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MASTER'S THESIS

THE IMPACTS OF THE FOURTH INDUSTRIAL REVOLUTION AND TECHNOLOGICAL ADVANCEMENTS ON THE TOURISM INDUSTRY

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TABLE OF CONTENTS

I	NTROD	UCTION	1
1.	ME	THODOLOGY AND RESEARCH QUESTION	3
2.	2. ABSTRACT		
3.	LIT	ERATURE REVIEW AND PREMISES	6
	3.1.	Societal and economic shift	6
	3.2.	From Travel and Tourism industry to Travelism	8
	3.3.	Technology is (about) to change everything	9
	3.4.	Tools or the Fourth Industrial Revolution	10
	3.5.	Linear thinking vs exponential thinking: why it changes everything 3.5	12
	3.7.	Green growth and Sustainable Development Goals intro	17
4.	TE	CHNOLOGY DEEP DIVE	18
	4.1.	Internet of Things	20
	4.2.	Artificial Intelligence, machine learning, Deep Learning and Big Data	21
	4.3.	Augmented Reality and Virtual Reality	23
	4.4.	Blockchain	26
	4.5.	Additive manufacturing: 3D printing	28
	4.6.	Drones	30
5.	GE	NETICS, NANOTECH AND ROBOTICS: A BRIEF OVERVIEW	31
6.	HU	MANITY GRAND CHALLANGES	33
	6.1.	Water	34
	6.2.	Food	36

	6.3.	Energy	_ 38
	6.4.	Healthcare	_ 40
7.	EDU	UCATION	_42
	7.1.	Self-Organized Learning Environments	_ 43
	7.2.	Personalized education	_ 44
	7.3.	Gamification	_ 44
8.	FRI	EEDOM AND TRUST	_45
	8.1.	Social Entrepreneurship and Impact Investment	_ 46
	8.2.	The power of the crowd: Open source, Crowdfunding and Initial Coin Offering	_ 48
	8.3.	From ownership to access	_ 50
9.	OPI	EN DISCUSSION: THE FUTURE OF TOURISM	_52
	9.1.	Reasons to travel and how does it affect the future flows of travelers	_ 53
	9.2.	The role of technology and the education needed to prepare for the Singularity_	_ 56
1(). LIN	IITATIONS AND NEW FRONTIERS	_58
С	ONCLU	JSIONS	_59
R	EFERE	NCE LIST	64

LIST OF FIGURES

Figure 1: Countdown to Singularity nr.1	14
Figure 2: The average cost of IoT sensors is falling nr.2	19
Figure 3: UNWTO vision and alternative scenarios and projections nr.3	25
Figure 4: Solar on Fire nr.4	38

LIST OF ABBREVIATIONS

- 4IR Fourth Industrial Revolution
- AI Artificial Intelligence
- AR/VR Augmented Reality / Virtual Reality
- DL Deep Learning
- ICO Initial Coin Offering
- ML Machine Learning
- SDG Sustainable Development Goal
- SOLES Self-Organized Learning Environments

INTRODUCTION

In a world facing major political, economic and environmental challenges, the role of technology in our lives is rapidly taking over and it is by many considered to replace several human-led activities in the near future. Within this framework of exponential technological advancements and dangerous climate conditions, tourism and the overall travel industry is facing the greatest growth ever happened in history. More and more people are traveling around the globe for reasons that vary from holiday to work and much more. Thanks to technology, indeed, people can now move from one place to another much faster, cheaper and securely than ever before. Technology and the many related industries that developed in the past 200 years are both the reason and the cause of this immense economic growth and environmental pressure we are imposing to our planet.

Climate Change, indeed, is publicly raising awareness, as seen in the last Paris Agreement in 2015, and is mobilizing most of the worldwide public and private bodies to finally commit into decreasing carbon emissions and push a long-awaited economic shift, away from fossil fuel and non-renewable resources consumption.

The many previous studies that have been focusing on this framework of tourism, technology, and environment have only touched very specific topics somehow as they all were separated to each other. In several studies indeed, the solutions proposed or studied were limited to analyzing what single destinations or single uses of technology affected very determined contexts. Examples can be related to the impact of solar technology in tourism coastal destinations (Nizic & Rudan, 2013) or the use of Internet of Things products for the development of smart cities and tourism destinations (Nitti, Pilloni, Giusto, & Popescu, 2017).

Further researches vary from the use of drones in ecotourism (King, 2014) to the applications of artificial intelligence (Zsarnoczky, 2017). Nonetheless, these studies are very targeted to one technology, one application or one destination only. None of the previous research has been specifically conducted to analyze the overall impacts that the entire ecosystem of innovation is bringing to the entire industry of travel and tourism.

Tourism indeed, the complex and multi-stakeholder industry of leisure and business travel, was not left apart from this revolution. It has been changing drastically the way many people have access to mobility, disposable income to spend on vacation retreats and business operations. Today, tourism accounts for higher and higher quotas of national GDPs around the globe and is moreover representing an important tool for the development of countries whose economy do still rely on natural resources and traditional forms of industries i.e. agriculture, fishing, etc.

