businesses.

Contribution to GDP Growth

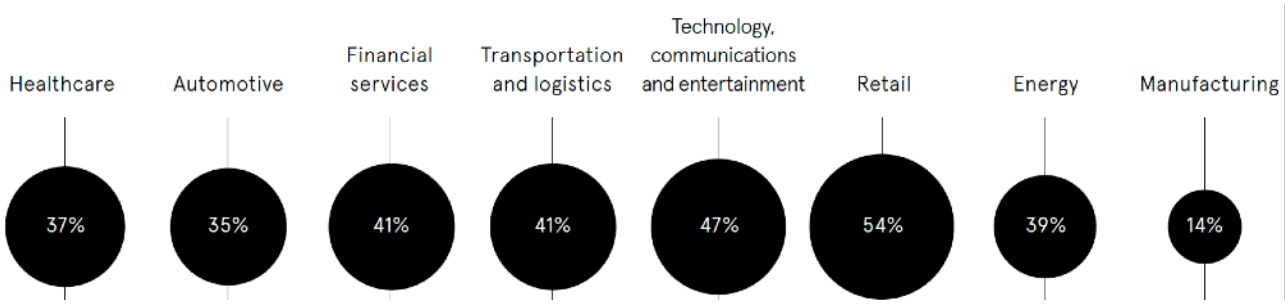
A 10% increase in broadband penetration has been found to increase economic growth from a low of 0.24% to a high of 1.50%. ICT investment was found to have contributed to one fifth of all economic growth in the EU during the period from 1995 to 2010. For the period 2005-2010, one third of all EU growth has been traced back to investment in ICT.

New ways of working

With the rise of the collaborative economy, more and more individuals can work using digital platforms.

1.3 Urbanisation and digitalisation

Within eight years, there will be ten times more data generated worldwide, according to Raconteur [5] .
The emerging huge shifts of rapid urbanisation, changing demographics, hyper-globalisation and accelerated innovation will shape the world. New megatrends are having a major impact on how people live and work. They are transforming the ways in which we do business, interact, understand services and carry out the essential processes of production. Four megatrends shaping societal evolution are rapid urbanisation, shifting demographics, hyper-globalisation and accelerated innovation.
Shane Wall said that Our digital being, who we are online and how we communicate, is becoming inextricably entwined with our physical reality. The key for us is asking how you create technology that helps life and doesn't detract from it. The growth of on-demand services is clearly here to stay and in the process is dramatically changing the nature of work for millions of people worldwide. Machine-learning, artificial intelligence (AI), the internet of things and big data are all expected to make major contributions towards enhancing the safety, speed and efficiency of supply chains worldwide.
Potential impact of artificial intelligence is shown below.



Technology goes hand in hand with data. Many FTSE 500 chief executives and business leaders around the world recount a new mantra: "data is the new oil". The fact is, oil is a finite fossil fuel, while data is infinite. In the next two years, 40 zettabytes of new information will be created. 90% of large organisations will have a chief data officer (CDO) by 2019, but only half will be considered a success, according Nick Easen [6]. Among the challenges expected is that the role will be brand new inmost companies and many new CDOs will be learning on the job. As the volume and complexity of datasets increases, CDOs will have to determine which information can add business value and drive efficiency for their businesses. This is true for professionals as well. What is changing, however, is the realisation that data and IT has a core role to play in every business and corporate culture is key to enhancing or repressing the digital imperative, especially in liberal professions services. Contrary to what one might think, digital transformation relies first and foremost on a culture shift, not technology," says Ross Mason, founder and vice president of product strategy at MuleSoft. "Every organisation should have a Chief Information Officer (CIO) at the executive table, with a strong technology advocate and facilitator at board level. Companies will then be better equipped to understand the impact of technology on their organisation". Moving to professionals world, in the professionals firm, each employee and professionals themselves need to be engaged in the digital journey. The next challenge as businesses transform digitally is to engage more with the data they're collecting and knowing its true worth. Cloud will continue to play its role, but edge computing is going to be a huge deal. It unleashes the IoT. Computing at the edge enables more sensors to be used and allows you to collect more data. Bandwidth and latency limitations are significantly reduced. And there's a multiplier effect to consider. Edge and IoT are not used in isolation. They are pieces in a bigger jigsaw. Industries are

[5] Raconteur, The digital Economy, February, 2018

[6] N. Easen, Executives look to data for the lead, Raconteur, February 2018.

embracing robotics, artificial intelligence (AI), biometrics, 3D printing, GPS, smartphones, and augmented and virtual reality. Each component feeds off the others. Edge computing can combine sensors with AI. Robotics can be improved with data analytics. The benefits but also the effects are multiplied. The volume of data created and the compute power required both increase massively. Colin Anson reports that the impact of industrial digital technologies on the UK economy over the next decade could be as high as £455 billion and add 175,000 jobs. Needless to say, liberal professions should face the digitalisation impact with adequate competence in understanding needs and providing the ad hoc individual response.

1.4 Metrology and Labour Market

What follows is a description of the emerging metrology and related jobs.
Metrology comes from the Greek word “metron" and “logos" which literally means the study of measurement. This study covers both the experimental and theoretical aspects of measurement and the determination of the levels of uncertainty of these aspects. The study of measurement is a basic requirement in any field of science and technology, most importantly in engineering and manufacturing. Since metrology is the study of measurement, it is expected to enforce, validate and verify predefined standards for traceability, accuracy, reliability, and precision. All of these are factors that would affect the validity of measurement. Although these standards vary widely, these are mandated by the government, the agencies, and some treaties. Consequently, these standards are verified and tested against a recognized quality system in calibration laboratories. In order to thoroughly grasp the concept of measurement, metrology is divided into three subfields. These three subfields in metrology are: scientific or fundamental metrology, applied or industrial metrology, and legal metrology. Each of these subfields is distinctly different from the other. Scientific Metrology is the organization and development of measurement standards and their maintenance. Industrial Metrology is the adequate functioning of measurement instruments used ins industry as well as production and testing processes. Legal Metrology is the measurements that influence economic transaction, health and safety.
Metrology is a set of technologies to acquire and manage data which constitutes both the process and vehicle of measurement. Data are essential component of smart manufacturing. Modern metrology has been developed to support trade and eliminate technical barriers between nations. Metrology helps nations trust in the measurements carried out in each country thus avoiding so-called double testing: those who make measurements to check the compliance of any item and those who buy should re-measure to make sure that item is compliant with specifications. International technical and scientific cooperation and the mutual acknowledgment of measuring capacity have allowed to go beyond “double-testing”, establishing a common platform for development. Europe is investing 80 billion euro annually in measurement (0,8%of EU GDP) with an impact on the economy at around 250 billion euro. The development of innovative sensors to monitor specific parameters and consequently to understand how to calibrate, how to bring reference samples into the field to ensure universal traceability, has increased the reliability of metrology and the use of big at a and their associated model-based processing. As the accurate inline measurements is the most pressing requirement of model-based processing moving beyond “sample inspections”, measurement will be increasingly oriented to “contactless” methods based on high-frequency optical and electromagnetic technology, in the THz or infrared range. Significant efforts are put into the ability to simultaneously acquire the intensity and spectrum of electromagnetic signals for process metrology purposes with the capacity to compensate interference between measurement point and remote sensors (by placing reference systems near the production line to check measurement capacity accurately and periodically. Another key factor is the availability of connected sensors levering next-generation Wi-Fi networks developed fro the Internet of Things and 4G or 5G mobile networks of connected sensors that provide a significant redundancy of measurements and data. A huge number of sensors enables distributed measurements, repeated over time and space, and more robust statistics with big data. The big benefit of industrial applications can be achieved using sensors based on low-power technology and secure communication networks. Miniaturisation and engineerisation of sensors improve the capacity to generate, process and interpret data thus cutting industrial function previously considered crucial as quality control and measurement.
Another benefit of big data is reductive maintenance which allows to minimize downtime and unplanned stoppage. Through bid data analytics smart systems monitor the conditions and health of equipment and notify when action is required.

1.5 Security Strategies

The issue of network security in high automation factories and beyond relying on smart devices is topical and the concept of Industry 4.0 itself can be deployed only when such systems effectively communicate with each other.
In metrology privacy means being able to generate data and secure them through an encryption system that minimizes possible interaction and undesired interference by unauthorized actors with no access credentials. In the industrial domain, this is important not only for the security of data flows between different departments or division of a company across non-physical links, but also for communication between different manufacturing organisations. Information flows (incoming and outgoing data) of a global corporation must be adequately protected and safe from interference.
Quantum physics (for which Heisenberg's un certainty principle is applied), describing the behavior of the matter, radiation and mutual interactions, you can build secure systems for data encryption, so that they are not immediately intelligible. The benefit comes from the dual wave-like and particle-like nature of the matter and radiation described in quantum mechanics. If two fundamental quantum states are encrypted and an act of reading data in either state is performed, by virtue of the wave-particle dualism, this action changes the other state as well. As a result, such system allows to detect external interference in data, therefore protecting the information flow exchange.

1.6 The age of quantum computers

Data protection techniques are based on encryption through algorithms with longer keys which simply increase the number of possible combinations to prevent decryption. Constantly rising, computing power forces to use longer keys to prevent data decryption risks. Quantum computers, being currently developed in the labs of advanced countries, are the biggest threat to current encryption systems, as they can effiucintkgly decrypt keys of any length. As the name suggests, these counters are based on quantum bits (Qubits) that can store more information than the two states of conventional bits, as they encrypt the quantum state of a particle, achieving much higher computing speeds than traditional electronic equipment. While the quantum universe threatens data security, as a result of quantum computer developments, it can also offer a solution:
quantum cryptography where security is based on the laws of nature, is immune to security risks generated by quantum computers.

