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From Tripalium to Otium: What future for Work in the era of disruptive technologies?

Sanae Hanine [a], **Brahim Dinar** [b] **Said Meftah** [c]

[a] Faculty of Sciences and Technology of Settat, Hassan First University ,Settat, Morocco
[b] Faculty of Legal, Economic and Social Sciences of Casablanca, Hassan II University, Casablanca , Morocco
[c] Faculty of Sciences and Technology of Settat, Hassan First University ,Settat, Morocco

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ABSTRACT

This article explores the uncertainties surrounding the impact of disruptive technologies on the future of work and employment. The schism runs deep between those who believe that the effects of techno-industry will profoundly affect the global workforce and affect skills through labor market polarization, the precariat, falling incomes, and growing inequality. While others believe that this phase is just a transition and that once past this milestone, productivity and prosperity will be there. In this perspective, a reflection on Atypical Forms of Employment sui generis in the techno-industry reveals the materialization of the modern tripalium. Africa, which is still lagging behind the technological revolution, is strongly concerned by the effects of this fourth revolution, especially in the face of a significant demographic dividend. The big question that arises concerns the possible effects of the prevalence of disruptive technologies on the employment ecosystem in Africa. Already characterized by its fragility and the absence of safety nets, ad hoc strategies must be developed to make the most of these technologies. The divergent scenarios on the techno-industry commentary will be integrated into the African labor market and what will be its impacts. Morocco, for its part, faced with gigantic development projects that have been amortized, is more than ever concerned by the techno-industry revolution. Is this a bargain or a Pandora's box?

Corresponding Author:

Sanae Hanine
Faculty of Sciences and Technology of Settat, University Complex, route de Casablanca, Km 3.5 BP 577 - 26000 Settat, Morocco
Email: hanine.sanae@gmail.com

1. INTRODUCTION

Faced with the surging wave of disruptive technologies which has submerged the entire planet by bringing with it trends that transform the ethos of societies at a global level, a Manichean approach has been developed and has become hardened in the face of its consequences on the content of work, its organization, its quality, and its value. This research returns to the controversial link between disruptive technologies and work. The subject's topicality relates to exponential fears regarding the impact of disruptive technologies, particularly AI, on the professional future of humans. Indeed, economists and academicians are divided on this point. Some have a Schumpeterian vision, which is referred to by his famous theory of long cycles borrowed from Kondratiev. They consider disruptive technologies an opportunity for positive change favorable to creativity and productivity. They believe that its negative effects on work and employment are transitory and short-term. Others observe technological disruption as threatening and sounding the death knell for wages, work, and employment as we have always known them and leaving behind a large idle category delivered to a sort of otium that designated at the Romans the moments of tasty idleness. But we don't know for modern times whether it will be tasty or not.

In the 12th century, "to work" and "to cause pain" were the same. Since then, a lot of water has flowed under the bridges. In our modern times, "Work" refers to "all activities by which human beings satisfy their needs and transform reality". The notion of employment, for its part, designates the situation in which this work is declared and remunerated [1]. A job is a situation that connects a worker to an organization through which income and social guarantees pass. In principle, an independent worker does not have a job. In the age of disruptive technologies, suffering has changed. What is happening to work and employment with the jerky development of AI, robotics, humanity 2.0, and the singularity? Certainly, modern society has attributed a highly symbolic value to work for the economic security it provides, identity, status, and social bonds. It is legitimate to ask how the New Forms of Work or atypical jobs as a new configuration of work resulting from the platform economy, the economy on demand, and the collaborative economy, induced by these disruptive technologies, respond to these three fundamental work principles . For [2], man is an active being. It is realized in action and the product of its action. Man realizes himself through his work: he does beautiful work; he produces a work [3]. What happens to all this when humans are replaced by robots and AI? [4] book titled "Confronting Dystopia: The New Technological Revolution and the Future of Work" argues that recent advances in AI and robotization portend a vast shift in humans and that we are already in the midst of a technological revolution that will have a profound impact on the livelihoods of people everywhere. According to the [5] report titled "Gen-AI and the Future of Work", AI is poised to profoundly change the global economy. While recognizing that AI will have an impact on income and wealth inequalities, (IMF, 2024) nevertheless affirms that its consequences remain difficult to predict.

Indeed, technological disruptions have always generated uncertainties about their impact on employability since the Luddite movement which constituted the first rebellion against machines in 1811, when British weavers rebelled against them by breaking the mechanics of their factories. This movement also failed due to the decisive coercion imposed by the government [6]. [7], for its part indicated by analyzing the work of economists [8], [9]; [10]; [11] demonstrated that the effects of labor displacement labor due to automation and AI are likely to be accompanied by several offsetting effects such as the productivity effect which reduces prices, increases the demand for goods and services and thus increases the demand for labor a capital accumulation effect triggered by new investments that increase the demand for labor.

Technologies explicitly aim to replace human labor with cheaper machines causing a "displacement effect" [12]; [13]. However, if history is anything to go by, they say more jobs will be created rather than destroyed in the long run. These benefits will be achieved in the longer term. However, certain short-term questions must be resolved, in particular concerning the polarization of income and the need to requalify certain segments of workers. Alfred Sauvy's spillover theory, which argues that technical progress does not harm growth and employment, served as a reference for defenders of the thesis which states that new technologies are major engines of growth and development. , capable of positively transforming the world of work. For [14], technical change does not eliminate jobs, but it shifts them. Technical progress has positive effects on growth and employment in the long term, which more than offset short-term job losses. Technological innovation generates productivity gains which result in wage increases or price reductions, and therefore an increase in purchasing power. The part of the gain that returns to shareholders via profits allows either an increase in investments (growth in the consumption of capital goods) or an increase in the consumption of final goods. Companies must therefore hire to adjust to the growth of new demand. There is therefore a spillover effect of jobs from the sectors which destroy them to those which create them. Disruptive technologies create growth in the sectors they enter or create entirely new sectors through the introduction of significantly cheaper, better, and more convenient products and services. Nevertheless, the necessary transition phases of new economic models and adapted institutions [15].

For his part, [16] expresses concerns about disruptive technologies because the latter transform the nature of jobs increase the complexity of worker's collaboration with machines and coordinate increasingly fragmented and scattered tasks on supply globalized value chains. Indeed, Industry 4.0, has induced a faster pace of change than previous technological revolutions, such as the steam engine at the end of the 18th century, electricity, mass production at the beginning of the 20th century, and even the ICT revolution at the end of this century. Many researchers are unanimous on the challenges that will be imposed by these disruptive technologies, particularly in terms of the replacement of the workforce by robots, the skills required to survive in a disruptive environment, and the education and training system that will accompany this transition. From this arise other concerns relating to the drop in wages, and the social protection of those left behind induced by this great technological upheaval [17].