In this overall landscape, tourism flows are changing fast and are highly dependent on factors such as security, accessibility, quality of services and products offered. These conditions will furthermore change in the next decades due to the disruptive technology revolution we are facing in all corners of the imaginable. The so-called 4th industrial revolution will indeed represent the biggest change in society and economy the human kind ever faced in millions of years, and it will take place at the fastest pace humans have ever assisted before.

In this framework of sustainable growth, technological revolution, political and societal shift, this research will try to comprehensively picture how tourism will change and how we will, or can, travel in a sustainable way in the next 20, 50 or 100 years in order to enjoy the benefits of tourism, while not compromising the environment, the local populations and still generating economic growth.

Starting from the assumption that tourism – especially sustainable tourism – is a complex adaptive system (Liburd & Edwards, 2010) and thus the leaders of tomorrow must be able to holistically comprehend all the values and principles that this industry represents and is driven by. The ultimate goal of this research is to provide the reader with a full picture of how the technological scenario is developing and stimulate everyone to cross this knowledge with real-life applications in the field of tourism and sustainable development.

The research also introduces an important concept that still very few people outside of the "futurists club" is knowledgeable of, the Singularity. As it will be explained in the paper, this term refers to a period in the near future where technology pace will be so rapid that will exponentially outpace humans and pose serious questions on the future of humanity. Without going too deep into this topic, however, the purpose of the next chapters is to show how fast the speed of technology is, and how faster we will experience disruptive breakthroughs in our lives, and thus the tourism industry as a whole.

As many years ago has been discussed by the futurist Alvin Toffler in his book 'Future Shock' (1970), society is changing in a way that cannot be fully understood if using the same tools and beliefs of the past. If we want to avoid the shock that will be inevitably generated when most of the existing cultures, economies and tools will be eradicated by completely new ones, society must make plans to prepare for it. The different changes that we experience throughout human life, indeed, lead us towards a strain on our body's immune system, resulting in stress and eventually illness. Our body can only bear a certain amount of change, that is called the adaptive range. If the amount of change is well above this level, humans' coping mechanism break down and the outcome results in destruction and irrationality.

By illustrating all the different variables that are playing a worthwhile role in this change, this research is therefore intended to provide a basic preparation and knowledge of the world, economy and technologies that will change our lives and the tourism industry forever.

1. METHODOLOGY AND RESEARCH QUESTION

The goal of the research is to study the current technological megatrends and constructively depict possible scenarios where these will directly impact sustainable development goals in the field of tourism. Different positivistic theories such as the Abundance era (Diamandis & Kotler, 2014) and the Law of accelerated returns (Kurzweil, 2006), Green growth and Travelism (Lipman, DeLacy, Hawkins, Vorster, & Jiang, 2012) will be used to structure the framework of discussion towards the different possibilities and scenarios of how technological breakthrough will shape humankind and, in the specific, how privately funded innovation is taking a faster path towards sustainability compared to the public sector. In-depth interviews with industry leaders and visionary of the current worldwide innovation scene will be presented to provide qualitative data on the current scenario. And together with existing literature and secondary data analysis, the main research question that will be attempted to give an answer to is

To what extent will the tourism industry be impacted by technology and how will possible future and sustainable scenarios look?

To answer this question, the paradigms used to look at the amount of data and propose the different scenarios about the future of tourism is a combination of constructivism and participatory inquiry. Indeed, no other paradigms seem to best fit this forward-thinking paper, which will try to collect existing knowledge from the past and combine it with the most advanced and influential megatrends to depict possible scenarios of the future. Multiple realities will therefore materialize, each of them constructing different possibilities.

Data from existing literature and reports from real life projects currently undertaken by innovative companies worldwide will be used to collect and shape the initial discussion. The different technology clusters that are developing simultaneously will be first analyzed separately and then they will be linked to how they are cross-contaminating each other in the overall innovation landscape. This data will further be combined with the existing knowledge of the author and opinions from several other innovators – who constantly provide written material about their vision on technology blogs and conferences.

The first section of the research will therefore focus on collecting as much knowledge as possible to consequently prepare the discussion with the three interviewed futurists and sustainability leaders: Rohit Talwar, Ian Yeoman, and Ignace Schops, whose precise description will be provided in the following chapters. The second part, representing the report of the open discussion had with the interviewed experts, will be more outlined following the framework of a participatory quest between the interlocutors to define beliefs and hypothesis on the future scenarios. A full truth, indeed, will never be achieved because of the incredibly complex systems who depends on, and the highly uncertain future that lays towards us. Limitations related to the impossibility of predicting the future with certainty and the immense variables involved in the process, do inevitably bring this research to limit its scope to creating enough knowledge for everyone to be able to understand the importance of such topic. Thus aiming to stimulate further involvement

from tourism leaders to apply, take into consideration and even develop new exponential technologies in their businesses.