1.7 Imaging techniques

Any camera is basically a measurement instrument since each pixel (picture element) provide information about luminance and colors. Transforming a camera into an instrument that provides data from a metrological point of view requires the availability of traceable samples. The hyper-spectral imaging combines three colors parameters with information about light spectrum composition. On a microscale, the same technology is used for microscopy. In biology fluorescent substances are used as markers to study specific functional activity of a cell. In thermographic cameras, instead, each pixel corresponds to a temperature value. By analyzing the infrared radiation spectrum is possible to measure the temperature. In turn, optical surface metrology is extensively used today to check peculiar surface features such as finishing, texture and structuree by means of optical interferometric profilometers. Below this limit, the nano metrology domain uses atomic force and electronic microscopes together. Following recent developments, contactless measurement technology is becoming more and more important. In recent years, coordinate measurement machines (CMM) have evolved toward contactless optical probes besides conventional probes.

1.8 Reshaping working environments

Metrology and automation in general will change the workplace structure. Measurement task and in general monotonous routine tasks are increasingly replaced by automated process and robots. Collaborative robot systems offer an entirely new form of cooperation between human and machine. Intelligent assistants ensure a high level of reliability and productivity crating more freedom for areas of work in which their creativity is required. Even Industry 4.0 will not succeed without human labour when it comes to overseeing the automated process, but the “how” is set to change. The control elements fro managing the machines will thus become much more important. With their user-friendly interfaces, they ensures that processes run efficiently and can be controlled safely. Software experts will be able to use technologies with the utmost precision while technicians can exploit measurements. If these learning technologies are integrated into areas of work, then they help employees with the application and can boost motivation and the willingness to assume responsibility. Automation solutions can take over dangerous, monotonous or strenuous tasks, operate in areas not fit for humans, increase productivity and secure wage-intensive locations. On the path towards Industry 4.0 experts in measuring and imaging technology can offer solid support. There are various software solutions to enable both communication between alla measuring systems and interfaces to alla common software applications. Measuring data is recorded quickly, through. tH multi-sensory mode, and optionally prepared for further use. This cuts complex programming tasks and costs for systems integration allowing additional competences to be employed in the technology development field. There is a newly launched business areas 3D measuring which represents an increasing demand for work and competences in cost-effective measuring and automation solutions. The systematic further development of application solutions in metrology, as well as interdisciplinary cooperation in a network of research institutions and business will bring about new jobs in automation and big data processing. Various measuring tasks are being successively integrated into production line. Sensors installation, serving for continual quality testing along the manufacturing line is a further sector asking high-profile competences. Since intelligent measuring technology ensure seamless operation along the fully-automated process chain, new job opportunities are growing in metrology.
Additional new jobs are required to improve maintenance effectiveness. The Internet of Things combined with Big Data analytics allow to aim at the digitalization of all industrial process stages, simulating the related phenomena and activities with increasing accuracy. As a results new technological jibs are required along with a new training supply.
Still, the multi data rate technology in the 2.4 Giga Hertz frequency range makes it possible to transmit high data rates and large data sets in the shortest possible time. The spread spectrum transmission and a multiple transfer of the records ensure transmission reliability and a fast and trouble-free measurement process. Data transferability therefore is an additional areas where jobs are demanded.
Metrotomography is a contactless inspection technique for low-density materials, acquiring a full set of information, from geometry to porosity, up to possibile interference or other issues inside an assembled part. It is becoming an established method in stamping because it can cut mold and die setup time by up to 80% and increase the efficiency of production process. This innovative aspect of metrology will promote new competences, jobs and new start-ups in metrology.

2.The future of work without Labour

2.1. Global unemployment

In 2019 the ILO will celebrate its 100th anniversary and in 2015, during the International Labour Conference, the future of work centenary initiative was launched by Director General Guy Ryder. The rationale underpinning the future of work initiative stems from the fact that it is difficult for the ILO (or any comparable international organization) to address all the implications of transformational change in its regular day-to-day activities. The overview of key trends with a view to informing and facilitating dialogue is offered through Issue Note series on Technological change, Labour Supply, Employment relationships and Social contract. In 1919, the founders of the ILO stated that they were "moved by sentiments of justice and humanity as well as by the desire to secure the permanent peace of the world". In 1944, the Declaration of Philadelphia stated that "the war against want requires to be carried on with unrelenting vigour". The initiative that will culminate in 2019 should give expression to those same sentiments and point the way to how that war can be carried on, with the same vigour, but also performing the tasks and applying the methods required by radically changed circumstances in the world of work (G.Ryder, The future of Work centenary initiative, ILO, 2015). The ILO has the capacity to consign poverty to history, to provide decent work and living standards universally, and to extend protection from the risks of working life to all. However, that potential is yet to be realized. The problems of unemployment, underemployment, inequality and injustice are becoming more, not less, acute.
Countries around the globe are facing the twin challenges of repairing the damage caused by the crisis and creating quality employment opportunities for new labour market entrants. Unemployment, Vulnerable employment, Working poverty and Inequalities are increasing.
Global unemployment levels and rates are expected to remain high in the short term, as the global labour force continues to grow. In particular, the global unemployment rate is expected to rise modestly in 2017, to 5.8 per cent (from 5.7 per cent in 2016) – representing 3.4 million more unemployed people globally (bringing total unemployment to just over 201 million in 2017). And while the global unemployment rate is expected to hold relatively steady in 2018, the pace of labour force growth (i.e. those in search of employment) will outstrip job creation, resulting in an additional 2.7 million unemployed people globally.

Unemployment, vulnerable employment and working poverty, ILO World Employment Social Outlook, 2017

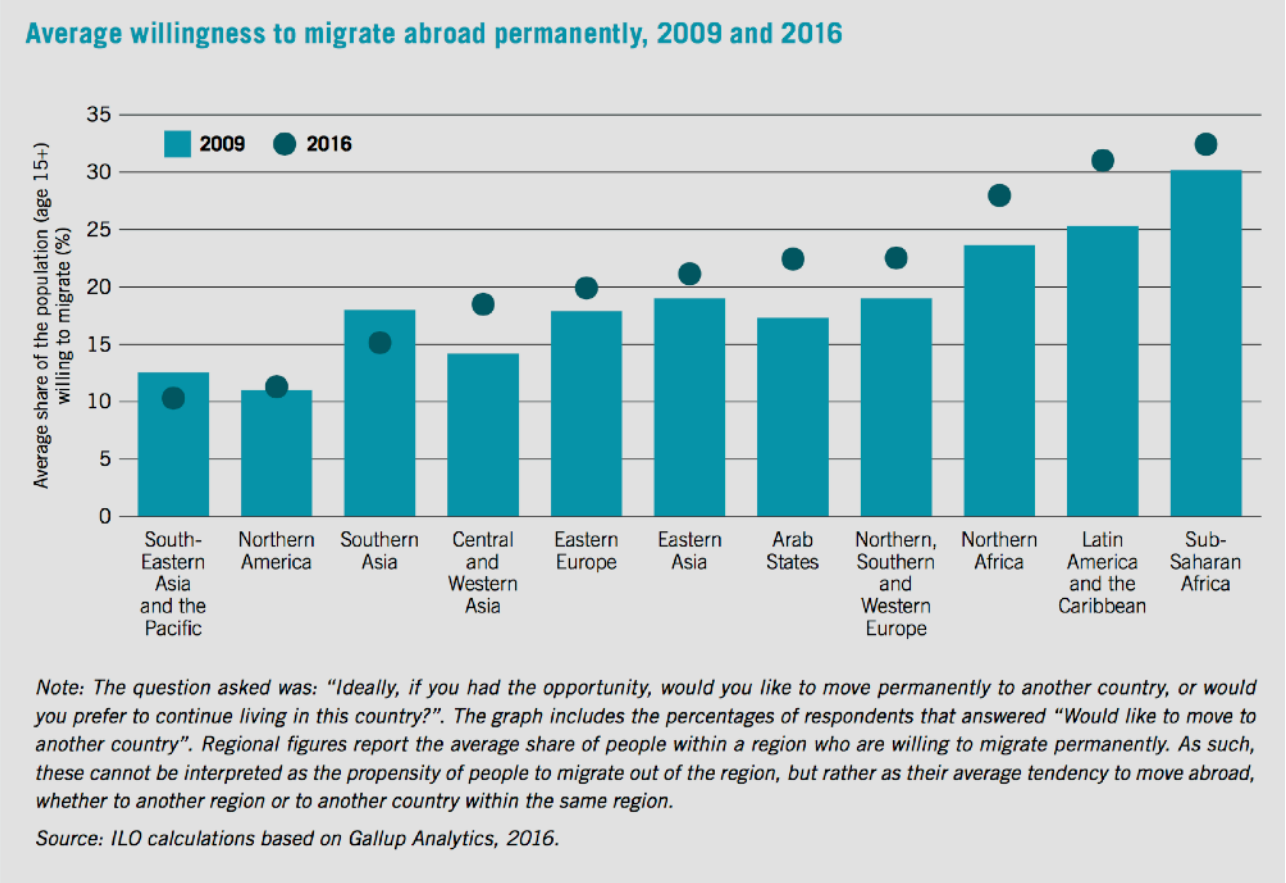
Unemployment, vulnerable employment and working poverty trends and projections, 2007–18

Country grouping	Unemployment rate, 2007–18 (percentages)				Unemployment, 2016–18 (millions)		
	2007–2015	2016	2017	2018	2016	2017	2018
WORLD		**5.7**	**5.8**	**5.8**	**197.7**	**201.1**	**203.8**
Developed countries		6.3	6.2	6.2	38.6	37.9	38.0
Emerging countries		5.6	5.7	5.7	143.4	147.0	149.2
Developing countries		5.6	5.5	5.5	15.7	16.1	16.6
	Vulnerable employment rate, 2007–18 (percentages)				**Vulnerable employment, 2016–18 (millions)**		
	2007–2015	2016	2017	2018	2016	2017	2018
WORLD		**42.9**	**42.8**	**42.7**	**1 396.3**	**1 407.9**	**1 419.2**
Developed countries		10.1	10.1	10.0	58.1	58.2	58.1
Emerging countries		46.8	46.5	46.2	1 128.4	1 133.6	1 138.8
Developing countries		78.9	78.7	78.5	209.9	216.1	222.3
	Extreme and moderate working poverty rate, 2007–18 (percentages)				**Extreme and moderate working poverty, 2016–18 (millions)**		
	2007–2015	2016	2017	2018	2016	2017	2018
Total emerging and developing countries		**29.4**	**28.7**	**28.1**	**783.0**	**776.2**	**769.4**
Emerging countries		25.0	24.3	23.7	599.3	589.9	580.3
Developing countries		69.0	67.9	66.7	183.6	186.3	189.0

In turn,

vulnerable forms of employment are expected to remain above 42 per cent of total employment in 2017, accounting for 1.4 billion people worldwide.
Progress in reducing working poverty rates is slowing and the number of workers earning less than US$3.10 per day over the next two years is expected to increase by around 3 million per year in developing countries.
As the recent ILO Global Wage Report 2016/17 highlighted, the gap between men and women, in hourly wages, which reaches as high as 40 per cent, continues to persist despite improvements in equal pay legislation in a number of countries.
At the same time, in light of exacerbating global uncertainty, the risk of social unrest or discontent has heightened across almost all regions. The ILO's social unrest index, which seeks to proxy the expressed discontent with the socio-economic situation in countries, indicates that average global social unrest increased between 2015 and 2016. In fact, between 2015 and 2016, eight out of 11 regions experienced increases in the measure of social discontent, most notably in the Arab States. Discontent with the social situation and lack of decent job opportunities are both factors (among others) that play a role in a person's decision to migrate.