First of all, let's start by taking a look at what disruptive technologies are. According to the literature, they involve a wide range of technologies, processes, and materials. They include artificial AI, generative AI, robotics, quantum computing, the Internet of Things IoT, virtual and augmented reality, drones, and cyber currencies. At the level of biotechnology, we are seeing the emergence of disruptions in the field of neurotechnologies with brain implants, genetic editing, stem-cell biology, Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR), synthetic biology and nanomaterials, etc. Researchers estimate that smart power grids, low-carbon energy information systems, intelligent transportation systems, mobile collaborative learning systems, collaborative manufacturing, smart energy, logistics digital technology, green ecology, smart cities, and Fintech are also disruptive technologies (we will detail all of these technologies in section I).

Disruptive technologies contribute to the intensification of uncertainties affecting the sphere of work [18]. In the VUCA era, the configuration of work will be disrupted on several levels: what we expect from our work, where we work, how we work, when we work, and who we work with. As a result, [16] highlights the division of economists concerning the fallout from this technological wave. Some economists have demonstrated their skepticism about the future of employment and expect that past trends of job destruction, polarization, and increasing income inequality will continue [19]. The current technological change is different since human workers will be replaced by robotization and AI, the uberization of the economy, and the rise of platforms generalizing independent work for all. The most pessimistic scenarios paint a black picture of a "jobless future" with the increase in the precariat as "taskers" become more and more numerous [20], [21]. Others are convinced that economic, social, and political forces will lead to adjustment processes that create new and better jobs.

In this sense, [17] believes that it is not currently possible to predict the overall impact of technological disruption on employability but historical evidence suggests that in the long term, the first effect compensates for the second, and employment and real wages will eventually increase. However, the transformation seems to go further this time threatening even high-skilled and knowledge-intensive jobs. Unlike previous waves of automation, which had the strongest effect on middle-skilled workers, the risks of AI displacement extend to higher-paid workers. Thanks to strong complementarity, the best-paid employees can expect a more than proportional increase in their income, which leads to an increase in labor income inequality. This would amplify the rise in income and wealth inequality that results from improved capital returns that benefit high earners. Those who own AI technologies or have stakes in AI-driven industries may experience increased capital income. This change could potentially exacerbate inequality [24].

The paradox induced by disruptive technologies lies in the opportunities offered by them but they also, cause profound ruptures in existing economies. Automation, AI, and other technical innovations threaten the existence of a large number of jobs in different sectors, from the lowest to the highest rung of the socio-economic ladder, including in high-tech industries and even administrations [22]. Increased digitalization and automation are expected to have a significant impact on the number and quality of jobs. Data from the International Federation of Robotics shows that the number of industrial robots per 10,000 workers has continued to increase rapidly over the past five years in all countries [23], [24]. Indeed, robot density has almost doubled over the past five years, reaching 126 robots per 10,000 workers on average. Disruptive technologies will have a profound impact on job availability and working conditions in the decades to come, and could lead to dramatic changes in people's lives"[25] . However, [26] argues that "disruption" appears in a context where everything must move quickly, too quickly, and therefore our world does not have the time to integrate the changes, to become aware of the negative of the situation, to analyze it to change it for the positive and to be able to appropriate it at all societal levels. [22] believes that we must be careful in assessing these emerging technologies before we can fully appreciate their positive effects on humans, societies, States, and the planet. Few organizations, whether governmental, commercial, academic, or religious, have a sufficient level of expertise to carry out this analysis, and fewer still can transmit their results to us in an accessible manner. The same paradox is highlighted by [27] who argues that history shows that the economy has constantly adapted to technological progress by creating new job opportunities and that these new jobs often require more skills and higher salaries. However, there is good reason to worry that this time could turn out to be very different because technology is accelerating (doubling about every two years, according to Moore's famous law) rather than growing linearly. We can expect that the years and decades to come will be marked by much greater progress than what we know from historical analysis. He states that AI and Big Data today only rank 15th among core soft skills and are the third priority in corporate training strategies by 2027. In all sectors, 75% of organizations plan to introduce AI in the next five years.

It appears from the literature consulted that reflection has already begun to "compensate" those left behind by disruptive technologies. In this sense [28], proposes the creation of a superfund for workers who lose their jobs following the necessary transitions to renewable energy sources. A universal basic income (UBI) for all, regardless of their connection to the labor market. [21] for its part proposes a sovereign fund established with taxes on the exploitation or ownership of assets. Bill Gates proposes a tax on robots to finance the retraining of workers who lose their jobs. [29] advocate taxation of national resources and reallocation of public funds to eliminate the lowest levels of poverty. Transformative technologies become more capital-intensive, knowledge-intensive, and more complex, the demand for skilled workers increases, establishing a complementary relationship between capital and human capital [16]. New professions will emerge, particularly at the intersection of professions, software, and machines, such as big data architects and analysts, cloud services specialists, software developers, and digital marketing professionals, professions that did not previously exist almost none a few years ago [30]. It is difficult to imagine what kind of jobs will be created for unskilled workers through the robotization revolution, although the possibility cannot be ruled out. It is more difficult to imagine societies composed only of individuals with the aptitude or desire to develop superior skills. It is also difficult to imagine the lasting societal commitment necessary to increase the level of skills of all. There is very little reason to believe that the declining share of labor in national income will not continue.

A new situation that is emerging concerns the jobs that will develop are "green jobs"; job creation will be pronounced in the Energy, Materials and Infrastructure sectors [31]. This thesis is defended by [28] who posits that major investments in energy efficiency and clean renewable energy needed to stabilize the climate, amounting to between 1.5 and 2% of global GDP per year will also boost job creation in all regions of the world. According to him, building a clean energy economy will be a positive source of job creation in all countries. He predicts that three economic sectors will experience a relatively large increase in employment, namely agriculture, where increased employment opportunities will result from the expansion of bioenergy production; construction through building retrofits to improve energy efficiency and infrastructure investments to modernize the electricity grid and public transportation systems; and the manufacturing sector to meet the growing demand for solar panels, wind turbines, and other renewable energy equipment.

And what about developing countries in all this? What would be the impact of these disruptive technologies on developing countries in Africa and more precisely our country: Morocco? [32] asserted that technological innovation creates winners and losers because it rewards those who adopt it early at the expense of those who fail to act quickly in transforming their production processes. Both cause and consequence of divergent growth and development trajectories, these countries have developed a variety of modalities of interaction between capital and labor. According to him, most countries in sub-Saharan Africa, Latin America, the Middle East North Africa, and the rest of Asia have failed to transform the global waves to their advantage. He added that the main risk for developing countries today lies in being trapped in old technologies rather than suffering from exponential technological change. It highlights the crucial role that country- or region-specific factors play in determining whether or not technological innovation and job quality move together. [32] believes that the future of work in the Global South requires the intersection of different factors such as skills, technology, infrastructure, regulations, and demographics.

