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EDITORIAL

Cyber-physical system

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The project of the digitalisation of the manufacturing processes underways in the major industrial countries since 2013 was conceived mainly as a technological way for re-engineering the industrial businesses in a techno-deterministic perspective. The German project added to this layer also the idea of an ambitious social re-engineering focusing on:

1. developing suitable "*health management and work organisation, lifelong learning and career path models, team structures and knowledge management* "(Final Report 2013:23) for an ageing workforce; this new workplace system should also allow the utilisation of immigrants and low-skilled workers with a growing necessity of receiving further training;
2. "*achieving far greater structural involvement of workers in the innovation process*";
3. "*combining a high degree of self-regulated autonomy with decentralised leadership and management approaches. Employees should have greater freedom to make their decisions, become more actively engaged and regulate their workload*";
4. "*The socio-technical approach of the "Industrie 4.0" initiative will unlock new potential for developing urgently needed innovations, based on a greater awareness of the importance of human work in the innovation process*", and therefore, "*In the smart factory, human beings, machines and resources communicate with each other as naturally as in a social network*".

Whatever version can be chosen of it, it is clear that these projects are not only based on a deterministic conception of technology but also on a kind of techno-optimism.

This kind of narrative is what Hirsch-Kreinsen (2016: 4–5) defines as "promising technology" and a "techno-utopia". A promising technology follows "*roughly three sequential process steps. First, the formulation of programmatic development perspectives called an expectation statement; second, the project of a collective agenda which increasingly structures the actions of participating and interested actors; and third, this interaction context solidifies gradually into a relatively stable action-context with a specific new logic and level of normative commitment*."

These different steps will put to the test the stability of the action-context and the collective agenda, because according to Hirsch-Kreinsen (ibidem 23):

> in the longer term, the technology promise of Industry 4.0 will have to pass through a long dark valley of disappointments, and lagging enthusiasm before a new phase can begin in which further advancements in the concept will doubtless be attempted. It can be anticipated that such a subsequent developmental phase will be one of more limited and realistic economic and social expectations. Inevitably by that time, the promising technology of Industry 4.0 will probably have lost at least some of its glamour.

For the journal, AI&Society, there were enough reasons to call for a critical assessment of this new industrial paradigm and its societal implications avoiding the paralysing choices between prophecies of doom and unrealistic and deceiving techno-optimism.

The call for papers listed two sets of questions, based on a position paper. The first focused on

1. the algorithms: are they a technical or a social endeavour?
2. What roles will the workers play in the new social networking made up of human beings, machines and resources?
3. Is the idea of a quantified self-realistic? At what price?
4. Is there a risk of technological unemployment?
5. Is the pace of the technological growth just a function of technology or also of social constraints?

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The second set of questions should afford the utilisation of these new technologies beyond the world of the industries and services. There are many questions such as, for instance, the so-called 4-D printing, that is the utilisation of the digital printing also on the living specimen and the growing symbiosis between human bodies and functional substitutes of it organs when not "augmented" substitutes, as devised in the last novel by DeLillo. It is also the case of the process of "datafication" of new spheres of our social life as Facebook is doing; lastly the risk of a global government ("singleton"), and for the possibility that humanity exists within a computer simulation. Just as seeking generalised computational solutions to problems of existential risk may be tempting for machine learning ideologues, so is the idea of humanity living in simulations a computational fancy."

The second set so was focused on:

6. Do the possibility of choosing from an online repository a virtual copy of objects and living specimen raise the question of a regulatory regime? Aiming to what? To guarantee the intellectual property of these "objects" or the public safety, in a regime of public access to their utilisation? Should, this regime, be based on laws and enforceable norms, or on a global voluntary agreement?
7. Is the free collection of personal data a risk for personal freedom and democracy? Is the commercial utilisation of these data acceptable?
8. Are there alternative concepts of the robot design and utilisation? How can these be qualified?
9. Is an ethical architecture of governance foreseeable, that is a governance system that is harnessing all the possibilities of this revolution, without denying the democratic principle of alternatives possibilities?

The following essays explore some or all these topics. This special issue of AI&Society is organised according to a simple criterion, first the essays dealing with a broad cultural critique of the cyber-physical systems paradigm and second the ones more focused on some specific aspects of it.

The first essay by Garibaldo and Rebecchi first deals with the practice of the giants of the web to collect personal information at scale to "*directly influence and modify your behaviour for profit. The collection of information is the gateway to a new universe of monetisation opportunities: restaurants who want to be your destination. Service vendors who want to fix your brake pads. Shops who will lure you like the fabled Sirens*." Garibaldo and Rebecchi discuss this process, utilising the theorisation of these actors, to understand how they are operating.

Second, they explore the new literature on the possibility for humans to transcend, via technology, biology of living, for instance, forever.

Starting from Freud's theory of narcissism, they highlight the risk of an unprecedented level of personal dependence on new technologies, providing the ability to be always connected, thereby bringing us back to primitive narcissism, fusion/symbiosis with the mother, and therefore a state of deep dependence. These technologies also give us the means to satisfy, to reach important elements of our autonomy, our (and not only our) ideal of the ego.

In the third place, they discuss the risk of a political–social regime of domination, devised by Zuboff. They state that it is not a regime of coercion, but of conquering us by giving us services to fulfil those we perceive as needs. Therefore, this regime provides answers to needs that have a real base, but also respond to our dependency needs: services organised to anticipate our every problem by taking care of us. It means that the monopolistic structure of the five giants is one of the problems. The other problem is to fight the process of transformation into goods and its extension to the origins of our desires and behavioural impulses. The power of the new media for communication and of the new tools for research should be largely at the service of solving the problems that affect us. An example can be that of widening the sphere of collaboration between us, and problems we are concerned with, for example, to combat illness, in a sphere of society that should be profit-free. To do this, the authors develop a critique of the scientific rationality of this paradigm through two examples the Big Data and algorithms and robots, artificial intelligence, and human work. Their critique aims at stressing the fact that at each stage, there are decisions to be taken, and therefore, the structure of the social and political power is more relevant than the nature of each technology.

Finally, they afford the idea of constructing real clones of the mind, avatars based on the software, and able to act like us even if we were already dead securing a virtual immortality. Utilising the available scientific knowledge on how our brains work, they underline the irreplaceable role of the biological substratum of our brain and the impossibility to separate this substratum from the psychic level of activity. It means that the idea of a reversing engineering of the brain is impossible. It does not imply that in principle, it will be impossible through research at a biological level, to reach important knowledge, and perhaps reproduce the brain, but it would be nothing but a human (perhaps with some other characteristic) brought to life in an original way.