Willingness to migrate, ILO World Employment Social Outlook, 2017



Due to the so called secular stagnation, global unemployment will rise by an additional 1 million by 2018. Within aforementioned unresting declining in decent work a new class of workers is emerging who lacks the seven forms of labour-related security namely, labour market security (income-earning security), employment security, (protection against arbitral dismissal), job security (ability to obtain employment contract), work security (social protection), skills reproduction security (opportunity to gain skills at work), income security (assurance), representation security (collective voice). Guy Standing calls these forms of insecurity "precariat (G.Standing, Precariat, Bloomsburry, 2011), who stay beneath other working classes such as Manual employee, Salariat, Proficians (professional-technicians) and Rentiers. According to Standing, we are in the middle of the global transformation, the painful construction of a global market system: market liberalization,

commodification of work, privatization of industry, labour market liberalization. The global system is the most unfree market system ever created, done in the name of free market. More and more income are going to rentiers, people who are getting returns from property, from asset financial or physical or natural. There is a new regulatory architecture that has been constructed in the last 30 years, at the top of which is the intellectual property rights regime. Under WIPO, millions of patents, copyrights, brand names have been established guaranteeing monopoly incomes to the possessors. Every single patent guarantees the owner of a patent 20 years of monopoly income. which amount 20% of GDP, globally. This is n0t a free market. In addition, State have been shifting public resource to give subsidies to the rentiers to attract them to the country or to keep them in the country. The growth of subsidies has been draining public expenditures , obliging government to cut benefits and services to population leading to the collapse of the income distribution system. The share of income going to capital and rent is being going up while the share to labour has being shooting down as a global phenomenon. The functions income distribution is going profoundly worse. Unemployment and wages. Profit and wages. Real wages declines.
The same for the relationship between productivity and wages.
Debt is become the hallmark of our age. A systematic aspect of exploitation: a source of rental income being sucked out od workers. The is a system, through financial institutions which has created a mechanism to increase debt. The outcome of this system is the global class fragmentation: plutocracy, elite serving the plutocracy, salariat, proletariat, precariat.
Precariat are habituate to accept unstable labour, they have to do work that it is not recognized and remunerated. Official statistics ignore that type of work. In addition precariat has no occupational identity (I am something and in retirement I can tel my grandchildren I was something. They live in a unsustainable debt. One mistake, one illness, on accident you plunge. Increasing poverty trap.
Precariat is the first mass group in the history which is systematically loosing every type of rights, civil, cultural rights, economic rights, social rights, political rights. If you are in the precariat you are a supplicant, ask for favor. We live in a state of revolt where we want the revolt but we are not sure how to revolt.
Yanis Varoufakis follows the same line of thought highlighting the end of the social democratic model which was based on two assumptions: i) the Income distribution among working class (income security, pension, health) and ii) the Distribuition between capital and labour.
The process of financialization dismantles the social model while financial capital depletes industrial capital and labour capital.
The rise of machine adds its effect towards massive dismantling effect, impacting on employment. (Y. Varoufakis at You Tube: https://youtu.be/BvgdtF3y0Ss)
Varoufakis points out the narrative of the dominant paradigm where private production of wealth is appropriated by the state for social purposes. In reality, our wealth production is collective and it is privately appropriated. The Iphone technologies represent the evidence of private appropriation of collective wealth since technology were created by government grant.
In Varoufakis' opinion, basic income should be considered as a dividend of the private appropriation of the common goods. Illusory separation between market and state need to be dissolved, since there is no market without state, no capitalism without state and no state without private firm. Hence, basic income replaces the social safety net which entraps citizenship and impedes free will.

2.2. World without Work

The end of work seems a futuristic concept but it has become a real history for cities such as Youngstown (US), Middlesbrough (UK) or other cities in Europe, where steel industry or textile industries collapsed. Youngstown, in particular, lost 50.000 jobs and more that 1 billion in manufacturing wages in 1977 after the closure of its Campbell Works mill (see https://youtu.be/Ni4bwCfa-SU). The city has become a metaphor for the decline of labor, the disruption of social cohesion due to cultural and psychological breakdown, such as depression, spousal abuse and suicide. Mental health centre's population triplicate within a decade while 4 prisons in 1990s were built. Technologist and futurists take this example to warn that the economy is near a tipping point, not for pollution, greenhouse gas emissions, or climate change but for the lack of work. According to Derek Thompson (D. Thompson, A World without work, The Atlantic, July 2015), futurists They imagine self-driving cars snaking through the streets and Amazon drones dotting the sky, replacing millions of drivers, warehouse stockers, and retail workers. The capability of

machines continue to expand exponentially, while human competency remain the same. Thompson points out that the continuous increasing of computer capabilities associated with their price decline, will lead to the risk of the disappearance of work. Assume that saving work is more important than saving jobs, what might happen to industriousness, the America's unofficial religion? The risk as well as opportunities of technological progress over unemployment was highlighted by Keynes who forecasted that technological progress might allow the reduction od working week.
The Millennium employment outlook, however seems opposite to that economic regime of Sixtiees where technologies had the power put back to work those put out by the introduction of new machines, as John Kennedy said. The "end of work" argument was highlighted by a group of scientists who argue to President Lyndon Johnson that the computer revolution would create a separate nation of poor, the unskilled, the jobless who would be able either to find work or to afford life's necessities (D. Thompson, cit). Today, two group of scholars are growing: those who confirm the Luddite Fallacy (the Luddites were a group of English textile workers who violently destroyed machine because they feared that these new machines were taking their jobs and livelihoods) and those who bellies in the rights of Luddites. Even if the end-of work is not imminent, the Technological Job Displacement exerts a slow but continual downward pressure on the value and availability of work with effects on wages and on the share of prime-age workers (25-54 years old) with decent jobs.
Economists at the University of Chicago (see Brent Neiman, The Global Decline of the Labor Share, Quarterly Journal of Economics, 2014, No 129) have estimated that the decline of employment is the result of businesses' replacing workers with computer and software. The comparison between AT&T and Google documents Neiman's findings. In 1964 AT&T was worth 300 billion in today's dollars with 800.000 worker while Google is worth 400 billion but with only 55.000 workers. Yet, the share of prime-age workers in US has been trending down since 2000. This age group, especially men who are at peak of their abilities and less likely that women to be primary caregivers for children or relatives, should almost all be working. This is why the employment rate of this group is considered the key statistics for understanding the decline in the workforce. Since 2000, the number of manufacturing jobs in US has fallen by 30% (5 million). In turn, the real wages of "college jobs" have fallen by 8% since 2000 and the number of college jobs who are underemployed is higher than it was in 2007 (T. Cowen, The Great Stagnation, Dutton Adult 2011, see the website Marginal Revolution University).
The impressive dexterity of Computer and Information Technology complements the demise of the working men. In this regard, it is worth noting the time differential between Technology Innovation and its impact on labour. Observing the robotic revolution in 1960 or the personal computer revolution in 1980 a timeframe of 10 years is confirmed as well as that occurring after the introduction of iPhone in 2005 which had effects on hotel jobs ten years later by helping homeowners rent out their apartment through Airbnb.
While there no doubt that technology destroys jobs, some doubts arise in quantifying those created. Observing the exponential growth in computer power with modest growth in job complexity and cognitive tasks some economist emphasize the end of jobs. Industrial restructuring in Europe over the recent years prospect a society with less work and urges social science to study alternative employment opportunities, such as social innovation, circular economy, community jobs, leisure jobs (R. Skidelsky, How much is enough? Rowan Williams, 2013). It unquestionable that the majority of jobs do not possess those characteristics raised by positive psychology such as a sense of purpose current and identity, autonomy, meaning. This job dissatisfaction forced a group of academics and economists, the so called post-workists to theorize the end of labour.
Lynn Hunnicutt, in particular, (L. Hunnicutt, Redifining te paradigm, The New American Colleges, 2015)highlights the reemergence of school as cultural centres rather than job-preparation institutions, going back to the original Greek meaning of school: teach people to be free. Accordingly, post-work proponent to be free from work. Regrettably, this vision is not experienced by jobless people or unemployed workers since studies have shown that unemployed feel a sense o social isolation. When people want to work, they feel miserable if they cannot. Studies on unemployment show that the impact of unemployment goes beyond the loss of income extending on heath, mental distress and social isolation. When workers identify themselves with work, the lack of work impact on their identity leading to social marginalization.Transition from work to leisure should take into account the full social cost in terms of cost for health services and those costs linked to criminality and social degradation at large. In this respect, the entire social protection (unemployment benefits, social insurance, social assistance) system should be