2. PROBLEM STATEMENT

We note the great complexity of the theme relating to the impact of disruptive technologies on work. The scale of this technological revolution and its sophistication make it difficult for researchers to have a clear vision of its consequences. Understanding the impact of technologies on labor markets is key to determining whether people will be able to transition from declining occupations to the jobs of tomorrow. With this in mind, we will try to answer the following question: What are the megatrends on the disruptive technologies and employment nexus and with what effects for Africa and more particularly Morocco? Therefore, our research work aims first and foremost at the presentation of disruptive technologies. Secondly, we will present New Forms of Work or Atypical Jobs. Thirdly, we will carry out an analysis of the consequences of these technologies on employment in Morocco. Several questions arise from our central question:

- What are the megatrends that tomorrow's workers will face?
- What are the new forms of work?
- How could AI reshape income and wealth inequalities?
- What skills are required in the era of disruptive technologies?
- What protection systems for those left behind by the technological revolution?
- To what extent have the social sciences been able to support this change?

3. METHODOLOGY

A systematic approach was adopted to identify disruptive technologies. This literature-based discovery process is particularly useful for identifying disruptive technologies that might require input from many technology domains. A documentary search was carried out in electronic databases: Google Scholar, Science Direct, Scopus, and Sage. The multidisciplinary databases included original research articles published in peer-reviewed journals, books, theses, and reports covering concepts of Industry 4.0 between 2018- 2024.

1. DISRUPTIVE TECHNOLOGIES: A KALEIDOSCOPIC VISION

1.1 First, let's talk about disruption

Initially, the disruption comes from advertising. Invented by [33] who published a book in 1996 entitled "Disruption: Overturning Conventions and Shaking up the Marketplace". [34] introduced the term (disruptive technology) through his book "The Innovator's Dilemma". He defines "disruption" as "an innovation which ends up replacing a dominant product or service in a market". Disruptive technologies are those that cause an upheaval in the market structure. At first, these technologies operate on the margins, but eventually, they supplant conventional technologies. The disruption of emerging technologies may not come so much from disrupting the existing market or technological paradigms, but rather from disrupting the existing model of capitalism, organizational structures, or social interactions. As highlighted by [354] who identifies two levels of disruptive technologies: 1) a first-order disruption that induces localized change, within a market, sector, or industry and 2) a second-order disruption that has much larger influences, affecting many sectors and significantly changing societal norms and institutions. In other words, these technologies disrupt social interactions and relationships, organizational structures, institutions, and public policies.

Table 1: Potentially Disruptive Technologies

Technology	Description
Additive manufacturing (3Dprinting, 3D scanning) Advanced simulation (3D modelling and 3D visualization)	Assembly of advanced materials. Rapid prototyping is the process of allowing manufacturers to quickly make design and product changes by taking advantage of computer programs and prototyping equipment, such as 3D printing.
Adaptive Security Architecture and Cybersecurity	Digital and virtual security for an organization or computer network
Advanced Materials	Category of new materials that are designed for improved and enhanced properties. This can include nanomaterials, composites, polymers, and metals.
Artificial Intelligence and Machine Learning	AI represents a broad range of technologies designed to enable machines to perceive, interpret, act, and learn to imitate human cognitive abilities. Within this spectrum, generative AI includes systems such as large, sophisticated language models that can create new content, from text to images, by learning from deep training data. In contrast, other AI models are more specialized, focusing on discrete tasks such as pattern identification. (IMF, 2024).
Augmented, Virtual, and Mixed Reality	AR consists of enriching reality by integrating and superimposing virtual information (sounds, 2D, 3D images, video, and text) using different devices such as smartphones, tablets, or Hololens. Augmented reality is designed to provide a unique, personalized, and revolutionary customer experience.
Autonomous Vehicles; Autonomous Systems	Operation of a vehicle or system without human intervention. Autonomous vehicles are also known as self-driving or driverless vehicles.
Blockchain; Digital Payments; Digital Currency	Digital ledger for use with virtual currencies and electronic payments (Bitcoin, Central Bank Digital Currency (CBDC)).
Chatbots	An automated computer algorithm designed to simulate human conversation
Cloud Computing and Cloud Technologies	Use of network of remote servers and internet to store and process, rather than using a local personal computer
Cyborgs and Cyborgification	A hybrid of biological and electronic system
Big Data (data mining, data analytics, and advanced algorithms)	Collection, Processing, Analysis, and Utilization of data from networks, sensors, computers, and electronic devices. Often used to identify and exploit patterns of behavior.
Digital ID	Digital or virtual individual identification
Digital-Physical Integration; Enhanced Humans	Using technologies to enhance, improve, or assist humans. The technologies are embedded in the physical system, as opposed to being external to the system.
Digital Twins	Virtual or computerized companion, often using data from the original to inform the twin.
Energy Storage	A device that captures and stores energy produced for use later. Critical for full implementation of intermittent renewable energy sources.
FinTech and Financial Innovations	Computer technologies and algorithms used for financial and banking. Often these programs and services are automated.
Internet of Things	Interconnection and networking of devices through the internet, and individuals to record, monitor, and optimize their activities in real time
Nanotechnology (advanced materials, nanomaterials, nanobots)	Nanometers are 10-9 meters or 1 billionth of a meter. Properties of materials change significantly at this scale.
On Demand Platforms and Services	The provision of services at the precise moment that they are needed or desired. A platform is a group of computers, devices, or technologies that are used as the foundation for different software applications or programs.
Precision and Personalized Medicine	Medicine and treatments tailored to a specific patient, based on their specific genetic and lifestyle factors.
Quantum Computing	Computing Computing based on quantum theory
Quantum technologies	Quantum technology is a class of technology that works by using the principles of quantum mechanics (the physics of sub-atomic particles), including quantum entanglement and quantum superposition.
Remote Monitoring	The monitoring of activities and functions at a distance via electronic or computer devices, sensors, and probes.

Robots and Robotics	A robot is a machine capable of being programmed to act automatically. When coupled with artificial intelligence, the machine can also learn, perceive, and act autonomously.
Intelligent systems; Smart infrastructure	An intelligent system is a system integrated with electronic sensors and controls that allow it to react, adapt, predict, and correct itself. Smart infrastructure and smart grids use data to respond to changes in supply and demand.
Biometrics	Measuring and monitoring biological functions, often health-related.
Biotechnology	Coupling of technologies and biology to monitor or manipulate biological functions.
Genomics, Gene Sequencing, and DNA testing	Sequencing of DNA, genomes, and genes provides a map or guideline for the creation and functioning of the organism.
Genetic Engineering; Gene Editing using CRISPR	Engineering and manipulation of genes and genetic materials. CRISPR is a specific tool that allows for the editing of genes.

Source: [35]

1.2 INDUSTRY 4.0.

Invented by German mechanical engineers in 2011, the term "Industry 4.0" describes the widespread integration and adaptation of ICT in industries. Industry 4.0 has been defined as the massive development stage of industrial manufacturing, comprising the organization and management of the entire value chain, and its technologies constitute the blurred boundary between the physical, digital, and biological production or manufacturing system [36]. They identified 35 quantified disruptive technologies and 13 key technologies: Internet of Things, Big Data, 3D printing, Cloud computing, Autonomous robots, Virtual and augmented reality, Cyber-physical systems, Artificial intelligence, Sensors, Simulation, Nanotechnology, drones, and biotechnology have been identified. However, the definition of Industry 4.0 remains ambiguous and has not yet been stabilized. According to [37], Industry 4.0 will increase the visibility of existing inequalities between people, businesses, and countries around the world, as each country adopts its own technologies in its own way.