Besides, quoting Heine, the authors say that the unhappiness, the unfulfilled need, the unsatisfied desire, are the basis of the search impulse. We want to find things that make us better, we and our future. We would like to find the key to a long life, the defeat of death.

But, says Heine:

> By creating, I could recover; By creating, I became healthy,

that is, in the creative process, there is the creation, the healing is realised, we move towards the future. However (yet), this process should be available to everyone.

There can be no private appropriation of science; there can be no profit, and war through science. By its nature, the creative process is free. If you were religious you could say, reinterpreting Napoleon:

> God gave it to us, beware whoever touches it.

The second essay by Brödner is based on a critical understanding of the computer science and a semiotic critique of the metaphoric use of "intelligence", "knowledge", "learning" as in the catchphrases: artificial intelligence, knowledge-based systems, machine learning, etc.

It starts from a historical view, since the 50s, of the "tidal waves of technological exuberance" related to the information technology of which Industry 4.0 is the third and last example. The first twos were the mainframe computers conceptualised as electronic brains in the 50 s and the computer integrated manufacturing (CIM) project of an unmanned factory in the 70s.

The main lessons from the first two waves are first that:

> the more differentiated, complex, and dynamic the codified knowledge is—and its objectification in technical artifacts—, the more demanding competence and working capacity are required to seize hold of these productive forces for effective practical use. This is subject to the experts' autonomy and cannot be planned and instructed;

and, second, that the apocalyptical predictions of lasting technological unemployment did not materialise.

Brödner takes a close look at the scientific and technological foundations of Industry 4.0, that is the third wave, to understand if "the novelty of the most recent approach can be determined". He goes through *computer components for digital control of physical processes which are equipped with interfaces to humans and other components. By data exchange via the internet, they can be globally networked (cyber-physical systems«, »internet of things and services«)*. These components as the multi-agent systems(MAS) and the artificial neural networks (ANN) are the technological bases for imitating human intentionality and learning capacity. The analytical understanding on how these technologies operate supports the claim that:

> The behaviour of computers is, as computing science teaches us, strictly restrained to executing computable functions by means of algorithms, it thus neither resembles the performance of a brain as part of a complex sensitive living body nor is it in any meaningful sense »knowledgeable« or »intelligent«—this predicate remaining reserved for the programmer designing the algorithms or the users making sense of the computing functions.

More specifically, on the intentionality and the learning capacity, it can be said:

> The key word here is »information« which itself is totally confusing, as it denominates different, incompatible concepts: either the syntactical measure of the »entropy« of a string of signs from a finite set (alphabet) according to Shannon (1948) or »any difference that makes a difference« in the context of a social practice according to Bateson (1980). By leaving this open, the physical world of deliberately designed machines with prescribed behaviour is confused with the social world of autonomous actors with the faculty of speech, of creating knowledge, and of designing purposeful artifacts. (..) Similarly, the term »machine learning« is again based on a mistaken analogy or attribution. The machine's changing behaviour is achieved by algorithmic procedures controlling its adaptation to environmental changes (in fact, this type of machines has formerly been rightly called »adaptive systems«).

The author goes to the philosophical roots of this mindset that is functionalism and its correlated reductionistic attitude. He opposes to the *praxeological perspective* that is a perspective *for analyzing the complex interplay of algorithmically determined physical data processing with the social process of signifying or interpreting the data in the context of an organization's social practices*. The idea of replacing human competences and expertise with smart factories and services denies *the fundamental ontological difference between physical events and social facts. While causal relationships in the physical world—in which, on the basis of semiconductor physics and formal logic, machine computation is operating—exist independently of human activity, objects and facts of the social world such as signification, meaning, or institutions are solely created and maintained through communication and cooperation based on shared collective intentionality. They are originated by declaration, i.e. by speech acts that make something the case just by representing it as being the case*.

His philosophical criticism concerns also the claim by techno-enthusiasts (Anderson, 2008) of the end of the theory that will be *replaced by huge volumes of data, in the »petabyte age« forecasts on the basis of pure correlations would be superior to hypotheses-based propositions, and correlation would replace causality*. It is evident in this case the well-known fallacy of *»cum hoc ergo propter hoc«*. The Big Data hype should also afford the test of the quality of the data, and the security to protect the data.

He proposes an alternative approach to the hype of *artificial intelligence* (AI) called *intelligence amplification* (IA) in which *human skills, particularly reflective and conceptual learning capacities, are combined with the precision and velocity of the machine*. This approach requires a socio-technical design of these technologies and of the organisations utilising it.

Summing up there is an alternative path. It consists in accomplishing *higher flexibility, productivity, and innovation capacity by sociotechnical design of decent work, rather than betting on questionable AI-promises. It means to organize a productive, creative and autonomous cooperation of competent and knowledgeable experts supported by useful and usable computer artifacts such that their working capacity and competence can further grow. It lastly means to leave the road to subjection*.

The third essay, by Cottey, shifts the focus on the required change of the economic model as a precondition for making the *effect of these technologies is to be benign*. According to the author the *current neo-liberal economy must change to a radically more cooperative model*, but contrariwise the current discussions and implementation of cyber-physical systems (CPS) *assume a capitalist economy* as economy-as-usual.

The essay stress, among other capitalist features of the economic model, the *conviction that economic growth is necessary*., irrespective of the fact that *human economic activity cannot grow beyond physical and ecological planetary boundaries*. Technology is therefore perceived by the supporters of this model as a way to reconcile the growth bias with the environmental risks. This situation is represented as a *mismatch*, starting from the way in which we word the problem, *between techno-optimism and economic conservatism*.

A first case, referred to the techno-optimism, is the asymmetry between the *potential* nature of the peril inherent to the coming technological revolution and the real nature of its huge promise, according to some techno-optimists. A sober representation of the problem should talk, instead, of cost and opportunities to be empirically ascertained. A second case as to the economic conservatism, is *to obscure the ecological, environmental and social problems* societies should afford in the implementation of this change. The essay first develops the linguistic aspects of the dominance of the neo-liberal economic models through many examples on how the economic discourse is organised.

In the second place, it affords the problem of which kind of economic change should be achieved to realise the technical promise of automation and digitalisation. The economic change should start from the *basic principle that all humans have a right to the basic necessities of a civilised life*. Implementing this basic principle means, according to Cottey, to undertake three economic changes regarding the concept of what work is about, the setting up of a system of unconditional basic income (BI), and of asset and income limits (AIL).