reinvented not in terms of social nets, because a net is not always beneficial especially for fishes, but in terms of universal rights and citizenship.
The other side of Computer refers to its positive effect due to the opportunity offered toward creativity. Scholars at Harvard University (L.Katz, Race between Education and Technology, Harvard University Press, 2008) see the next wage of automation returning to a new form of artisanship or artistry. This is the case of digital design and the so call 3-D printing, such as Rhinoceros, where machine construct complex objects, time ago realized by artisans. There is a growing number of start ups, the so called "makerspaces" which exploit the opportunity offered by 3-D printing. Thompson reports the case of the Columbus Idea Foundry a converted shoe factory equipped with machines, such as 3-D printing to make gift and jewelry and a purposed built industrial space allowing lay person to be entrepreneur. This kind of industrial sites combine production, learning and social networks. The uploading of 500.000 hours of YouTube Video 500 million new Facebook photos every day provide data and information that have economic value and can be transformed in economic activities. It worth noting that activities carried out in centers like Columbus Idea Foundry allow the achievement of missing goals in the business as usual factory, such as independence, a sense of purpose and competency development. Columbus idea Foundry can be seen a good practice of post-wage arrangements in a world of work were fewer full-time jobs are replaced by machines. Contrary to the belief that as some jobs aree eliminated more will be create by innovation, the new Millennium is presenting a new world where technology continues to accelerate reducing the work demand. Artificial Intelligence makes most jobs obsolete and redundant. Office workers are replaced by office automation, while robots are going to replace blu collars jobs ands massime unemployment is expected. This scenario is well described by Martin Ford (M. Ford, The rise of Robots, One World Ed. 2015) recalling the historical conversation between Henri Ford II, Employer and Walter Reuther, Unionist. Ford, showing new machines suggested to buy robots to pay union costs, while Reuther replied: how are you going to get them to buy your cars? If technological progress will continue as predicted, the image of cites as office buildings based, will change since the decline of work make these buildings unnecessary. Soon or later, unemployment and social degradation due to technology progress will be a key issue for governments, contrasting what Adam Smith called the invisible hand to refer to the social order arising from the individuals' selfish actions. rather, what seems urgent would be the visible hand of the public intervention. The role of the State, in fact, will be stronger that in the past, in order to balance inequalities sprang off by automation and technological job displacement. The new dawn of social innovation is arrived and the public intervention should support this shift toward a life with less work by providing local community centers and public spaces where people meet, learn skills and build networks and by ensuring decent life through universale basic income.
A new model of society is needed based on part-time jobs in the new economy that allow independence, the strengthening of interpersonal relationship, reducing greenhouse gas emissions, part-time green jobs that combine environment protection with social care and support the good life, the Aristotelian ultimate goal of life. While a prospect of a future with no work seems hopeless, a future of less work could bring a glint of hope. If it the case, the redesign of work organisation should be part of the fourth revolution. After a society driven by machines (industrial revolution), the subsequent society managed by the economy of scale (second revolution), followed by society depending on Information technology (third revolution), the fourth industrial revolution inspired by Artificial Intelligence and Big Data, could reinvent work, take advantage of good work and good life.

2.3 Work and Labour

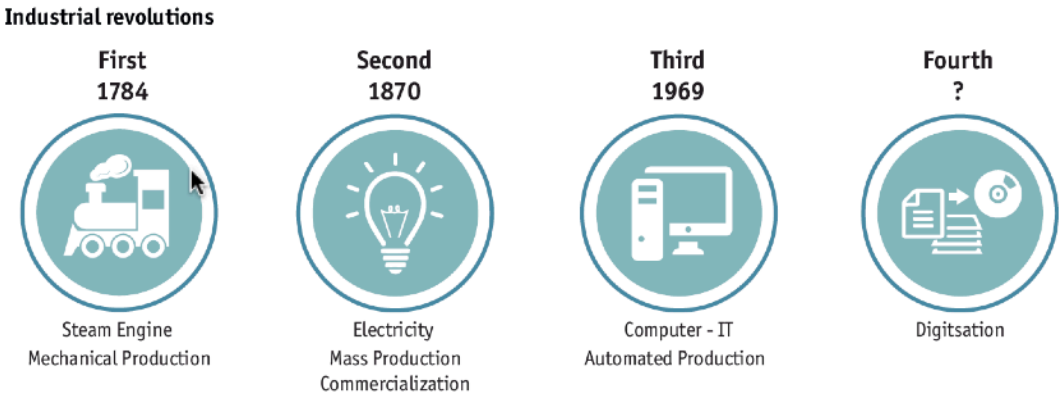
In the ILO, being an International Labour Organisation, there is a ongoing discussion on the difference between Labour and Work, a separation highlighted by the Marxist tradition where labour was associated with exploited work, an epistemological category opposed to work. In English language the word becomes either work or labour depending on the relative context.
According to Frayssé (O. Frayssé, Work and Labour as metonymy and Metaphor, Triple C, N0 12, 2014) the words work and labour belong to a galaxy of representations that comprises many words, and a complete vision of the galaxy is required to help us choose the right definition/ translation in each instance. In his words, the organization of this galaxy enables one to identify the sometimes hidden and unconscious dimensions of the work/labour concept.
In part 1 of The Capital (Commodities and Money) (K. Marx, The Capital, Penguin, 1993), the distinction of two separate words for different aspects of labour are pointed out, underlining that

work can be used for all productive activities, regardless of theory social context, whereas labour is associated with what makes these productive activities useful for capital (surplus value). In this sense, one cannot substitute work for labour when speaking of Labour Unions as well as one cannot say she is looking for labour, when in quest of employment. Frayssé compares the different use of the word “work” in Adam Smith’s Wealth of Nations highlighting the coexistence of different meanings: tasks to be done = division of labour; nature of the tasks= work; the amount produced=labour. As a result, labour and work are synonymous, since division of labour consists in parcelling work. Labour is defined “work to be done”, whereas commodities are “work done”. e distinction between work and labour becomes sharp when Smith’s focus is on labour
as the measure of (exchange) value.
The ILO’s founding documents (Versailles Treaty, 1919, art 427 and 1944 Philadelphia Declaration) reaffirming that labour is not a commodity, are rooted in aforementioned distinction and espress the view that people should not be treated like commodities , capital or nere factor of production or even resources. Instead, people who work for a living are human being and treated with dignity and respect. The comparison between Marx and Smith lead to a conceptual distinction between work producing goods as use values and involving a concrete experience or hardship, and labour generating exchange values which can be measured through the market bargaining. Here work and labour cannot be used interchangeably.
The Shakespeare’s comedy Love’s Labour Lost in which a king and three of his friend promise to study and not become involved with women, explains the omnipresence of work and labour in human life.
In Frayseé word, the ever-growing commodification of everything makes it necessary for workers to sell their labour power to obtain access to nature’s untransformed bounties, such as a fresh breeze of clean air or a drop of pure water, silence or an unspoilt landscape.
The appropriation by capitalists of the exchange value generated by activities not designed for the purpose of creating exchange values, as we can see in data mining, give these activities the character of unpaid labour, as prosumers and social network users realize that their activity is profitable to others and start demanding compensation for something they were doing for free, thereby accepting the commoditization of whole aspects of their private lives, which now look like work/labour to them. Aforementioned consideration goes beyond the lexical distinction between work and labor and extends the reasoning to the distinction between the haves and have-nots in our society.

2.4 Digitisation of the labour market

A report by the economist (The Economist, Shaping the future of work, 2016) highlights that the digitisation revolution has the potential to raise global income level and improve the quality of life for population around the world.

Industrial revolutions (from The Economist, Shaping the future of work, 2016)



In The Economist words, to date, the primary beneficiaries have been those that either have the skill set to invent and produce these technologies or those that have the financial means to afford access to the digital world. Ordering a cab, booking a flight, buying a product, making a payment, listening to music, watching a film, or playing a game—any of these can now be done remotely. In the future, technological innovation will also lead to a supply side miracle, with long-term gains in efficiency and productivity. Transportation and communication costs will drop, logistics and global supply chains will become more effective, and the cost of trade will diminish, all of which will open new markets and drive economic growth. Digitisation, mobility, big data, cloud computing, and analytics, and other drivers of transformation are expected to have a significant impact on jobs, ranging from significant job creation to jobdisplacement, and from heightened labour productivity to widening skills gaps.

The Report focuses on the gap between skills offered by eduction system and those demanded by employers. The issue is not only on the soft skills such as critical thinking, the ability to communicate effectively or collaboration or adaptation to changing priorities, but the preoccupation touches even the hard skills associated with the new jobs. It is confirmed that the demand for highly skilled workers has increased while the demand for workers with less education and lower skills has decreased and recognized that the current mismatch between business needs and education system supply stems from the restructuring process since 1970s in US and 1980 in Europe. Technological advances have revolutionised industries, changing the nature of the tasks and the kind of activities employees engage in. The most in-demand occupations did not existed 10 years ago and the velocity of change is expected to quicken. It is taken from granted that the education system should support industry rather than being a public service forming he awareness capability, the exercise of freedom or the achieved of human right. This kind of false narrative reaffirms the Achilles (education) and Tortoise (Technology), without considering the acceleration (aims of education system). Notwithstanding this false narrative it is acknowledge that at all career levels, employees are increasingly required to integrate knowledge from a number of areas and work in teams to find innovative solutions to problems.

Technology goes hand in hand with Talent and with out talent, which depends on computerization, economic development will stagnate. In turn, Technology depends on big data, that is the massive amount of digital data from any digita source, such as Facebook or You-tube. The sheer volume and variety of data and the velocity at which data is processed and exchanged has converted data into big data affecting new digital jobs on one hand and displace routine jobs on the other (The economist, cit). In-memory technology is used to extract value from big data, employing sophisticated algorithms to store data “in-memory” to allow for real time processing with practically no time lag. The new cultural environment is “hyperconnectivity” (multiple forms of digital communication we are engaged in) which has exponentially increased the volume, variety, and velocity of data, thus making data more valuable. The use of big data in Artificial Intelligence, robotics, quantum computing, will impact non only in the work organization but also in our way of lives. The use of big data has generated sophisticated algorithms to better manage robotics, understand and orient customers, replace routine jobs. Smart cities deploy the use of big data to improve many aspects of our daily lives such as optimizing traffic flows based on real time traffic information (The Economist, cit) while government can exploit big data to make better decisions by taking action based on patterns and need revealed by analyzing large volumes of data. If big data can support government decisions and help public institutions redesigning labour market ecosystem, there is also concern about the impact of technology applications on routine jobs.