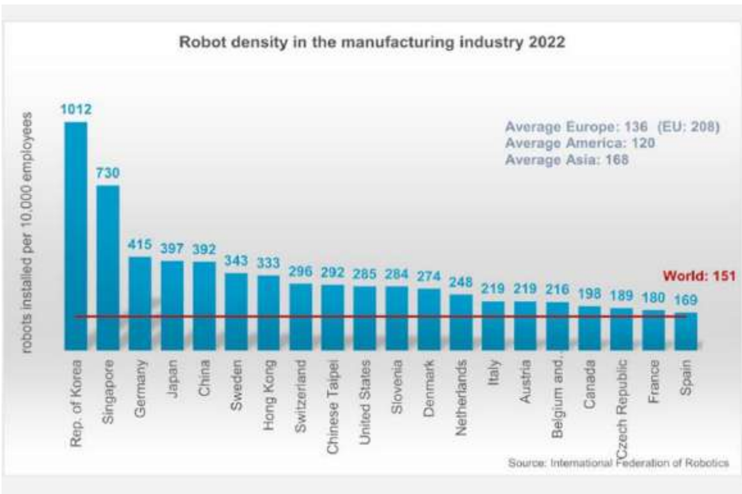
Table 2: Potentially Disruptive Technologies

Disruptive technology	Definition
Autonomous robots (industrial robots, robot arms)	Autonomous robots are advanced machines that can perform tasks and make decisions without human intervention, using AI, sensors, and computer systems.
Cyber-physical systems (CPS)	Systems that are networked and have the computing (cyber) component closely integrated with the physical components. Cyber components detect the state of the system and the environment and then provide continuous feedback to control the system and act on the environment.
Smart sensors (smart actuators, smart objects, and smart dust)	A smart sensor network is an embedded WSN made up of a set of sensors, called nodes, integrated into the structure of interest in predetermined positions, to monitor a particular event or measure a parameter (temperature, pressure, etc.) in continuous and in real-time, communicating wirelessly with at least one Sink Node, with calculation and/or storage functions.
Industrial Internet of Things (IIoT) or industrial Internet	Thanks to the establishment of an ecosystem made up of connected objects (machines, connected sensors, etc.), IIoT makes it possible to collect data in real-time which is then processed and analyzed to optimize performance machines, improve operator productivity, and increase customer satisfaction.
Smart factory and intelligent factory	An interconnected network of machines and communication mechanisms benefiting from high-performance computing capabilities. The smart factory is a cyber-physical system that uses advanced technologies like artificial intelligence (AI) and machine learning to analyze data and manage automated processes while learning over time.
Internet of Services (IoS)	Involves a wide range of technologies. The main four that play a vital role in materializing the Internet of Services vision are Cloud Computing, service-oriented Architectures (SOA), Big Data, and Mobile Devices.
Machine-to-machine communication (M2M)	Used for automated data transmission and measurements between mechanical or electronic devices. The key components of an M2M system are: Field-deployed wireless devices with embedded sensors or RFID-Wireless communication networks with complementary wired access including, but not limited to, cellular communication, Wi-Fi, ZigBee , WiMAX, Wireless LAN (WLAN), Generic DSL (xDSL) and Fiber to the x (FTTx).
Manufacturing execution system (MES) and SCADA	Optimizing production processes is one of the objectives of a manufacturing execution system (MES), which facilitates the digitalization of manufacturing operations. SCADA, which stands for Control and Data Acquisition System, is a system that allows operators to monitor and control industrial processes through a graphical interface. SCADA focuses on monitoring and data collection through sensors and actuators.

Advanced human-to-machine interface (HMI)	An advanced human-machine interface (HMI) is a system that allows intuitive interaction between a human operator and automated machines or systems. It provides tools and visualizations to control and monitor complex processes, improving the efficiency and safety of operations.
Internet of Data (IoD)	Allows direct access to data on any network when it has at least two characteristics: identification and confidentiality.
Internet of Energy (IoE) (smart grid)	System based on digital sensors and advanced controllers that integrate power plants, renewable energy, data management networks, as well as electricity and storage networks. It represents a transformation of smart grids, aiming to create a more flexible and efficient power network.
Flexible production system (FMS) and cluster concept	Designed to easily adapt to changes in products and quantities. It combines elements of flow and batch manufacturing systems, allowing different styles of parts to be processed simultaneously. The concept of a cluster, often used in conjunction with FMS, refers to a grouping of machines and resources that work together to produce a diverse range of products, thereby optimizing production efficiency and flexibility.
Location detection (digital traceability and GPS)	A system that uses GPS technology to monitor the location of an object, person or vehicle accurately and in real-time, which is essential in various fields such as search and rescue operations, logistics, and security.
Drones, UAV (Unmanned Aerial Vehicle), RPA (Remotely Piloted Aircraft) and UAS (Unmanned Aircraft Systems)	UAV: refers to any unmanned aerial vehicle used for recreational or professional applications. RPA: refers to aircraft piloted remotely by a human, often controlled in real time. UAS: encompasses unmanned aircraft systems, including drones, ground control, and all associated communications systems. These definitions are interconnected and define various aspects of unmanned aerial technologies.
Neurotechnology	The assembly of methods and instruments allows a direct connection of technical components with the nervous system. These technical components are electrodes, computers, or even intelligent prostheses.
The industrial metaverse	A digital world that integrates technologies such as cloud and edge computing, industrial AI, and digital twins, allowing us to mirror and simulate real machines and factories, buildings and cities, networks, and transport systems. It can optimize processes and foster sustainable practices, shaping the future beyond simulation. It will be an always-on (persistent) world, allowing the interaction of an infinite number of people and assets (concurrents) and providing full immersion in a physics-based, photorealistic, real-time simulation. In this digital environment, individuals can break the barriers of distance and work together across countries and continents, enabling a whole new level of collaboration.
Omniverse	Set of all possible universes, including the multiverse and all realities, dimensions, and variations resulting from it. It is a broader notion than the multiverse, which focuses only on a set of parallel universes, while the omniverse encompasses everything that exists, including universes that can be completely different from each other.
5G network	The fifth generation of standard technology for cellular networks. It represents a new wireless standard after previous generations (1G, 2G, 3G, and 4G). It offers faster data transmission speeds, reduced latency and the ability to connect more devices.
6G	Sixth generation of wireless communications technologies supporting cellular data networks. It will succeed 5G and meet the needs of speed-hungry systems for transporting large quantities of data, in particular intelligent transport systems, interconnected vehicles, the Internet of Things, holographic communication, and the digital twin. 6G will likely be much faster, at speeds of around 95 Gb/s (ITU, 2023). The conceptual phase of 6G development has been launched. Technical standards will begin to be developed in 2027 and deployment will begin in 2030.