The concept of work should include whatever human activity *contributing to the well-being of the self or other people* and, therefore, should be extended to *the care for oneself and for others*, that is beyond the conventional, remunerated work. This concept of work cast a different light on the problem of technological unemployment. The unemployment effect can affect the conventional, remunerated work but the sphere of the care is unlimited in nature. BI is much fair than the traditional safety net systems for the poor and the left behind, because: *Such systems are, with possibly a few exceptions, harsh and demeaning (Laverty and Loach 2016). BI avoids the injustices and inefficiencies of such 'last resort' systems by providing a modest income for everyone*. AIL fits well with BI and it is a way to afford the fact that *many people have a strong desire to excel, in some way or another, and everyone needs respect and recognition*.

An economy incorporating AIL and BI needs ways of satisfying these desires and needs. Such ways must be benign. That is, they must be such that human activity as a whole does not compromise justice, or harm the environment or the earth's ecology.

The author is wondering whether CPS can play a positive role in an economic ambiance so reformed. His answer is that *within a business-as-usual economy, cyber-physical systems and similar technological developments cannot resolve the basic problems of sustainability; if, however, there is the social will, technology can contribute significantly to the creation and quality of a cooperative and sustainable economy*.

The fourth essay, by Degeling, is an exemplification of some arguments that are highlighted in the first two essays on the implication of algorithms' utilisation. The author assesses the reality of the diffusion of predictive policing software. The predictive policing "*refers to a variety of techniques used by police departments to generate and act on crime probabilities, often referred to as predictions. These non-binary probabilities are in most cases calculated by software that analyses previously recorded data and use machine learning algorithms to make assumptions about future developments*". It is an application of the data mining and of the "Big Data" processing techniques. The basic idea is that these techniques are superior to human decision-making, and Degeling develop a critique of the so-called *solutionism*, that is the view that "technology *is capable of solving nearly every problem of society"*. This solution "*often ignores the socio-technical contexts to which the technology is being applied. Predictive policing can change police work and its consequences on those that are meant to be protected, dramatically—not always in the way its inventors intended"*. As already stated in the first two

essays, each technique is based on some assumptions and biases, that is on human decision-making and the automated version is just an implementation of those assumptions and biases. The mathematic modelling, besides, hides some cultural and political trends as the "*shifting since 9/11 towards a more preemptive approach of labelling and persecuting individuals based on their characteristics rather than their actions*." It can imply dire consequences for those involved in the labelling process and the essay develop many actual examples of it.

It is also unable to deliver what promises in many cases, and the introduction of the automation in the justice system can be very disruptive.

The author expounds examples of the main predictive policing software based on "*either predicting places and times of crimes, or identifying likely offenders"*; the later one is the very risky in terms of threats to privacy and human rights. All this software is based on some kind of classifier and "*a classifier can be viewed as a decision rule*"; the technophiles say that "*the data speak for themselves*" as Anderson, the editor in chief of Wired, stated in 2008, and "*that the predictions are "objective" and thereby avoid human limitations and biases are overly naïve"*. The main critique, by Degeling, can be summarised in a set of questions: *but how are these instances defined in the first place? What is the target variable, what are the class labels, and how and by whom are they assigned to instances (such as behaviours or people)?* As the author says "every learning algorithms as, on one side, *the inductive bias to favour simpler hypotheses with as few features as possible*, and, on the other side, *the maximum conditional independence*, i.e. *the assumption that factors work independently of one another in contributing to their effect (such as making someone likely to commit a crime)*. These are only some example of inductive biases. The utilize of inductive biases are, according to Degeling, are unavoidable but because of this we should be aware that *neither the collection of data nor the action upon receiving a classifier's predictions operate in an abstract space. The constraints of the real world often not only reduce their effectiveness, but raise questions about whether they should be applied at all*. For this reason, *the software implementing the algorithms has to be publicly available and processes need to be established that allow police to intervene in the data processing. We also highlighted that all data mining depends on the data it is performed on, and since policing is never only about crime, the data that are produced by the police may be flawed—by inaccuracies, (implicit) biases or purposeful manipulations that pursue secondary goals*. There are also legal problems.

For all these reasons, the utilisation of this kind of software should pass a three-part test that he describes.

The fifth essay, by Carew, is along the same topic of the first by Garibaldo and Rebecchi but with a different scientific perspective. The author starts from the observation that "*Total Data is imminent*", that is the ushering "*ushering in a data-driven world wherein every human action, reaction, interaction, transaction, thought or desire is quantified, reified, recorded and used. Physical or virtual, all is recorded, known or unknown, seen or unseen, until data permeates every facet of our shared human existence*."

Starting from this observation he raises two research questions:

> RQ1. What are the implications of Total Data for the ontological self?
> RQ2. Will Total Data ultimately engender symbiosis or assimilation?.

To answer to the first question, the essay considers *"the polymorphic and dynamic concept of the self in a range of lived contexts in order to explicate and reify the implications of Total Data in a systematic and representative fashion"*. He lists six different contexts—private, social, worker, consumer, citizen, human—and for each of them he assesses the likely consequences of a world of total data. The effects will be dreadful. As to the private self, it *"would potentially be eliminated"*; in the case of the social self, there is a present and clear danger to personal privacy that is "*largely unrecognised or are underappreciated* because of a dialect between *what are perceived as short term gains or gratifications and, for instance, an increasing using social media for both monitoring the activity of current employees, and also for pre-employment vetting"*. In the latter case, there is a social obligation to the utilization of the social media, because *"the conscious decision not to participate on social media may have serious personal repercussions*. It means that *embracing social media, and thus helping perpetuate Total Data, is an ostensibly easier choice in a world where convergence is expected, and divergence treated with suspicion*".

As to the worker self, the *"Mobile devices such as smartphones mean that nowadays employees are always connected to work; contactable, observable, and controllable"*. It implies that "*the distinction between private social life, previously considered in the Private Self and Social Self, and work life is also becoming increasingly blurred and tenuous*." This situation leads to "*a panopticon-type effect*", as Foucault stated, "*whereby one behaves in a fashion that allows for the possibility that one may be watched at any time or at all times*." Another consequence is that "*the freedom for workers to be creative, innovate, and experiment free from observation is lost. Convergence is once again promoted instead of divergence, even though innovation and creativity is intrinsically divergent in nature*".