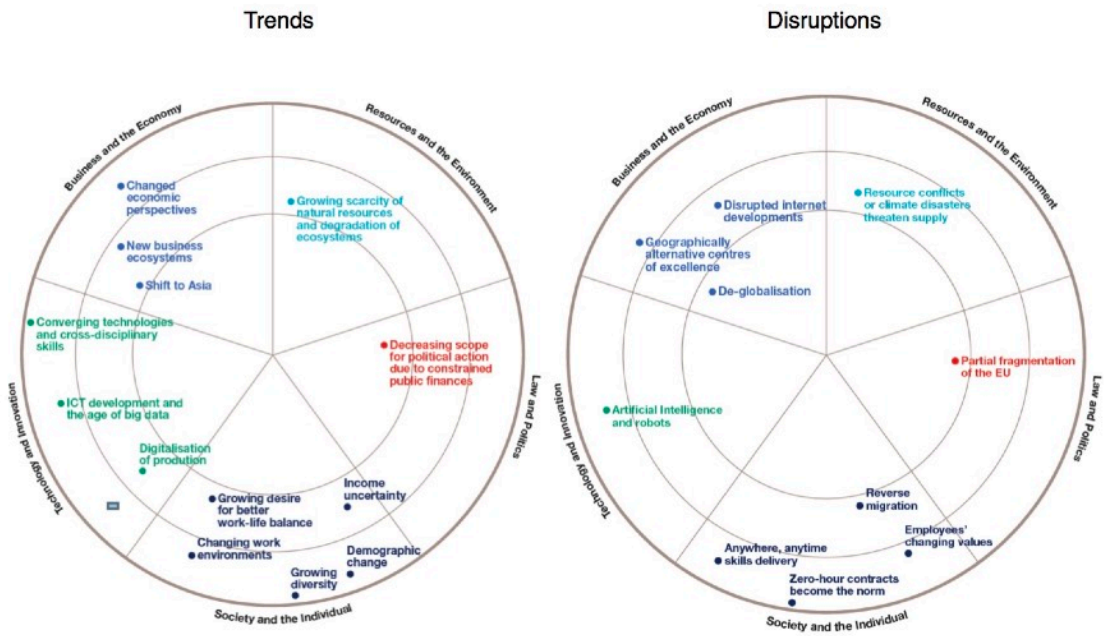
Big data (plural as the Royal Statistical Society recommends) are among technological drivers of change presented in the 2016 World Economic Forum Report (WEF, The Future of Jobs, Workforce Strategy for the Fourth Industrial Revolution, 2016). Mobile Internet, Big Data, Robotics, Artificial Intelligence, Advance manufacturing 3D, Biotechnology, are all shaping the fourth industrial revolution already impacting on society and employment. Concurrent to the technological revolution are a set of broader socio-economic, geopolitical, environmental and demographic drivers of change, each interacting in multiple directions and intensify one another as highlighted by Klaus Schwab and Richard Samans (WEF, cit). With their words, as entire industries adjust, most occupations are undergoing a fundamental transformation. While some jobs are threatened by redundancy and others grow rapidly, existing jobs are also going through a change in the skill sets required to do them. The debate on these transformations is often polarized between those who foresee limitless new opportunities and those that foresee massive dislocation of jobs. The proposal of the WEF to face the technological change and the talent shortages follows the “reskilling hypothesis” in that today’s workers should be adapted to the new

labour demand and the education system reformed. However, mass unemployment and growing inequalities need something more that an adaptation strategy. Businesses should take an active role in re-training programmes while government should take action to support individual lifelong learning and to create enabling environment towards an inclusive society. It is acknowledged that the drivers of transformation currently affecting global industries are expected to have a significant impact on jobs, ranging from significant job creation to job displacement, and from heightened labour productivity to widening skills gaps. Expected employment effect foreseen by the World Economic Forum, involve a considerable growth rate in Computer and Mathematical job areas, as as in Engineering, and a remarkable decline in Office and Administrative Jobs as well as Manufacturing and Sales. Major impact affects the core curriculum content of academics and higher education institutions. Nearly 50% of subject knowledge acquired during the a four-year technical degree is obsolete. The WEF Future of Jobs Survey shows the skills family areas of the fourth industrial revolution, pointing out the relevance of Cognitive rather than the Physical Abilities, the importance of Content skills rather process skills, as basic skills and the role of system skills, complex problem solving skills together with technical and social skills, as cross-functional skills. Finally, envisaged workforce strategies are reported in order to meet the Talent and Skills challenges brought about by expected business disruptions.

2.5. Labour Market of the future

Technologies reshape the workplace, transforming our homes and change work organization and societal interactions. Implications are expected for the business model at large with related concern about the capacity to rebalance the economy and deliver sustainable development as asked by 2030 United Nations Agenda. The expected disruptive impact on jobs of advances in robotics, artificial intelligence and 3-D printing is a focus for reliable forecasting. Regrettably, the study of future change is destined to be inaccurate even when a robust methodology combining the statistical analysis (forecasting) and the scenario studies based on subjective predictions (foresight) is applied. The Future of work: jobs and skills in 2030, (UK Commission for Employment and Skills, 2014) falls within the foresight methodology and offers a focus on labour market changes that can be considered a reference study on the issue. Thirteen trends were selected and their impact on labour market is studied by distinguishing changes resulting from trends and related disruptions and creative destruction the labour market, using Schumpeter's hypothesis. Tek key disruptions were selected according to their plausibility and probability.
Next figure show Trends and Disruptions

Trend driving the future of UK Jobs and Skills and Disruptions
(from UK Commission for Employment and Skills, 2014)



Four development paths were identified (combining the extrapolation of trends and disruptions) to describe coherent and plausibile stories merging technology and socio.economic variables. First scenario (business as usual) is characterized by greater business flexibility and incremental innovation with moderate growth. Second scenario (the great divide) shows a divided society due to the robust growth driven by high-tech industries which reinforces the economic division between the haves and have nots. Third scenario (skills activism) foresees technological innovation and automation of white-collar jobs with repeated large-scale job losses and extensive government-led skills programmes. Finally, the fourth scenario (innovation adaptation) is a stagnant economy where productivity is improved through ICT solutions. Needless to say, alternative scenarios are not mutually exclusive. For each scenario, the situation, the employers and employees behavior, the education providers and policy makers strategies are described. Labour market implications of aforementioned scenarios have been linked to seven economic sectors (Health, Professionals, Retails, Education, Manufacturing, Digital, Construction). Salient results are recalled below (see UK Commission for Employment and Skills, 2014.
Significant increase in the number of jobs in health and social care due to demographic factors (ageing population), social trends (working parents requiring childcare), and opportunities that will emerge with investment in medical research and innovation. It is anticipated that the increase in job opportunities will attract a range of individuals (from those entering the labour market for the first time to those transferring from other sectors). The adoption of technological innovations within the health and care sectors is expected to change the profile of many jobs. Migrant workers are expected to fill high- and low-skilled job gaps.
Developments in the professional and business services sector are likely to be linked closely to globalisation and internationally traded services, the adoption of technological innovation, and providing solutions to new or increased social demands (such as an ageing population). One of the major influences is likely to be the automation of professional jobs and the impact of ICT using smart algorithms.
Jobs and skills in the retail and logistics sector will be impacted by the increased use of ICT in work processes (both back office and customer facing), the continued impact of the Internet in multi-channel retailing, and social consumption patterns (including satisfying 'green' consumer choices). Overall, a growing population will probably drive growth in the demand for both low- and high-skilled jobs within the retail and logistics sector. Data and technology enable new service models for retailers, allowing for increasing sophistication in segmentation and customisation through customer profiling.
The development of market-based and employer focused education is expected to become an increasingly important driver for the sector. Social trends and enabling technologies create a need for increasingly personalised modes (in structure and content) for learners. This is particularly the case for Further Education and Higher Education, where higher fees focus the minds of learners on employability questions and return on investment. Online and blended learning techniques will become more widespread and sophisticated to match the expectations of fee-paying learners.
Whilst a full rebalancing of the economy (where manufacturing re-assumes a larger proportion of the economy) is less likely, a stabilisation in manufacturing employment levels is plausible. Within a globalised production environment, the demand for low-skilled labour in UK manufacturing will continue to decrease. One of the major uncertainties facing the sector is the degree to which additive manufacturing or 3D printing will revolutionise production and supply chains.
Changes in technology are expected to drive productivity and the development of new business models in the Creative and Digital Sector. The sector will have a significant impact on other sectors as digital and creative solutions are applied in different business processes and fields. Alongside expected improvements in productivity that come with the application of ICT tools, companies will seek to incorporate digital platforms as a core part of their innovation processes (for example, in open innovation platforms).
Whilst it is plausible that the sector will continue to experience the (cyclical) impacts of the economy as a whole to 2030, there are several key drivers that are likely to shape employment and skills demands. The growing population of the UK will sustain demand for construction jobs although the building of new housing relies on an enabling regulatory environment. Resource efficiency is another key driving factor for the sector, both in the creation of new housing stock and in improving existing stock. Whilst some of the sector will continue with established techniques and approaches, new technologies (for example, energy and materials) will change work needs for both construction, maintenance and repair.
Finally, the UK Commission for Employment and Skills Report highlights key messages helping actors to take action for future skills. Needless to say, as digitalization grows, it is expected a

significant impact on employment and skills in the decades ahead, at all levels and in alla sectors. Work in the future will be more interconnected and network-oriented. What follows is the extract from the Report. Workers and employers will require the competencies to work across different disciplines, to collaborate virtually, and to demonstrate cultural sensitivity. If location-based and time-based work becomes eroded, organisations will need to develop new HR and contractual mechanisms to manage performance, address issues of trust and transparency, and invest in keeping the skills of a largely virtual workforce up-to-date. Successful solutions may be found through combining established disciplines with novel developments, for instance with material sciences and nano-technologies. The spread of disciplines and jobs across sectors will also stimulate the hybridisation of skills which will provide some individuals with a strong position to compete within an increasingly demanding workplace

The shrinking middle will challenge the workforce. The high-skilled minority (characterised by their creativity, analytical and problem solving capabilities and communication skills) will have strong bargaining power in the labour market, whilst the low-skilled will bear the brunt of the drive for flexibility and cost reduction, resulting in growing inequality. Jobs which have traditionally occupied the middle of the skills hierarchy and earnings range, such as white collar administrative roles and skilled / semi-skilled blue collar roles, are declining at a significant rate due to changes in work organisation driven by technology and globalisation. There is evidence that new types of jobs are emerging to fill the middle ground but these have markedly different entry routes and skill requirements.