Source: [36]

Figure 1. Robot density per 10.000employees



1.3 BIOTECHNOLOGY

Biotechnology encompasses many fields such as synthetic biology, molecular biology, genetic biology, gene editing, proteomics, biomimicry, and genomes [“-].In the era of Industry 4.0, synthetic biology will be increasingly explored, and its main function consists of the creation of artificial biological devices or organisms capable of imitating systems organically created naturally. The main application areas of synthetic biology are agriculture and healthcare. In the era of Industry 4.0, synthetic biology will be widely used in the field of renewable and clean energy with improved efficiency for powering many systems such as robots and self-driving cars.

1.4 HUMANITY 2.0

In his book entitled “The Singularity is Near”, [38] predicted that the exponential development of new disruptive technologies will lead to the emergence of Humanity 2.0. In this book, he describes his vision of technological singularity, through the combination of three main sciences: genetics, nanotechnologies, and robotics combined with AI. The revolutions in bioinformatics, brain sciences, genomics, proteomics, and therapeutic cloning of organs and tissues will allow humanity to live longer. Man and technological networks will interpenetrate and mutually reinforce each other in a way that will extend the frontiers of intelligent life without predictable limits. The distinctions between human and machine, between reality and virtual reality, will gradually blur. People will be able to adopt different bodies and multiple versions of their minds. From this perspective, transhumanists will speak of post-humans leading to the Singularity which means technological change so rapid and profound that it represents a rupture in the fabric of human history. The dizzying dynamics of AI associated with progress in the fields of nanotechnology, biotechnology, computer science, and cognitive sciences (NBIC) will probably lead transhumanists to the fusion of man and machine, of the union of biology and technology. The effective fusion of man and AI would herald the birth of a new humanity that would benefit from the analytical capabilities of a supercomputer and would be freed from the disadvantages of the biological body. The future will tell us…

2. DISRUPTIVE TECHNOLOGIES AND JOBS

2.1 ATYPICAL FORMS OF EMPLOYMENT (FAE)

Disruptive technologies have given rise to the birth of Atypical Forms of Employment (FAE). According to [39], typical employment concerns a type of regulated, continuous, indefinite, full-time work, falling within a direct relationship of subordination between employer and employee. On the other hand, Atypical Forms of Employment (FAE) concern a type of temporary, part-time work, agency work, and other multi-party employment relationships, disguised employment relationships, and legally independent, but economically dependent employment. These are situations where employment relationships are ambiguous because the respective rights and obligations of the parties involved are not clearly defined [41]. Atypical Forms of Employment are characterized by working hours that are not fixed in advance. The employer is not required to offer a given number of working hours and the worker is not directly employed by the company for which he provides a service. These contractual arrangements are commonly referred to as “on-call” or “on-demand” work. In this type of work, workers are generally not covered by labor legislation or social security schemes.

On their part [42]coined the term “heteroatom” to refer to the genesis of many types of self-service, collaborative and voluntary work, crowdsourcing, micro-working, and a wide range of other activities that provide economic value to businesses and organizations, but little or no monetary compensation to workers. According to them, the digitalization of the economy has transformed the division of labor between humans and machines, pushing many people into low-paid work or being accepted as “users” of digital technology. Tasks are performed by individuals who are neither employees nor independent contractors.

This reconfiguration raised questions about the perspective of integration of this community of workers into the labor market, its inter-professional mobility, its level of remuneration, its rights to social security benefits, its access to training, to protection in terms of safety and health at work, its ability to exercise its rights in terms of freedom of association and collective bargaining, etc. The statuses are ambiguous, between salaried employment and independent work. On the positive side, we can remember the great flexibility and autonomy. On the negative side, in terms of remuneration, it turns out that salaries are low or even extremely low, payment is often fraught with uncertainty, and there is no possibility of accessing benefits. In terms of status, there is no social protection, information asymmetry, and no reliable reference systems for conflict resolution. For the worker, we will also note the boredom linked to the poverty of tasks and their repetitive nature, social isolation, the stress of self-organization, and finally the blurring of the boundaries between private and professional life and a possibility violation of privacy.

2.2 THE PLATFORMIZATION OF EMPLOYMENT

Across the world, we are seeing the rise of the “on-demand economy,” where work is distributed through web platforms or mobile applications. Workers in these new forms of employment are classified as independent contractors, while their remuneration depends on the work provided. Thus, some of these workers have a greater risk of finding themselves in ambiguous employment relationships, or legally independent but economically dependent work [40]. The appearance of collaborative platforms is one of the most important recent changes in the world of work. The latter are based on digital intermediation, either via open outsourcing platforms (“crowdwork”), or mobile applications using geolocation. Crowdworking refers to work managed by online platforms that allow organizations or individuals access to an undefined and unknown group of other organizations or individuals willing to solve specific problems or provide specific services or products in exchange for payment. Crowdworking is characterized by intensive professional use of ICT, as well as a wide diversity of workplaces: home, local clients, external sites, public transport, hotels, coworking spaces, or any other [43].

Three main types of crowdworking on platforms are identified. The first type consists of marketplaces for fragmented virtual services, micro-tasks that can be run from anywhere with a computer and an Internet connection. Work is only paid if it is done well. Workers are rated by the platform and their rating is displayed when they apply for a task. The second type involves crowdworking for independent tasks. These platforms are only open to independent professionals, who must be certified by the platform and provide professional credentials. Freelancers announce their daily or hourly rates, and labor seekers select them based on profiles and prices. A third type consists of crowdworking for material tasks and services, executable at the local level. The tasks are not virtual and consist mainly of tasks: shopping, babysitting, watching pets, gardening, home repairs, and a wide variety of tasks that generally do not require specific tasks [37].

The emergence of platforms and ubiquitous connectivity has given rise to fragmented work, a more mobile workforce, where workers take short-term jobs, often on a contract or piece-rate basis. This creates greater flexibility in employment and increased precariousness. It can also create greater income instability and volatility. According to the [41], digital labor platforms generated global revenue of at least $52 billion in 2019. Around 70% of revenue was concentrated in just two countries, the United States (49 &) and China (23&), while the share was much lower in Europe (11%) and other regions (17%). The seven largest global technology companies reported cumulative revenue of more than $1.01 trillion in 2019, and most of these companies are investing heavily in digital workplace platforms. In this order, digital platforms increase the amount of unpaid work that is not considered work, by creating forms of work that were not previously done at all and by converting certain forms of paid work into unpaid work [42].