Total Data "*seeks to understand and classify the Consumer Self to commodify as a data asset and primarily sell to*", through the data mining and data analytics techniques. It means first that it is possible to differentiate "*winners from*

losers, separating those to target as consumers from those to exclude as existential nothings". In the second place, the same techniques "*offer increasing opportunities for identifying new patterns of consumer behaviour to do so*". This profiling of each individual is "*asymmetric, one way, practically unavoidable* and resulting in *power being vested in the data holders and not the data subjects*". Thirdly, it "*tends to feed a shallow culture of consumerism, hedonism, and conspicuous consumption*". Finally, this "*further begs the question as to whether the Consumer Self is even an ethical human ontology to personally experience, identify with, or aspire to*." The consumer self if it is not immoral, it is at least amoral.

The consequences on the citizen self are very dire; in this case Total Data "*seeks to classify the Citizen Self to predominantly monitor and control*, through an intrusion *unrestrained and unchecked into all aspects of citizens' lives*". The likely consequences are that "*contemporary data practices further the danger of the Citizen Self becoming a mere collection of numbers to a Total Data oriented government; a digital doppelganger to endemically monitor, predict and control*. These are the reasons why citizens *distrusting governments can be a healthy manifestation of democracy, bringing with it valuable critical questioning, discourse and citizen participation and engagement*".

The human self, that is our being individually and collectively human is under the threat of a specific culture of the system engineers that "*focus on functional aspects when developing technologies and data-oriented applications. This instrumental focus feeds the Total Data machine, and leads to a myopia over what is intrinsically and tacitly lost to the Human Self in a data-driven world. Development methodologies used by systems engineers tend to propagate and reinforce this functionalist, mechanical worldview, whilst rendering alternatives as irrational and impractical*." But this is a technocratic perspective and it dismiss the very fact that "*the Human Self, at its core phenomenological essence, is therefore not changed by technology, but rather the lived expression of a human life is"*.

Having said that, the answer to the second research questions is very clear, the main trend is towards assimilation instead of symbiosis. To wit, for Carew, "*technological symbiosis represents and encapsulates the wonderful potential that technology holds for humanity. It envisages"*. The polar opposite, assimilation, means "*to integrate into one in order to produce a singular collective. The very notion of integrated and convergent technologies has been almost unanimously promoted as something positive in the literature, unusually on utilitarian premises such as communication, productivity and efficiency"*. In this perspective, "*these technologies are instead producing a singular data-oriented collective on all activity to be used, in an opaque fashion, for instrumental purposes such as monitoring, sorting and controlling people"*.

As the author acknowledges his prognosis is "*frankly, stark*" but "*Total Data is not upon us just yet*" and to avoid to resign ourselves to this future we need "*to undergo a seismic paradigm shift for the data-driven world*." To this end, the human-centred tradition of systems engineering should be recovered.

There are now three essays dealing with topics of work.

The sixth essay by Salento deals with Industry 4.0 as a topic for social sciences. The first concern is *"to question the notion that digitalisation is merely a technical process, arguing that it is rather a social construct, always partial and temporary, resulting from specific decisions, taken on different regulatory levels and interwoven with contemporary economic and social dynamics*". In the second place, the essay focuses on the "*implications of hyper-digitisation for the organisation of production, considering in particular what space for self-determination remains for the workers who are involved (or embedded) in cyber-physical systems*". Eventually, it "*will consider the prospective impact of the new machines on employment, and we will seek to understand the conditions under which digitalisation can be an opportunity rather than a threat for societies*".

To understand Industry 4.0, it is necessary, without underestimating its innovative features, to be aware that there is "*continuity with the technologies and organisational solutions experienced in the 1980s with the first application of microelectronics to artefacts and services. Neither the machines nor the algorithms or organisational solutions are radically different from those used ten or twenty years ago*".

Having said that, Salento portrays Industry 4.0 ad a field of decisions where there are, as stated by Masino and Zamarian, "*at least three significant decision-making processes*:

A. *concept/design decisions concern the objectives to which the artefact should be oriented, the specific functions it performs, and the patterns of interfacing with the operators;*
B. *adoption decisions deal with the choices regarding the phases, sectors of activity and processes in which the artefact will be used. Such decisions usually fall within the purview of management and are of great importance to the terms and conditions of work;*
C. *usage decisions are made by the operators, and may be different from those planned by the designers and required by the management. In addition, they may change over time and may generate recursive transformations"*.

This is the main reason why a technological deterministic approach is inadequate and, on the contrary," *technology does not develop ineluctably along some inherent path, but*

in accordance with decisions taken by economic and political actors, based on academic research and requiring huge economic investment: in short, decisions that can be made only by national and supranational executives and by large-cap companies."

As to the implications for workers, "*the issue can be examined on a variety of analytical levels, from macro to micro: from the markets in which businesses conduct their competitive actions to the workers' tasks*". Focusing on the third decision-making process (C), the one made by the operators, Salento states that "*whether the intelligence of the new machines corresponds to an increase in the autonomy and skills of operators is an open question (..)the new cycle of technological innovations, in continuity with the previous ones, seems to increase above all the potential for vertical coordination and control of production processes. Even the participatory and proactive role of workers should not solely be interpreted as a process of "democratisation" of production processes*". The rhetoric of the "*employee engagement rooted in in the human relations movement*" becomes, with Industry 4.0, more relevant "*when tacit knowledge can be exploited for gain*". The role of Trade Unions become relevant to shape the kind of involvement actually realised.

The impact on employment rates is the most controversial aspect, the author agrees with those that consider unrealistic "*the idea of the endless employability of humans in competition or even only in cooperation with machines"*, due to the real socio-economic conditions of the context.

In conclusion, Industry 4.0 "*can be read as a transnational re-industrialisation programme, driven by coalitions of large corporations and national governments and developed in a different form in each context*". In Europe, the context is more oriented to an industrial-based accumulation of capital rather than financial, but it does not imply that there will be positive outcomes but people will "*understand the dynamic of capital accumulation in which the new technologies are used, and to develop adjustments to make them compatible with the needs of societies. It is not just a matter of rethinking redistribution (which would itself be a challenge): sustainable income distribution should be guaranteed at the time and in the places where value is produced. In other words, we need to tackle economic democracy*".

The seventh essay, by Caruso, questions the realism of the main representations of Industry 4.0 as a mainly positive process as it happened for the previous wave of ICT technologies. The essay reviews these representations starting from the institutional ones. Then, a review of the literature on the digital work is carried on.