The future workplace will be multi-generational, with four generations working side-by-side. Traditional notions of hierarchy and seniority will become less important. The skills for leading and managing the four-generational workforce, and for facilitating collaboration across multiple generations and their values, will be in increasing demand.

The complex values of this multi-generational workforce will impact upon employers' ability to attract talent, at all skill levels. Attitudes to corporate social responsibility, or expectations of flexible working conditions, will alter the ways employers recruit. Cross-generational skills acquisition will be important.

Aforementioned study shows that the impact of digitalisation can be anticipated and that disruptions can be mitigated thorough an intelligent government-led retraining programmes.

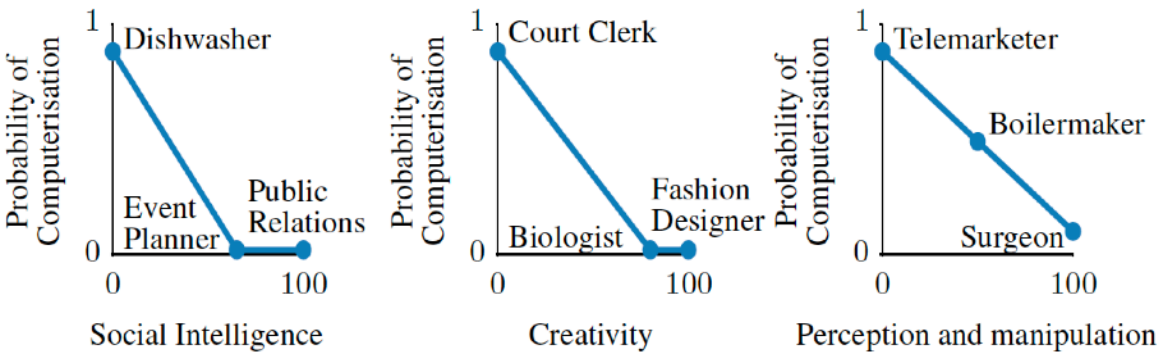
2.6 Jobs susceptibility to computerization

An inspiring assessment how susceptible jobs are to computerisation is provided by Carl Benedikt Frey and Michael Osborne (C. Benedikt Frey, M. Osborne, The future of employment, how susceptible are jobs to computerisation? Oxford University Engineering Sciences Department, 2013). Their hypothesis is based on recent advances in Machine Learning (ML) and Mobile Robotics (MR) as the new form of computerisaton defined as job automation by means of computer computer-controlled equipment. Then, they develop methodology which categorises occupations according to their susceptibility to computerisation. Finally, they estimate the probability of computerisation for 702 US occupations examining the expected impact of future computarisation. The research is rooted in the perennial issue of technological unemployment raised, among others, by Keynes, who explained the disparity between means of economizing the use of labour and the capacity to creare new uses for labour. Notwithstanding the disagreement about driving forces behind high unemployment rate, it is acknowledged the effect of computer-controlled equipment on the jobless growth.

Bendikt and Osborn point out that computerisation is no longer confined to routine manufacturing tasks bringing the example of autonomous driverless cars. This is the key issue of their hypothesis in that the computer substitution is not limited to manual and routine tasks, but is extended to non-routine tasks. Developments in Machine Learning such as Data Mining, Machine Vision, Computational Statistics, ands in Mobile Robotics, such as Artificial Intelligence, facilitate the shift of computerization towards complex and non-routine tasks. In short, ML and MR enhance technological capability to replace human tasks towards a jobless growth. Their review of the historical relationship between technological revolution and employment start off by describing the Queen Elisabeth's refusal against the patent of the William Lee's stocking frame knitting machine. In the view of Lee, workers would be relieved of hand-knitting. In the view of the Queen, workers would have lost their job. Contrary to the belief that technological progress brings benefits to a growing share of the labour force, the peculiarity of the nineteenth century manufacturing technologies is that they were deskilling (substituting fro skills). The pattern of capital-skill complementarity, emerged in the late nineteenth century as manufacturing production

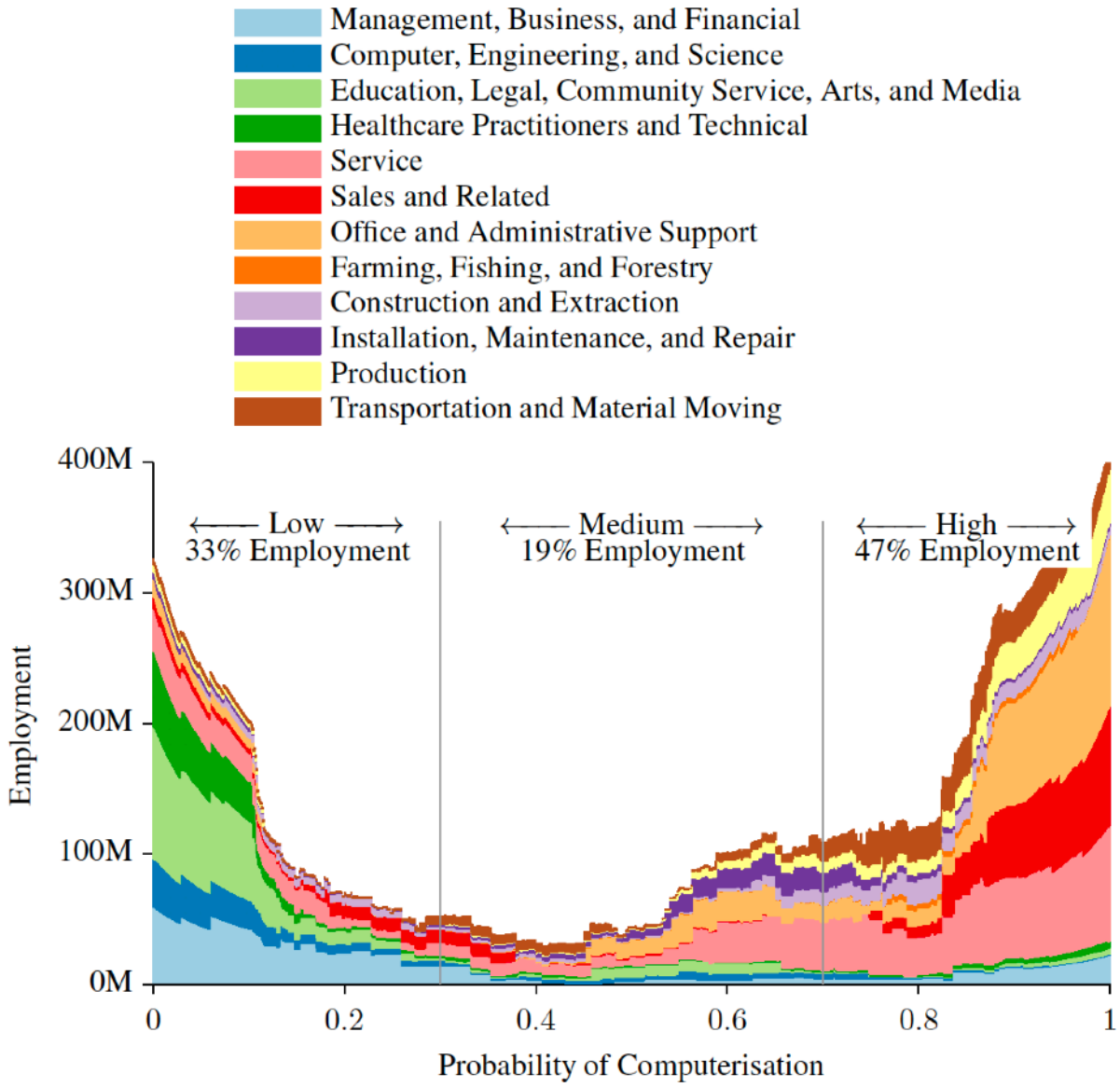
shifted to mechanised assembly lines, continues and progress in the new millennium thanks the computerisation (ML+MR). Using their words, The expansion in high-skill employment can be explained by the falling price of carrying out routine tasks by means of computers, which complements more abstract and creative services. The result has been an increasingly polarised labour market, with growing employment in high-income cognitive jobs and low-income manual occupations, accompanied by a hollowing-out of middle-income routine jobs. As in other fields, technological revolution is linked to the decline of the computer price which forced employers to substitute labour for computer capital. But there is more. The work computer is able to perform depends on te ability of a programmer to write rule or algorithms that direct the technology in each possible task. If a problem can be specified, than the computer overcame human effort. In their words, The extent of job computerisation will thus be determined by technological advances that allow engineering problems to be sufficiently specified, which sets the boundaries for the scope of computerisation. Advances in the fields of ML, MR and AI lead to the so called technological job displacement, since they turn non-routine tasks into well-defined problems. Handwriting recognition or machine translation algorithms obtained by analysing data from United nations documents, statutory translated in fine languages, exemplify the issue. Going back to big data it is easy to understand that a wide range of non-routine tasks are becoming computerisable. Machine learning algorithms are therefore better able to detect patterns in big data than humans (see session IIIA, C. Benedikt Frey, M Osborne, cit). In addition, the absence of biases brings another comparative advantage of algorithms. In contrast, humans must fulfill a range of task unrelated to their occupation, such as sleeping, which hamper occupational performance. The study reports examples of the dexterity of computer, such as the cancer treatment diagnostics at Memorial Sloan-Kettering Cancer Centre, carried out from 600.000 medical reports, using 1.5 million patients records.
The use of sensors on pipes and water infrastructure to reduce water loss by 50% in cities of Doha, Sao Paulo and Beijing in another example of the computer dexterity.
The impact of Machine Learning on non-cognitive tasks is complemented by the analysis of the impact of Mobile Robotics on non-routine manual tasks. Based on aforementioned assumptions, the susceptibility of jobs to computerisation is carried out considering three profiles: Perceptions and manipulation tasks, creative intelligence tasks and social intelligence tasks.
Table below show the probability of job computerisation on each profiles. While Dishwasher, Courtclerk and Telmarketer are completely replaced by computer, Biologist, and Surgeon have less probability to be substituted by computer.