2.3 ALGORITHMIC MANAGEMENT

The organization of work is also disrupted by what is called algorithmic management, which consists of the delegation of managerial functions to algorithmic and automated systems. This involves the strategic monitoring, evaluation, and management of workers through algorithms, replacing some tasks traditionally carried out by humans. [44], new algorithmic management models are associated with both intensive digital surveillance, which reduces worker control and autonomy, and illegal bias against certain workforce groups' role in recruitment, selection, and job allocation decisions [45]. Among the most discussed impacts of algorithmic management on the work of platform workers we can cite the precariousness of employment and income, due to the unpredictability of work demands; difficulty making autonomous decisions in carrying out tasks to comply with given instructions; accidents, and mental distress at work; high work intensity to meet needs or earn a living by working on platforms [46].

Table 3: Examples of atypical forms of employment

Forme du travail	Caractéristiques
Wage portage	Wage portage is a form of employment that combines elements of employment and entrepreneurship. This is a tripartite contractual relationship between an employee, an umbrella company, and a client. The employee chooses and negotiates his missions with clients while benefiting from employee status and associated social security coverage.
Employee sharing	The worker is hired jointly by a group of employers and works on a rotating basis in different companies. Job sharing is where a single employer hires several workers to jointly fill a specific job position on a rotating basis to perform the same function within the same company.
Casual work	Refers to the employment contract not requiring the employer to regularly provide work to workers, but offering the flexibility to call them on demand.
ICT-based mobile workers	Workers whose main place of work is not their employer's premises (or their own if they are self-employed) and who use ICT most of their time.

Voucher based work	Refers to situations of employment paid on vouchers that the buyer of a service can acquire from a third party (usually a government agency) and which covers both salary and social security contributions.
Portfolio work	Refers to situations in which a freelancer works for a large number of clients and only provides small jobs for each of them.
The "zero hours" contract	The employer guarantees an employment contract but does not commit to providing continuous work. This type of contract is based on the principle of on-call work, depending on demand. The employee must remain available to the employer without the latter being subject to the obligation to provide him with any working time and the employees must be immediately available. Zero-hours employment contracts and "casual" employment contracts are often confused as they share several similarities. In both cases, the employer is not required to offer a guaranteed volume of work. However, a zero-hours contract specifically means that there is no guarantee of work, while a casual contract may involve more variable periods of work, where there may be agreed hours or sporadic commitments. It is important to understand the details of each type of contract, as they can have different implications for employee rights.
Crowd working	Refers to online platforms that connect supply and demand for work for projects divided into microtasks and organized through a virtual cloud. Crowdsourcing of work or crowd working can be translated as open outsourcing of work or outsourcing to the multitude. It refers to work carried out from online platforms that allow organizations or individuals to access an undefined and unknown group of other organizations or individuals via the Internet to solve specific problems or provide specific services or products, in exchange for payment (Green et al. 2013).
User generated content	Refers to all original content created by users of a brand and published on the Internet. This includes, for example, customer reviews, photos, videos, and comments relating to the brand.
Prosumer	Kind of work where it's not always easy to distinguish the producer from the consumer.
On-call working	Occurs when an employee must be available to work on short notice. This may mean being on call during normal working hours or 24 hours a day, 7 days a week. While on call, an employee may be at home, at work or elsewhere and waiting for a possible call. It is essential that he is reachable within the previously agreed time frame and that his work can start as quickly as possible. On-call service may be for a specific job or task, or it may be general. An on-call employee does not work but must be available to work if necessary. This means that the employee can be called to work at any time, even outside of their usual working hours.

2.4 Social implications on work induced by disruptive technologies and atypical forms of employment

The growth of atypical forms of employment poses challenges to the relevance of labor law and social security. All forms of participatory work disclaim all responsibility of the employer, leaving the responsibility for tax status, social security, insurance, etc. borne by the workers. Most platforms not only consider workers as service providers, but also establish their own rules to which workers must comply and submit, and retain the freedom to change them unilaterally. In crowdwork, pay rates are low or extremely low. Wages are not guaranteed and workers are systematically put in competition with other workers, even globally in the case of online tasks. Consequently, the links of subordination become more and more blurred. The representation of collective interests is also threatened, and structures for worker representation and social dialogue are mostly absent.

Many experts say the job market will become more divided, with well-paid, highly skilled IT workers and managers, software developers, and others on one side, and low-skilled, more highly skilled workers on the other often in precarious conditions. For [21], the 20th-century distribution system, which prioritized employment and employment-related social benefits, has irreversibly collapsed. However, a system anchored on a basic income would particularly benefit workers, as well as the precariat in general. These developments have created a new, rapidly expanding "precariat" class, made up of millions of people forced to accept a life of unstable work and living, with no professional identity or corporate narrative to give to their lives. And the amount of unpaid "work" increases relative to the amount of paid "work", as more and more people work away from their fixed workplace and outside of fixed working hours, or in jobs that are only paid when they are "on assignment", ignoring travel time. The precariat has grown around the world with the spread of flexible working practices and associated economic insecurity. The global "precariat" concerns several million people without an anchor of stability or security. They are becoming a new dangerous class in the making. The shift to non-regular employment, flexible employment, casual and temporary work, with part-time work and the growth of employment agencies. [27]argues that a guaranteed basic income should be adopted by states to address the threat of a "jobless future." Yet technological change has not received much attention in political science.

Technology dividends are unevenly distributed among companies. Some cutting-edge companies are taking full advantage of new technologies. In addition, entrepreneurs and micro, small, and medium enterprises find it difficult to adapt to new technologies. This phenomenon is accompanied by the rise of highly concentrated markets for products and services, generally dominated by a very limited number of star companies, as we saw above concerning big data [11].

[26] believes that "the social system is distraught by disruption". Indeed, theoreticians, academicians, and sociologists no longer have the time necessary to theorize the effects of disruption on Humans and Social matters.

According to him, disruption is also, from a systemic point of view, extremely problematic because it increases the rate of entropy in the universe, at all levels: physical, economic, mental, political, cultural, and informational. He does not believe that disruption works like speculation: it pays off enormously in the short term when we are ahead of everyone, but in the medium and long term, it reverses, and above all, it destroys the economic system. According to him, it is urgent to rethink, to reorient disruptive potentialities, not to destroy the social, but to reinvent a new form of society.

3. A GLASS CEILING FOR AFRICA?

After having clarified the concepts relating to disruptive technologies and new forms of work, we will try in this second section to refocus the literature review on the subject of the repercussions of these trends on Africa with a focus on Morocco. The overall impact of disruptive technologies on macroeconomic development in Africa is still unknown and multiple scenarios abound, ranging from overly optimistic to exceptionally pessimistic. For [4], Africa is unique in its experience. It has neither benefited from the benefits of the digital revolution nor been hit by the massive loss of mid-level jobs observed in many developed countries. For several decades, it has been grappling with the challenges of globalization and its demographic transition will only amplify. Africa's population is expected to almost double to reach 2.5 billion people by 2050, which would; be home to the youngest population on the planet. This impending youth bulge is expected to trigger demand for 1.1 billion jobs across all skill levels.