The institutional reports reviewed afford the likely implications for the economy and the industry at large. What is interesting to note is the social side of work. These reports state that Industry 4.0 "*combines a high degree of self-regulated autonomy with decentralized leadership and management approaches. Employees should have greater freedom to make their own decisions, become more actively engaged and regulate their own workload. We thus have further confirmation that from the point of view of work, the rhetoric concerning Industry 4.0. is the same as those relating to post-fordism, the knowledge-based economy and digitization*". Where they are less optimistic is the issue of unemployment, mainly for the lower paid, lower-skilled, and less-educated workers. It means that "*automation will continue to put downward pressure on demand for this group, putting downward pressure on wages and upward pressure on inequality. In the longer-run, there may be different or larger effects*". There will be, on a longer perspective, the risk that, without specific policies, "*instead of broadly shared prosperity for workers and consumers, this might push towards reduced competition and increased wealth inequality*".

Looking at the digital work, the first conclusion is against any deterministic vision of technology. What is relevant is the understanding what technologies were designed for concerning political, economic, and social objectives. However, also in this perspective, there are intended and unintended effects, because there are complex interactions between forces of production and social processes. Following Orlikowsky, there are also direct and indirect effects, mainly in the case of digital technologies due to its pervasive nature. Finally, there are processes of "*reconstitution in use*" of a technology that is a different kind of application of the technology that alters its nature.

As to the digital work, Caruso states that "*all the elements that define the positive aspects of digital work and the 'knowledge turn' in work are controversial*" also because of some long-term trends in the industrial organisation. For instance, according to Caruso, "*contrarily to what the institutional reports state and foresee, in Western societies new employment creation mainly concerns the lower tertiary sector* ". It also depends on the "*increased productivity resulting from technological innovation and the delocalisation of planning, management, control and even research activities"*.

Besides, there is the new phenomenon of the crowd working. It leads to an expansion of "*temporary collaborators, consumers and users who to a certain extent replace paid work*". However, what is more relevant is that "*Crowdworking thus fits into the continuum of relocation, as Bergvall-Kåreborn and Howcroft highlighted, virtualisation and the implementation of internal markets and tendering systems*". These new 'strategies of companies would shift risks "*further onto workers, and companies would escape legal regulations, social partnership relations and collective agreements. Also, technical writers and management consultants wonder what would happen to the knowledge base of the companies. While digital*

crowds might bring new and more varied expertise to the job, there are concerns over the leaking of company-specific knowledge and workers' commitment".

It is, therefore, possible to identify some trends. Summing up: "*a weakening of the separation between personal life and work; a constant shift from stable jobs to precarious jobs with lower pay; growing pressures on workers to improve both the quantity and quality of their job performances, yet often without any compensation in terms of occupational stability, salary or career development opportunities; this divergence between requested performance and compensation individualizes job relations and diminishes workers' loyalty to and even involvement in the firm, thus reducing the potential for internal cooperation and knowledge sharing; finally, an expansion of monitoring activities, used to regulate the performances of these workers in ever greater detail, and hence diminishing (instead of increasing) their power of discretion and autonomy*".

The nature of the employment relations itself is in the process of change as documented by the Eurofound report (2015).

Apart from the risk of technological unemployment, Caruso concludes his review stressing the unachieved promises raised: "*Work organisation has not become more horizontal, if not partially and formally. Workers did not increase their decision-making power or their autonomy. Work has become more creative only for a fraction of highly skilled workers. On the other hand, work has become more precarious and less paid and the distinction between work time and life time has weakened. Contrarily to what is stated by the institutional readings of Industry 4.0., so far technological innovation does not replace predominantly less-skilled jobs. The creation of new jobs mainly concerns the backlog of services*".

However, on the other side, he stresses the fact that structural dynamics in 'digital economy', in fact, are characterised by some core ambivalences and dichotomies. These dichotomies range from

Socialisation of production versus individualisation of the employment relationship; the cooperative exchange versus market exchange; collective participation in decision-making versus verticalisation of the decision-making process; autonomy of labour versus digital Taylorism.

Therefore, there is a possibility "*that the production process will shift in a direction favourable to labour*" and it depends on "*the capacity for coalition and conflict and on the bargaining power of the latter. These elements develop within the labour relationship also thanks to the support of dynamics (politics, cultural, organisational) and actors external to the production process, as the history of the workers' movement, according to Bartolini, demonstrates*.

The next four essays develop reflexions partly based on empirical work, either as field research or as laboratory experiments.

The eighth essay, by Freddi, deals with the quantitative and qualitative effects of digitalisation on employment. The essay is based on a broad economic literature review and on some "*preliminary results derived from empirical research conducted by means a comparative, holistic, multiple-case study"*, in the meaning of Yin. The research involved "*a total of seven companies, four of them belonging to the mechanical sector, and two to the ICT one, were interviewed following an in-depth, semi-structured questionnaire"*.

The section on the literature review starts from the agreement with the criticism developed by Valenduc and Vendramin (2016) on the well-known studies by Frey and Osborne and the World Economic Forum. The weak point of those studies is, according to Valenduc and Vendramin, "*the assumptions that there is a 'direct cause-and-effect relationship between emerging technological innovations on the one hand (in particular learning machines and mobile robotics) and the anticipated productivity gains to be made by using robots as substitute for human labour on the other (based on the likelihood of this substitution occurring for the individual tasks within a job)'*. However, a macroapproach is not enough because of the "*novelty and pervasiveness of digital technologies*"; it requires "*micro-level analysis micro-level analysis in order to try to answer the following questions*:

- *to what extent new digital technologies are currently employed by leading manufacturing companies and what is the pace of their application?*
- *what are the new technologies under the umbrella of Industry 4.0 that are actually expanding and for which kind of specific use?*
- *in which ways are new technologies affecting employment, or may do it in the future?*
- *are labour skills changing due to the application of new technologies, if so how?*"

The empirical part of the essay affords these questions.

In the literature, there is a high level of disagreement among the researchers on the relationship between innovation and employment, namely, digitalisation and employment.

On the relationship between innovation and employment, the first disagreement is on which analytical level should be used: macro, industry or firm level? According to Pianta (2005), the industry level is considered by scholars who applied it as the *"most satisfactory level of analysis, as it is able, on the one hand, to differentiate between the variety of technological regimes and strategies and, on the other hand, to bring in the demand dynamics of specific sectors, taking into account country differences in economic structures*".