Probability of Job computerisation (from C. Benedikt Frey, M. Osborne, cit)



Finally, the measurement of the employment impact of computerisation is provided using data source of US Department of Labour.
The table below shows the distribution of occupational employment over the probability of computerisation (low, medium and high probability).

Probability of computerisation on 12 economic sectors (from C. Benedikt Frey, M. Osborne, cit)



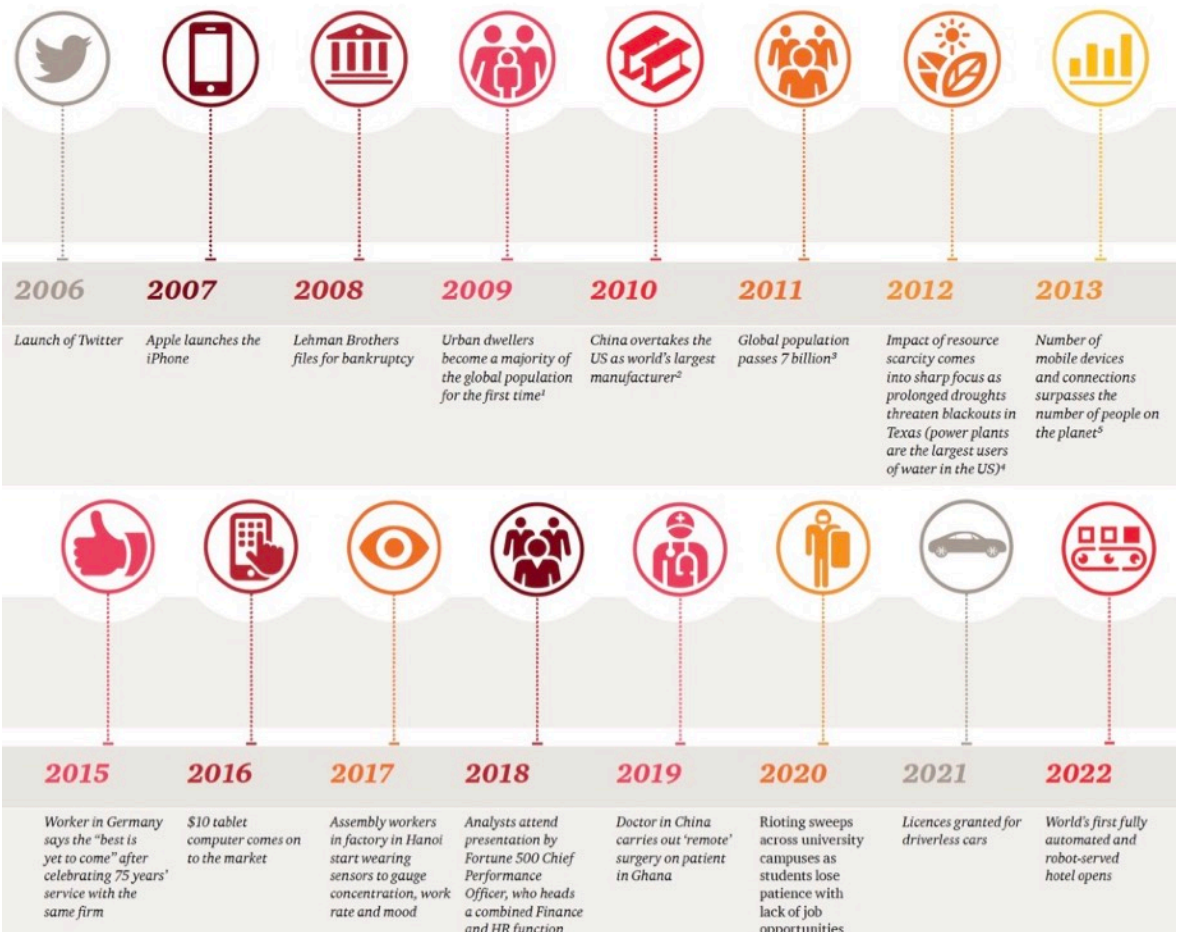
In their words " according to our estimate, 47 percent of total US employment is in the high risk category, meaning that associated occupations are potentially automatable over some unspecified number of years, perhaps a decade or two" (pag 38).
Sales, Service and Office and Administrative Support are occupations with higher probability of computerisation. Carl Benedikt Frey and Michael Osborne conclude their study highlighting that "for workers to win the race, however, they will have to acquire creative and social skills".
It is curious that they use the verb learn for machine and acquire for humans. Regrettably, the "skills acquisition" depends on multiple factors and variables which go beyond algorithms.

2.7 Different strategies about the future

The future of work report of the Human Capital Consulting (HCC, PWC, The future of work, a Journey to 2022, 2017) recalls the destructive innovation that are creating new business models and destroying old ones. ICT Technologies, Big Data and Robotics are having huge impact on how people interact and work. Traditional career model pertain to the past while many job titles of tomorrow will be ones we have not even though of yet. Escursion to 2022 from 2006 shows the technology progress which brought huge income to some and poverty to others.

Table below shows the escalation of Technology progress

A Journey to 2022 (from The future of work, PWC, 2017, cit)



From the launch of Twitter (2006) to Automated Robot serving at hotel (2022), technology pervades the work of work and the family life. The world of work in particular has been investigated according to the social interaction dimension (Individualism versus Collectivism) and the network organization (Fragmentation versus Integration). Three scenario analysis were obtained. The first one refers to the combination between Individualism and Integration. Here, the big company and globalization take centre stage, consumer preference dominate and the separation between have and have-nots is definitive. Profit, growth and market leadership are driving goals, Economy of scale will drive innovations, while job security is threaten. Second scenario is called Small is beautiful and combines Individualism with Fragmentation. Small business networks are opposed to global businesses and networks prosper. The driving goal is the maximization of flexibility with a multidimensional business portfolio. Work organisation is dominated by flexibility, autonomy and short term contract. Third scenario links Integration with collectivism and is defined the Green World where companies develop a social conscience and green sense of responsibly. Consumers demand ethics and environmental credentials as a priority. Society and Business see their agendas align. Common good is the driving goal while ethical values and work-life balance characterize the world of work. Individual wants are replaced by the common good which prevail over personal preference. Collective responsibility on social and environmental issues overcome consumer preferences. Aforementioned study highlights that the ultimate goal of society (Individual wants versus Common good and Big business rules versus Collaboration and Network) attract the use of technology and related research and development tasks.

3.The future of professionals

3.1 The need to consider Professional as a collective set

Although Professional draw on different bodies of knowledge, their jargon varies and their working practices can be quite diverse, Professionals have many features in common. First of all they are a solution to the same problem such as insufficient knowledge to cope with all of daily challenges. Professionals have knowledge, experience, skills, and know-how that those they help do not. Second, there is a practical reason for considering a collection of professions together in one category, since each profession has much to learn from one another and an advance in one field of knowledge can be used in many professions such as the quantum computing. They can draw analogies from the work of others and carry lessons learned into their own business.
More than this, professionals frequently see the potential and need for fundamental change in others more clearly than in themselves.
In merging different professions in a common category, such as that formed in the Italian Association the advantage is to encourage practitioners from many fields to think more widely and strategically, and to accept the possibility of change in their own disciplines.

3.2 Knowledge and professional tasks as threatening factors for Professionals

The future of professionals is linked to the change in production and distribution of knowledge. The knowledge of professionals is an applied knowledge in that they use knowledge to solve a societal problem. This professional knowledge is a combination of the formal knowledge learned at school, know how, experience and skills learnt during the professional experience and guided by professional bodies. Professional knowledge, contrary from goods, increases with its use, while good, when are consumed there is less left for others. In addition, professional knowledge is non-excludable, contrary to goods which can be prevented from consuming unless the price is paid. Most important, contrary to goods professional knowledge, as knowledge tout court, can be digitalized, that is it can be converted into binary signals and processed electronically.
Professionals operate in a business environment and similarly to all economic processes, they work can be disaggregated in multiple tasks. Professional work is non longer regarded as a monolithic, indivisible lump of activity but instead is broken down into constituent tasks and allocated to other people or systems who are best placed to discharge the work at as low a cost as possible, consistent with the nature and quality of the service requited. Nature of knowledge and the disaggregation characteristic of professional knowledge lead to the decline of the current professional firms model in that professionals are not the only source of expertise, while their tasks are taken on by machines that are becoming increasingly capable.