On this point, [17] underlines the technological delay in Africa in the diffusion and retraining of their current and future workers. He believes that the diffusion of technologies is now lower than during past technological revolutions. This is due to the high costs of technologies, particularly in the informal sector where the majority of Africans work today and where they will probably continue to do so, 86% of jobs in Africa were in the informal sector (72% excluding agriculture), the most highest in the world [47].

This could exacerbate development gaps compared to advanced countries, as has happened during previous technological "revolutions". On this point, experts believe that Africa can potentially overcome certain aspects of automation that have disrupted developed economies. For example, the reliance of the informal sector on manual labor could be circumvented by moving directly to advanced digital solutions. However, this observation should be taken with a grain of salt because the global economy still does not have a comparable set of transnational data for developing countries on these fundamental questions [17].

Thus, [5] predicts that 26% of jobs in low-income countries around the world will be affected by AI. Developing economies may experience less immediate AI-related disruption, but they are also less ready to capture the benefits of AI. This could exacerbate the digital divide and income disparities between countries. The impact of AI is also likely to differ significantly between countries, at different levels of development, or with different economic structures. Advanced economies, with their mature, service-oriented industries. However, these economies could also miss out on early productivity gains from AI, given the lack of infrastructure and skilled labor. Over time, the AI divide could exacerbate existing economic disparities, with advanced economies exploiting AI for competitive purposes.

The effects on employment following the potential exposure of professions to generative artificial intelligence vary across country groups, with exposure to automation of 5.5% in high-income countries compared to just 0.4% in low-income countries. Thus, creating proactive policies to support just and orderly transitions, is very important. It is therefore essential to encourage social dialogue and regulation to promote quality employment [48]. The impact of technologies on employment is a non-deterministic process that differs across countries. The employment impact of these new technologies will vary depending on the skill composition of the manufacturing sector and the structure of the education level of workers in different countries. Expanding markets for existing goods and services and creating new products and services will generate more jobs. However; such compensatory effects, depend on the distribution of benefits from technological change. For her, the impact of robotization and digitalization on employment is ultimately a political and not a technological question. The future of jobs will be different depending on the ability of countries to create the conditions conducive to this redistribution. Many new jobs can be created if governments implement policies that tackle some of the big problems we face, nationally and globally. The ramifications of the new technological revolution will likely vary across regions and countries around the world [16]. The spread of robotization and digitalization will likely make it more difficult for middle-income countries to link economic growth with the creation of decent jobs at scale [4]. For [53], modern technology has increased productivity and ushered prosperity in many countries, including BRICS (Brazil, Russia, India, China, and South Africa) and the middle-income economies of Asia. At the same time, countries with large numbers of workers with ordinary skills or less tech-savvy are being left behind, creating what is commonly referred to as the "digital divide."

Africa lies at the lower end of this digital divide. Africa's lack of access to modern technologies hampers the productivity gains that digitalization typically brings. Job creation options are limited despite its vast natural resources. Most workers rely on either agriculture or the informal service sector, where productivity and wages are low. It should also be noted that the Freelance market in Africa represents approximately 3% of the global online job market in 2022. It is concentrated in the countries of South Africa, Nigeria, Kenya, Morocco, and Egypt. Morocco represents 0.19% of the world total respectively. In 2022, 68% of online workers are located in five countries, with India hosting 22.2% of the global total, while Bangladesh provides 15.8%, Pakistan 12.2%, United States 4, 9%. For the African continent, Egypt represents 2.4% of freelancers in the global total. Moroccan freelancers constitute 0.56% [50]. The impact of robotization on employment in developing countries is a complex and controversial subject. There are potential pros and cons to consider.

The digital skills gap, infrastructure and logistics bottlenecks, insecure land rights, difficulties in importing inputs and exporting products, and red tape. If future public investments prioritize the needs of high-tech businesses, such as developing post-secondary STEM skills, rather than the productivity concerns of the large informal sector, such as improving access and quality of primary and lower services, secondary education, improved rural-urban connectivity and access to low-cost mobile Internet, income inequality will widen and economic development will not be inclusive. Globally, Third-world countries may have a harder time adapting to economic changes brought on by robotization because they often have weaker institutions and less developed social safety nets.

Table 4: Comparison of scenarios on the impact of disruptive technologies in Africa

Optimistic scenario	Pessimistic scenario
Increased productivity and better integration of companies into global value chains.	Loss of jobs in sectors where tasks are routine and repetitive can lead to increased unemployment.
Job creation in the industrial, services, and digital sectors (more than 16 million jobs by 2030, with a potential contribution of up to $180 billion to the continent's GDP according to the International Finance Corporation).	Income disparity and inequality: Productivity gains generated by robotization may not be shared equitably, which could increase income disparities between the rich and the poor.
Boosting e-commerce, Fintech and online platforms with over 400 million smartphone users.	Increasing the dependence of African countries on companies outside the continent to provide AI technologies. This could contribute to patterns of technological neocolonialism Relocation of manufacturing activities to advanced economies.
Improved income in the informal sector.	Relocation of manufacturing activities to advanced economies.
Revolutionize agriculture by accelerating precision farming, improving crop yields and sustainable farming practices, growing value and supply chains, expanding access to export markets and increasing the sector's contribution to GDP.	Disappearance of the middle class
Providing access to online education	Issues related to digital sovereignty and cyber security
Improving financial inclusion through fintech and enabling more efficient banking processes, risk assessment for loans, and personalized financial services, reaching populations. AI could also be harnessed to optimize business processes, and currency valuation and stabilize regional and national economies, promoting e-commerce.	
Improving healthcare services through remote care and health data management.	
Stimulation of entrepreneurship and innovation.	
Development of renewable energies and the development of the blue and green economy.	
Mitigating the effect of climate change.	

3.1 The Technological Transition In Morocco: What Issues

Like African countries, Morocco is beginning its technological transition. Industry 4.0 presents both challenges and opportunities for Moroccans. Numerous gigantic projects opened in diversified sectors including large infrastructures, logistics (the port of Dakhla Atlantique and the expansion of the TangerMed port, the port of Nador West Med), and renewable energies (the construction of the nine stations of desalination, Noor stations), dams, the automobile industry (also planning the launch of 100% Moroccan cars) and aeronautics. Moreover, Morocco aims to develop a national defense industry, achieved through the creation of suitable industrial zones aimed at developing industries specialized in military equipment and reducing dependence on arms imports. These initiatives include the creation of maintenance centers and the production of drones, thus contributing to strengthening the country's defensive capabilities.

Morocco has also announced the adoption of civil nuclear power and the intention to build nuclear reactors to diversify its energy sources, in particular by integrating renewable energies. According to the International Atomic Energy Association, Morocco would be among the future producers of atomic energy. Morocco is preparing to become a nuclear energy-producing country in the coming years, according to the International Atomic Energy Agency (IAEA). The start of the green hydrogen revolution Morocco's semiconductor industry is booming, supported by investments in equipment manufacturing and advanced technologies. The recent inauguration of a new electrical component production line by STMicroelectronics augurs a promising future in electric car manufacturing in the country.