Following the empirical studies carried on at this analytical level, there is a first important result that Freddi sum up this way: "*product and process innovation have opposite employment effects: product innovation, in particular if developed in contexts of high demand growth, have positive effects, whereas process innovation, often adopted to increase productivity and reducing labour costs, leads to job losses"*. The empirical part of the essay confirms this result. There are other streams of research based on macroeconomic and simulation studies. Summarising all these different approaches the previous conclusion on the difference effects depending on process and product innovation can be confirmed. Besides, Pianta adds that "*the specificities of industries, countries, and macroeconomic conditions are crucial determinants of the results obtained in empirical studies*". As to the issue of skills and wages, the conclusion is that "*the large branch of literature studying the relationship between technological innovation, change in skills and wages have clearly pointed out that there is a relationship between these factors, however it has some key weak points due to the fact that a macroeconomic perspective is missing. In particular should be necessary for integrating these analyses to take in to consideration not only a narrow labour market perspective but also the socio-economic context in which the analysed changes take place*."

Coming to the relationship between digitalisation and employment the literature and the ongoing field research should take into account the *disruptive nature* of some features of the digital technologies. Taking into account does not mean to assume it but to assess to what degree these technologies are actually disruptive. The main disagreement is on the occupational effect; the debate follows the same scheme highlighted in the case of innovation. In this case the quarrel at the analytical level is on the distinction between tasks and occupations. The weak point in the literature is that the "*empirical findings show that among the different technologies included under the umbrella of Industry 4.0, mainly robots have received a great deal of attention so far, while the current application and employment impact for other emerging technological opportunities such as 3D printing, Internet of Things, Augmented reality, Big data Analytics have not been studied yet"*.

The empirical research allows to draw these conclusions:

> the analysed companies are more involved in product than process innovation therefore they believe they will expand their workforce in the near future. In particular they need to widen the number of employees involved in software development and big data collection and analysis. Moreover, as companies believe that in the future services will have a growing role in value creation, they expect to hire more people working in service provision. In terms of skills requirement, companies point out that they face growing difficulties in finding workers they are looking for.
>
> It is interesting to note that, in this group of companies:
>
> there is growing need of multi-disciplinarity, where also technical employees need to have more a systemic view as well as soft-skills.

The ninth essay, by Mazali, presents the results of "*an empirical survey conducted by the author together with a multidisciplinary research group between 2014 and 2015 in some of the largest Italian factories. In particular, the article analyzes the links between digital society, digital culture and Industry 4.0, focusing on the issue of people's participation in the process of change, within a specific case study from railway sector*". The study also originated by the observation that "*the discussion on the social and organizational effects of the new paradigm is still underdeveloped. One of the key aspects of this discussion is the question of participation and the 'people-centered' culture (where 'question' has the double meaning of: subject to be analyzed, or topic; and problem, object of controversy and disputes). This issue needs to be addressed critically by analyzing both the RE-personalization processes and the new processes of DE-personalization caused by digital automation*."

The new digital trend affecting culture, society and factories share the same rhetoric of being people-centred, that at the workplace "*corresponds to the rhetoric of collaborating worker in co-responsibilization practices*" in the meaning of Ramsay.

Mazali summarises in the following statement the relationship between digital society/culture/factories:

> the new digitally-transformed factory knows everything about everyone in real-time, just like in society. Opportunities and critical issues of this model balance each other out: knowing everything implies being able to manage complexity in order to turn it into benefits; at the same time, it underlines the urgency to reconsider the subject of control on human capital and its participation in the production processes.

The train makers case is very interesting because of this company made in a short period of time—2012–2017—a transition from a traditional artisanal process to a smart factory. The plant has, indeed, "*numerous Industry 4.0 features: communication flows integrating manufacturing and warehouses; preventive maintenance services; product and processes simulated in a virtual environment, for testing and in order to prevent problems, and it has an inner training academy for its personnel. The core system is based on a mixed reality system: virtual reality plus augmented reality*."

This process of transition produced many transformations "on the way of manufacturing and on their work". The first

is the development of "the digital avatar of the train: flexible, open, a real 'master' in the sense that it is a system that directs or controls the functioning abilities of other subsystems". The second is a shift "from the centrality of the tacit and informal knowledge of the production line to the centrality of hyper-formalized knowledge, made available by the production line thanks to digital media." It implied that the previous participation of a large part of the employees—from workers to designers—in managing the complexity of the product was substituted by:

> the domain of engineering, and it is managed at the beginning of the production process". On the production line there is, therefore, no more the traditional craftsman but what is called a digital craftsman, that is "the user of digital media who applies the skills acquired through his personal use of digital media to his work.

And they are organised in teams. Summing up these are the main features of the new socio-technical system 4.0:

1. "*A 3D master of the train: the virtualization of the entire process, from design to production to maintenance. The production process turns into an inter-operable, integrated and continuous flow of information that can be elaborated and modified in real time, useful for problem solving. The 3D master of the train is an open model, capable of integrating different types of information that are useful for various stages/requirements of the production process*.
2. *The use of mobile devices such as tablets (personal and interpersonal communication tools which are connected and therefore suitable for sharing production-related data)*.
3. *Team-based organization (reverse learning model)*."

Other aspects of the people-centred rhetoric are the centrality of the user and the consumer as well as the centrality of the employee's participation in the smart factories.

The first two aspects can be considered as a process of personalization of a product or a service.

This process can range from the possibility for the user/consumer of delivering inputs in the last stage of the creation of a product/service to the "*highest levels of co-construction of the product/service. For example, in the automotive industry, the two extremes are represented on the one hand by the possibility to choose a specific type of car configuration, and on the other by a 'do-it-yourself' type of car production"*. The last is the case of Tabby that for Mazali represents "*the integration of companies and consumers, and of factories and society*".

Following the rhetoric of the employee's participation "*the ideal type of the factory worker of the future—utilising the categories by Castells (1997)—is participative and proactive, as opposed to the resistant or reactive factory worker of the twentieth century*".

According to Mazali, this is part of a more general trend in our society the individualisation process "*which are pervading the contemporary professional practices in all sectors. These processes become part of the factory work and they introduce new issues: the crisis of the delegation and representation model, and the diffusion of a culture that assigns responsibility to the individual at the expense of a collective identity*." However, the participation in the 4.0 factories has a peculiar dimension in between the collective dimension and the individualisation processes:

> the 4.0 work paradigm proposes the peaceful middle ground of the team (as described in the case study presented here), which shares some features with the 'networked individualism' framework proposed by Barry Wellman (2011) to describe the characteristic traits of sociality in the network society: functional, flexible but also ephemeral. The team operates within a limited time range, bound to the need for fast and reconfigurable production, just like in digital networks. This model is advancing quickly and it questions roles, cultures and old practices.