Prediction of the decline of Professional is due to the rise of technology and ICTs which transform the way that professional know-how is shared in society.
In the so called 'print-based industrial society', professionals have played a central role in the sharing of expertise, being the main channel through which individuals and organizations have gained access to certain kinds of knowledge and experience. On the contrary, in the 'internet-based society', the machines capability will take on many of the tasks carried out by professionals. The new millennium shows an 'incremental transformation' in the way expertise is produced and distributed in society, leading eventually to a dismantling of the traditional professions.
Richard Susskin in 1995 made the prediction that lawyers would, in the future, primarily correspond with clients by email. In 2017, for a lawyer to receive their client's queries by post is increasingly a rare event. According to Susskin, Professionals play such a central role in our lives that it is difficult to imagine different ways of tackling the problems that they sort out for us. But the professions are not immutable. While they are a profession to meet a particular set of needs in a print-based industrial society, in a Internet-based society their role is threatened. As a result, if they are not adapted to Internet-based society needs, they will be displaced by feasible alternatives.

3.3 Examples of displacement effect of technology in liberal profession sector

There are many examples highlighting the decline of professionals in the book of Richard and Daniel Susskin, "The future of the Professions" [7]. More people signed up for Harvard's online courses in a single year than have attended the actual university in its 377 years of existence. In the same spirit, there are a greater number of unique visits each month to the WebMD network, a collection of health websites, than to all the doctors working in the United States. In the legal world, three times as many disagreements each year amongst eBay traders are resolved using 'online dispute resolution' than there are lawsuits filed in the entire US court system. On its sixth birthday, the Huffington Post had more unique monthly visitors than the website of the New York Times, which is almost 164 years of age. The British tax authorities use a fraud-detection system that holds more data than the British Library (which has copies of every book ever published in the UK). In 2014 the US tax authorities received electronic tax returns from almost 48 million people who had used online tax preparation software rather than a tax professional to help them. At WikiHouse, an online community designed a house that could be 'printed' and assembled for less than £50,000, built successfully in London during September 2014. The architectural firm Gramazio & Kohler used a group of autonomous flying robots to assemble a structure out of 1500 bricks. The consulting firm Accenture has 750 hospital nurses on its staff, while Deloitte, founded as an audit practice 170 years ago, now has over 200,000 professionals and its own full-scale university set in a 700,000 square-foot campus in Texas. The best-known legal firm in the US is no longer a traditional law firm, rather the legal advice platform legalzoom.com.
These developments are connected. They are early indicators of a transformation that we have been studying together since 2010 showing remarkable changes in which expertise in society is shared.

3.4 The future of professionals: effects of digitalisation and artificial intelligence

In the study of Richard and Daniel Susskin two future are envisaged. The first one is an incremental transformation where professional adapt their competences using new technologies. The second future is long term, where technology actively displaces the work of traditional professions. Over time more of the tasks done by professionals are going to be done by increasingly capable systems or machines, or by the two.
In the words of Daniel Susskin, there are two major factors that are shaping this future. Firstly, the failure of "the grand bargain". This is how the professions traditionally provide services to the exclusion of others, instead of as gatekeepers of knowledge. Not only are their processes expensive and antiquated in our internet-based society, it's as if there is "an intentional obfuscation" of the work they do.

[7] R. Susskin, D. Susskin, The Future of the Professions, Oxford University Press, 2015

Secondly, Daniel quoting Patrick Winston, one of the fathers of artificial intelligence, highlights that there are lots of ways of being smart that aren't smart like us. This idea is central to the change of professionals.
A key distinction introduced by digitalization and related technology refers to Jobs and Tasks. Being jobs a set of tasks carried out by competencies, those tasks carried out by machines (robots, pc, smart phone, sensors, etc) displace human work.
Machines will increasingly carry out professional tasks. This is already starting to take place and is expanding beyond the initial area of document review.
When machines can carry out routine tasks, the professionals are left to concentrate on the non-routine, but Artificial Intelligence (AI) is paradigm shift, in that non-routine tasks are automatized. Machines are becoming more adept and start to encroach upon the non-routine and fewer and fewer professional tasks are left for humans. This increasing machines capabilities seems a trend leading to a world without work.
A further issue refers to the assumption of AI which states that machine have to learn to artificially think like human, more particularly professionals, in order to displace the professions.
This is acknowledged as "AI [fallacy". In fact. machines do not need to learn how to think like humans. Machines process information differently. They can process so much information that the result can be better than that reached when relying upon human judgment.
With the processing power of a computer, certainty of outcome may be increased to the extent that judgment is no longer required. Thus, judgment can be made redundant, just like those trained to use it to an expert level, the professions.
The future of professionals follows the centralization principle supported by computing power under which the knowledge currently curated by the professionals will be in the hands of small number of corporations controlling the entirety of the distribution of professional knowledge.

3.5 Professional role and the power of digitalisation

A common question raised in the professionals world is the following: What I do in my job is exercise judgement and as a machine can't think or reason, it can never exercise judgement, so these particular tasks are safe from automation.
In the digitalisation society, the right question is, 'To what problem is judgement the solution? Why do we call upon human experts in this particular case to exercise judgment?' The answer is uncertainty.
As a results, a better question is, 'Can a machine deal with uncertainty better than a human being? With Richard Susskin words, the answer to that is of course they can. What machines are incredibly good at doing is processing far larger volumes of data than human beings and running algorithms and routines through them.
The first evidence of this was back in 1997 when IBM's Deep Blue beat world chess champion Garry Kasparov. The computer was able to calculate up to 330 million moves per second whereas Kasparov — at best — could consider about 100 moves per go. The computer won through brute force processing power.
In America, Daniel Katz, a law professor has created a machine that successfully predicts the outcome of US Supreme court decisions. This system knows nothing about the law, it relies on data from past Supreme Court cases.
According to Susskin, this lesson isn't just true for judgement but across all faculties of human beings.
What machines are good at doing is processing far larger volumes of data than humans and running algorithms and routines through them.
For centuries doctors, accountants, lawyers, teachers and architects have solved problems too complex for most of us. But today, the future of these professions are seriously in question as artificial intelligence, non-thinking machines and automated systems are poised to do the jobs of human experts at a fraction of the cost.

3.6 Professional model of work

Observing the literature on the future of professionals the unsustainable factor is rooted in a model of work, namely the advisory work, that rests on increasingly antiquated techniques for creating and sharing knowledge.
Professionals are unable to advise themselves because they lack the expertise, skills, know-how and experience or crucially, they lack the intellectual sources to acquire this knowledge for themselves.
The professions are responsible for many of the most important functions and services in society – yet affordable access to their work is low. However in a technology-based Internet society there will be a wide range of new ways to create and share knowledge that are more affordable and accessible.
Leading professional firms often claim that they strive to bring the best of their knowledge and experience to all of their clients. In practice, this is rarely achieved, according to Susskin. This model of work is often not transparent.
Recipients of professional services, often by the nature of the arrangement, are able neither to evaluate the substance of the guidance they receive nor to judge whether a given profession is best placed to undertake the work.
As a result of the obsolete model of work, professions are unaffordable, under-exploiting technology, disempowering, ethically challengeable, underperforming and inscrutable.
A technology-based bias called 'technological myopia', accompanies the model of work.
This is the tendency to underestimate the potential of tomorrow's applications by evaluating them in terms of today's enabling technologies. This reflects the inability of a sceptic, because of the shortcomings of current technology, to concede that future systems may be radically more powerful than those of today.

3.7 The inevitability of change for professionals

The inevitability of change for professionals is due to computerisation of their work which began in earnest in the late 1970s with information retrieval systems. Then, in the 1980s, there were the first generation AI systems in the professions, when most focus was on expert systems technologies. In the next decade, the 1990s, there was a shift towards the field of knowledge management, when the professionals started to store and retrieve not just source materials but know-how and working practices. In the 2000s, Google came to dominate the research habits of many professionals, and grew to become the indispensable tool of practitioners searching for materials, if not for solutions. Today the computerization of professionals works is characterised by major progress with Big Data, where extremely large data sets can be analysed computationally to reveal patterns, trends, and associations, especially relating to human behaviour and interactions. Into the 2020s and beyond, professional will all be involved in the second wave of AI system.
A common mistakes are highlighted in studies on the future of professionals [8] This is a tendency to confuse the means with the ends. In a technology-based Internet society, where there are more effective ways to produce and distribute practical expertise that makes less use of personal interaction, the error is to let this veneration for tradition inhibit important change. There are a myriad other opportunities in life for human beings to enjoy face-to-face interaction with one another. There is no obvious reason why our apparent need for interpersonal contact should have to be satisfied by our accountants and doctors.

[8] A. Abbott, The System of Professions, Chicago University Press, 1988, R. Abel, The decline of Professionals, Modern Law Review, 49, 1986; R. The future of medicine, Oxford University Press, 2011; J Barrat, Our final invention, St Martin Press. N.Y. 2013; J. Bing, The Riddle of the Robots, Journal of International Commercial Law and technology, 3, 2008; G. Brock, Out of Print, Kogan Page, London, 2013, H. Campbell, Digital Religion, Routledge, London, 2013; M Carpo, The Digital Turn in Architecture, Wiley and Scott, 2013; A. Carr, The Professions, oxford Press, 1933; C. Christensen, The Innovative University, Harward Business School, 2011; D. Cuff, The Architecture form the outside In, Princeton Architectural Press, 2010; L. Floridi, the future of information, Oxford University Press, 2013; D. Foray, The Economics of knowledge, MIT Press, 2006; C. Golding, The race between Education and Technology Harvard University Press, 2009; J. Groopman, How Doctors think, Mariner Books, N.Y. 2008; Y. Harari, Sapiens, Harvil Secret, 2014.

3.8 Call to action

There is an appeal for today's professionals to be involved in shaping the circulation of practical knowledge and to "actively strive" for its affordable, empowering, ethical and transparent distribution.
Of course, one of the issues of most pressing concern to the professions is the timeline for the predicted changes. With a project such as the "artificially intelligent attorney" Ross, IBM reports to be "closer to commercial release than expected", there is a definite feeling that momentum is building.
Professionals should be prepared to face this change by organizing adequate retraining activities, so that digitalisation and AI are better learnt and by identifying new business model that join technology with creativity and empathy. As far as the future Professionals want, this can not be different from that shaped by the United Nations 2030 Agenda which reaffirms the Corporate sustainability and related Sustainability Reporting on Human Right principles, Labour and Environment principle and Anticorruption principle.