All of these projects also include the integration of advanced technologies and a sustainable approach. This could involve investments in digital technology, robotization, artificial intelligence, the Internet of Things, and other key Industry 4.0 technologies. Companies that can successfully navigate this new environment will have a competitive advantage and be favored in accessing international markets.

However, currently, no strategy is specifically dedicated to Industry 4.0 in Morocco [(&]. Industry 4.0 presents considerable potential for Morocco through improved productivity and competitiveness. Overall, digitalization does not yet constitute a tool to stimulate employment in Morocco. According to Crunchbase, only 13 start-ups were able to raise more than 100,000 USD between 2011 and 2020. Automation and robotization can increase reduce costs and develop new products and services and improve the quality of existing ones. New professions will emerge in the fields of programming, cybersecurity and data management. According to the "Digital Evolution Index", Morocco is part of the "Break Out countries", that is to say, it is one of the nations with still weak digital evolution, but which are progressing quickly and can quickly claim the status of "Digital Nation". To this end, the advent of the industry of the future in Morocco will considerably strengthen competition to attract foreign direct investment. From a long-term perspective, the increasing penetration of disruptive technologies in businesses should lead to job losses in certain sectors, which would undoubtedly increase inequalities between citizens, but also between regions, hence the importance of support policies for the requalification of workers and the reduction of the digital divide.

In Morocco, the adoption of Industry 4.0 requires significant investments and skills, which can be an obstacle for some companies, particularly SMEs. There should be an opportunity, given the strong correlation between GDP per capita and the digitalization index [32], which however indicates that only 1.7% of the workforce in Morocco has digital talents. Digitalization needs a private sector with good governance and the security and sovereignty of its data.

Regarding employment on platforms, the Moroccan labor market remains very modestly impacted, i.e. 4.5%. Moroccan "taskers" face the same problems that suffer globally in terms of labor law [39].

Table 5. Ecosystem of the Digital Nation in Morocco

Indicator	Ranking	Year	Source
Internet access	97,18% équivalent à 35,64 millions	2023	National Telecommunications Regulatory Agency
Mobile Connectivity Index	84th	2019	Global Association of Mobile Operators
Global connectivity index	61st	2019	Huawei
Inclusive Internet index	59th	2020	Economist Intelligence Unit
Network Readiness Index	87th	2019	World Economic Forum
Internet growth	23,639 %	2020	www.internetworldstats.com
Broadband penetration rate	17.5% for fixed broadband 41% for mobile broadband	2015	World Bank
The percentage of households equipped with a computer or tablet	60,6%	2019	Statista Research Department.66
The online services index	78th	2018	World Bank
E-Governement developpment index	106th	2020	European Institute of Business Administration
The Global Innovation Index (GII)	75th	2020	European Institute of Business Administration
Business development around innovation	107th	2020	European Institute of Business Administration
Collaboration between companies and universities	117th	2020	European Institute of Business Administration
The exploitation of knowledge	110th	2020	European Institute of Business Administration
Robotic density (the number of industrial robots per 10,000 employees)	54th	2017	United Nations Conference on Trade and Development
Nombre de serveurs internet sécurisés	439,41	2020	World Bank

Table 6: Forecasts on the impact of disruptive technologies on the Moroccan economy

Sector	Positive impacts	Negative impacts

Industry	Increased productivity Better integration into global supply chains, particularly with smarter and faster supply chains. Improvement of abuse and products Made in Morocco.	Increase in unemployment among the category of less qualified workers. Increased competition for SMEs/I and VSEs who are unable to get on board with digitalization.
Agriculture	Increase in agricultural productivity, given that disruptive technologies can contribute to maximizing harvests through automation, research on seeds will have a positive impact on food security and the promotion of exports.	Deepening the gap between large and small farmers. Polarization of the sector by capitalistic minority versus a large fringe of farmers left behind.
Blue economy	Improvement of fishery resources through better knowledge of the marine environment and its protection while ensuring its sustainability. Advancement in biotechnological research in this sector will make it possible to exploit marine resources such as algae and initiate new revolutionary processes such as cellular agriculture (see our article on the Blue 3.0 economy for further detail on this point [52]). -Mitigation of the effects of climate change on the marine space.	
Finance	Increase in the rate of bankable people. Promoting the implementation of the e-dirham. Development of Fintech and e-commerce. Increased transparency and fight against fraud.	The digitally illiterate will be excluded with the increase in the lack of autonomy and freedom of citizens.
Éducation	New configuration of the education sector through the automation of teaching and the personalization of learning. The teaching profession will be profoundly changed.	Students and teachers who do not have digital skills will find themselves excluded from the new algorithmic agora.
Health	Improvement of access to care and medical and pharmaceutical research. Better readability for viruses and pandemics.	Because disruptive technologies are more expensive to begin with, improvements in healthcare will only benefit the wealthy and capable countries. Poor and territorially disadvantaged people will have difficulty taking advantage of this windfall.
Skills	The happy few who have skills in disruptive technologies will be the elite at the top of well-paid jobs in Morocco. According to the logic of market supply and demand, their skills will be highly valued even by other countries. This would mean that incentive policies should be outlined for them to avoid a brain drain. Given the youth of the techno-industrial revolution, digitally competent people will have a moment of boom before their skills are themselves taken from below by disruptive technologies.	Given the deep digital divide in Morocco, those who do not have digital skills will have difficulty integrating into the job market. This suggests that a large proportion of young people will be exposed to unemployment.
e-government	Improvement of services provided to the taxpayer Transparency and reduction in appearance, particularly at the level of legal services, taxes, and administrative services.	The digital divide could prevent a large group from benefiting from progress.
Work on platforms	Given that work on platforms worldwide is growing exponentially, the number of Moroccans working there will increase and help reduce unemployment.	Increase in precariousness and job insecurity.

Thus, Morocco should prepare for the techno-industrial revolution by developing a global national strategy for Industry 4.0 in harmony with global sectorial policies, particularly agriculture, industry, and services. The development of human capital and the reorientation of the education system and infrastructure should constitute the transversal cornerstone of this strategy.

CONCLUSION

The impact of technology on the future of work is unclear. It is both a challenge for policymakers and sociologists to frame the high-speed beginning of this radical change towards which humanity is moving. The first question we all must answer is: what kind of humanity do we want? What kind of future of work do we want? What do we want technology to do and not do? What does it mean to create a dignified and happy environment for everyone? A future of work, inclusive for all, for the present and future generations? In this conclusion, we return to the second-order impacts induced by disruptive technologies that is to say at the level of our Humanity. What will remain of our humanity when the machines have taken everything from us? Are our societies sufficiently prepared philosophically, sociologically, and morally for this technological surge? Is anyone able to tell us what kind of societies we are building for tomorrow or rather the near future? What remains of work as a creative work that sublimates our madness and our psychological and mental meanderings? Questions open the door to a plethora of research.

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