Finally, there is a clear difference between the of the twentieth century and this new kind of automation represented by the Algorithmic management, that is the personnel management by an algorithm:

> "This impersonal automation component (Steiner and Dixon 2012) can be considered as one of the specific forms of alienation in the digital economy and in digital factories. The balance between the worker being able to control the process by using their own intelligence and digital media tools and devices, and the automation of digital algorithms that remove the human element from the process analysis (not the processes) is one of the key issues for the future in the debate on quality of work". This process can be described as un-personalizing.

The tenth essay, by Richert, Müller, Schröder and Jeschke, deals with the problem of the hybrid teams made up of man and machine. More specifically it affords the design of machines "*inspired by human-like elements (body parts, gestures, facial expressions etc.) and especially robotic systems and can draw on the knowledge of a long tradition of anthropomorphism*". This is a new field in which it is necessary the cooperation of many different disciplines and experimental phases. The paper refers to the results of the empirical study "*Socializing with robots*" (SoWiRo) funded by the Start-up Grant of the RWTH Aachen. The study was carried on in a virtual environment setting was used to guarantee a

safe interaction with a robot and to manipulate the robot's characteristics easily. However, it must be explored whether the findings are transferable to real production environments. Therefore, the project "*ARIZ—Work in the industry of the future" builds an industry 4.0 demonstrator, which takes the knowledge of SoWiRo as a starting point for real-life experiments within a demonstrator factory"*.

The scientific disciplinary fields span from psychology to cognitive science and artificial intelligence; this field of research can be defined as anthropomorphism. According to the authors, the new technological possibilities are triggering a "*revolutionary change on the industrial hall floor. The conversion of production lines to 'in the box'-production by hybrid, networked teams consisting of humans, robotic systems as well as virtual agents (software). The cooperation between man and machine will in future be able to take place side by side—without the usual safety areas*." This will be possible through the cooperation of anthropomorphism with technology.

The most difficult challenge for the designers are the anthropomorphic components. The challenge is made up of two different objectives: reproducing human movements and affording the complex problem of the human acceptance of human-like machines.

The first part is improving at fast rate thanks also to ergonomics studies: "*the transfer from the extensive knowledge of human work (e.g. ergonomics) to robotic systems offers great potential for realizing 'real' teamwork situations where robots and humans are involved in a common complex value-added process*." There are also safety problems and, on one side, the new "*lightweight robots offer due to their lightweight construction more safety for direct interaction with humans than classic heavy-weight systems*". On the other side, the development of a very sensible artificial skin for robot makes possible that "*if a robot notices an unscheduled contact, its movement is immediately stopped or slowed*".

The second part is complex. The authors refer to the studies by Jentsch (1997) and Mori (2012) on "*what influences human acceptance on human-robot interaction*" and if "*the design gets too anthropomorphic*" then something happens—the so-called "uncanny valley" effect—and "*humans reject interacting with the robot or else*". There are many different explanations, that the essay analyses, and it is clear that there are also cultural factors playing a role in the dialectic of *acceptance* and *alienation*. Namely "*in Western cultures such as Europe and the USA, people define themselves—among other things—by comparison with machines. A too great similarity between man and machine intensifies the fears and thus reduces the acceptance. To realize the highest possible amount of acceptance, the 'Sociability' of robots as an interdisciplinary field is evolving in the last decade, the field of Social Robotics*". The Social Robotics deals with the development and design of robots which interacts socially with humans. In this case, the scientific disciplinary fields involved are broader than in the traditional robotic. It includes not only engineering and computer science but Human–Computer Interaction (HRI), AI, cognitive science, (developmental) psychology, interaction design, biology, and especially ethology and contribution by pedagogy, sociology, philosophy, science, technology studies and social science in general. Social robotic develop robots which can assist in "*a range of tasks that are unpleasant, unsafe, taxing, confusing, low paid, or boring to people. For example, nurses making rounds in assisted living facilities spend much of their time sorting and administering medications" and in future "might act as guards, help fight fires, deliver materials on construction sites and in mines, and distribute goods or help consumers in retail stores. Robots might even provide high-interaction services such as taking blood and coloring hair*".

As to the hybrid team, the empirical study confronted the human-robot interaction with two different robots: either an ABB robot arm or a humanoid robot designed as human-like but not too realistic in a shape and facial expression. The empirical results show that the personality of the worker plays a role: "*The teambuilding with machine-like robots, which do not constantly perform in the expected manner, is dependent from the type of personality of the worker*". Further work is considered necessary "*to explore how other participants' characteristics (e.g. attitude towards robots) influence the performance of hybrid collaboration and the subjective perception of it*".

The 11th essay, by Müller, Shehadeh, Schröder, Richert, Jesche, is part of the same stream of German research, Work in the industry of the Future (ARIZ), described in the previous essay. The specific research and development project described in this essay is part of the "*Innovations for Tomorrow's Production, Services, and Work*" Program Funded by German Federal Ministry of Education and Research. It is aiming at investigating "*the status quo of workplaces in industry 4.0 will be investigated, and new approaches of the work organization will be designed and researched and novel design potential of cooperative hybrid human-robot work systems will be investigated. Moreover, an industrial demonstrator will be built in the Festo AG, a German industrial control and automation company, which allows a realistic assessment of the expected outcomes of this work*". The first step of this project is a work analysis of job design and work organisation to understand its weakness. The analysis will regard the qualification requirements and technology sequences, as well. Finally, the research will make possible also assess the health and personality development in these new hybrid industrial hall floors.

It is important to make a distinction between co-existing and collaborating robots:

> Co-existence is the lowest form of human–machine interaction. It describes an episodic clash between man and robot where man and robot work simultaneously in an overlapping area. They do not necessarily work towards achieving the same goal while there is a common goal in the cooperation. Within a cooperation, there is a clear division of tasks between man and robot, but human and robot share a common goal. Collaboration describes the direct interaction between humans and robots with a direct physical or aural contact

The essay describes a list of selected procedures for "*analyzing production environments. They vary in method, level of analysis (from micro to meso level) and the characteristics they cover (e.g. stressors, tasks, feedback). All of them have been tested, meet the scientific standards and can be used to analyze production-related jobs. In particular, they are advantageous in comparison to the analysis methods of consultancies and self-developed methods, most of which are neither theoretically nor methodically sound*". This assortment of methods "*has so far been purely literary and requirements described but not operationalized. It is necessary to examine the extent to which these instruments are suited to derive requirements for future hybrid workplaces*".

The author list 16 different procedures that are based on a variety of research tools: from observation to group discussions and workshops.

The last essay, by Park, has a different focus. It deals with the implication of the fourth industrial revolution on the innovative cluster policies. After a thorough analysis of the role of innovative clusters "*as powerful instruments to strengthen industrial competitiveness, innovation, and regional economic growth*" he states that "*innovative clusters will face difficult challenges in the Fourth Industrial Revolution era because production and process management do have little geographical barriers due to hyper automation and hyper-connectivity. Therefore, innovative cluster policies have to focus to carry the smart specialization strategy not only at the design but also at the implementation phase*." He, then analyses the Europe strategy 2020 and highlight its choice to make "*cluster-based approaches are the core tool for a new industry policy focusing activities on specific sectors of the economy*". He thinks that this strategy is very positive in social terms, because there is a risk that this deep process of chance "*may cause income disparity between employees on the one hand, and provide a high level of autonomy for qualified employees on the other hand*". One possibility to avoid such social negative outcomes is to enact policies "*for boosting cluster activities focusing on technology innovation and regional economic growth resulted from global competitiveness*."

This special issue collected contributions coming from different scientific disciplinary fields, different cultural orientations and focusing on various subject matters. This variety is in itself a value and, besides, there is a largely shared understanding of how to interpret Industry 4.0 and its societal consequences.

First of all, the different contributors stress the necessity to read this process not only as a technological one but a multifarious transformation phenomenon. There are at stake political, social issues and the effects will spread on all the different social dimension and at the individual level. All these levels and issues are at the same time affecting the phenomenon and affected by it in an inextricable flow of interaction. This is the reason why all the contributors refuse any technological determinism. This process of change is a field of choices to be done from different social, political, economic, cultural actors.

In the second place, because of what just said the process of change is open to opposing outcomes and all the different grades in between. It is, therefore, possible to conceive and to design alternative policies at all the level analytically identified.

Here some hints on the proposals:

1. The utilisation of this new technology to satisfy, as Garibaldo and Rebecchi say, and to reach important elements of our autonomy, our (and not only our) ideal of the ego. Widening the sphere of collaboration between us, and problems we are concerned with, for example, to combat illness, in a sphere of society that should be profit-free. There can be no private appropriation of science; there can be no profit, and war through science. By its nature, the creative process is free.
2. Instead of the Artificial Intelligence, we can develop Intelligence Amplification, as Brödner states, in which human skills, particularly reflective and conceptual learning capacities, are combined with the precision and velocity of the machine. This approach requires a socio-technical design of these technologies and the organisations utilising it.
3. Contributing significantly to the creation and quality of a cooperative and sustainable economy, as Cottey highlight with precise proposals and with the awareness that the current neo-liberal economy must change to a radically more cooperative model.
4. Developing a socially responsible way of producing algorithms, as Degeling advocates, through specific tests.
5. Fighting the on-going process of assimilation and developing, as Carew argues, a counter-proposal of a symbiotic relationship whereby technology does not control or take precedence over people, but rather helps

and empowers them to realise their creative and existential potential as humans to improve society and the human condition in an ongoing evolutionary fashion.

6. Supporting, also in the field of social sciences, a shift in the awareness of what is at stake, as Salento states, to develop adjustments on how the new technologies are used by the capital to make them compatible with the needs of societies. It is not just a matter of rethinking redistribution (which would itself be a challenge): sustainable income distribution should be guaranteed at the time and in the places where the value is produced. In other words, we need to tackle economic democracy.
7. Stressing the ambivalences and dichotomies in the digital economy, as Caruso does, to support the possibility that the production process will shift in a direction favourable to labour. And to rise a call for action to the European Trade Unions, because positive outcomes of 'Industry 4.0.' for workers will mainly depend on social conflict and politics.
8. Debunking prophecies of doom as to the employment perspective, as Freddy argues, in the digital economy, stressing the importance of the kind of innovation will be designed and implemented
9. The critical rethinking of the rhetoric of participation and people-centred culture, as Mazali does, to analyse both the RE-personalization processes and the new processes of DE-personalization caused by digital automation, in the real world of the factories.
10. To develop a new branch of technological and scientific research, as the two contributions by the IMA/ZLW & ifU, at RWT Aachen University explains, for the socio-technical design of an effective hybrid team of people and machines in the future factories.
11. Asking for new public policies to manage the transition of the innovative industrial clusters to the new digital industrial world, as Park does.

These positive scenarios do not rule out the existence of clear and present threats to the individuals and society at large, as every contributor document. Among these risks, there is also the risk of the crisis of democracy because of the rising power of a handful of companies controlling the core activities of this new world.

Nothing better than Tim Cook's speech, on 2015, did at a meeting of a non-profit organisation (EPIC)[1], can illustrate some of these threats:

"*I'm speaking to you from Silicon Valley, where some of the most prominent and successful companies have built their businesses by lulling their customers into complacency about their personal information*," said Cook. "*They're gobbling up everything they can learn about you and trying to monetize it. We think that's wrong*". And he added:

"*You might like these so-called free services, but we don't think they're worth having your email, your search history and now even your family photos data mined and sold off for god knows what advertising purpose. And we think someday, customers will see this for what it is*". And he, in a paper on privacy, concluded:

> [a] few years ago, users of Internet services began to realize that when an online service is free, you're not the customer. You're the product

Where there are different evaluations is the assessment of technological unemployment due to the growth of the digital economy and the artificial intelligence.

There are some essays sceptic about the prophecies of doom, also because of past prophecies in the 80s and 90s; others are less optimistic because of the disruptive feature of this new revolution.

Guest Editors

[1] I retrieved the quotation thanks to the very illuminating book by Tim Wu—*The Attention Merchants—The Epic Scramble to Get Inside Our Heads*—A. A. Knopf, 2016, p. 335. Anyway, the sources are available on the web: http://techcrunch.comhoI5/o6/02/apples-tim-cook-delivers-blistering-speech-on-encryption-privacy/. and http://www.apple.com/privacy/.