2. ABSTRACT

The structure of this research follows four general sections. In the first part, it will be discussed what are the premises and the technological background for understanding this rapid change in society and economics. The chapters will explain the concepts of travelism and fourth industrial revolution, and the Singularity will be fully described as key to understand and see the changes happening in the world from an exponential point of view, rather than an intuitive linear one. Understanding how technological development runs on a logarithmic scale compared to linear biological development is fundamental to fully acknowledge the chapters that will follow about the technology deep dive. To conclude this section, the last chapters will touch the topic of Climate Change and the Sustainable Development Goals. The purpose in this part will be to provide clear and irrefutable data on why the environment topic is fundamental to our survival and, especially, to the effective achievements of this rapid development in technology, society and hence economics.

In the second section, all the principal megatrends related to digital development will be introduced and for each of the subcategory there will be a dedicated discussion in order to not only describe what is the overall direction of technology. But also why and how each specific innovation can bring tremendous change and opportunities to the tourism field and its related industries. These chapters will be divided into two main subsections, the first related entirely to the tools of the fourth industrial revolution, hence IoT, Artificial Intelligence, 3D printing, Augmented Reality and Virtual Reality, and ultimately Blockchain. The second, it will analyze the parallel broader trends in Genetics, Robotics and Nanotechnologies. These last innovations, fundamental to the exponential development towards the Singularity.

These chapters are all to be considered enabling discussions for fully understand the third and fourth sections of this research, where it will be analyzed in a more holistic view how all this ecosystem of innovations is impacting the humanity grandest challenges. The technologies discussed previously, will indeed be related to the increase of food production we need to achieve to feed a 10 billion population planet, but also to guarantee universal access to pure and clean water in any community. How to create self-sufficient energy grids that are resilient and can bring light, food preserving tools and much more to the people that yet do not have access to.

In this section, two separated chapters about education and freedom will also be discussed and several scenarios will be presented to show how technology can increase ubiquitous access to information, hence directly affecting how people will educate themselves and increase freedom, both in a physical sense, and from an economic perspective.

The last section, denominated open discussion, represents the report of the three interviews undertaken with the futurists and industry leaders already mentioned in the introduction of this paper. This section will compare the three different point of views of the people interviewed on the future scenarios and will basically shape the final conclusion of this research.

3. LITERATURE REVIEW AND PREMISES

3.1. Societal and economic shift

To fully understand the roots of the exponential development of the tourism industry and the different technology drivers, it is first needed to briefly explain what are the social and economic changes we are experiencing worldwide.

As shown in different reports and especially pictured by the McKinsey paper (2012) on the economic center of gravity, in the last two decades the power has shifted back to Asia, rapidly and potentially leaving behind the United States of America and Europe. By 2025 China is expected to become the world's most powerful economy, and more generally Asian populations are all facing impressive growth and increase of prosperity.

Within this scenario, we are seeing how on the one hand, mature economies such as Europe and the US are so far the most visited destinations, and are also representing the ones with currently the highest expenditure in tourism-related industries. On the other hand, however, these trends are rapidly being taken over by the Asian destinations and its middle class.

Aging populations in Europe and the US will increase pressure on the limits of economic growth for those areas, which will leave space to younger markets such as Vietnam and Indonesia in Asia, or Nigeria and Kenia in Africa. This last continent, considered to experience the highest levels of middle class growth (Deloitte, 2012) of the last centuries.

These new markets and social classes will have the purchasing power and the interest to widen their horizons to travel around their neighboring countries first, and then to international destinations. Thus representing an extra 3 billion people moving internationally in the next decades, and tens of billions if you consider domestic travelers.

Moreover, enormous economic projects such as the One Belt One Road (Jinchen, 2016) led by China to re-establish trade routes from Asia to Africa and Europe, are going to redesign much of the current flows of wealth and hence the people affected along the way. The immense urbanization rates and density of Asian cities will generate the highest concentration of megacities (over 10 million population) and thousands of other urban areas with over 1 million inhabitants, 221 only in China. These new cities are already at the forefront of establishing more sustainable and livable places for their residents and visitors. New airports and high-speed railways are being built to support the rapid growth of passengers, and smart city projects implemented to offer all sorts of services to the people that will populate those areas.

In this very fast process – and sometimes even unclear from a western perspective – the usual conception of the Asian market as strictly related to cheap manufacturing paradises and few commercial areas in the big cities, is nowadays old and passed. Asia, especially China and India, is bringing on many of the latest breakthroughs and sustainable initiatives worldwide. No industry leader can afford to neglect this trend and reality, and many present and future destinations will have to adapt their offer to the specific needs of travelers coming from those areas.

Moreover, the worldwide trend of aging travelers will sooner or later affect any country because of the increase in life expectancy. Thus representing a bigger slice of the market share and especially requiring very different products and quality standards than those of earlier ages.

Within this framework, Middle East destinations and their travelers are also increasing exponentially their market share, estimated to reach 11% of the total number of tourists worldwide, assuming geopolitical stability is maintained (Amadeus, 2016). Thus increasing the needs to accommodate travelers with real different lifestyles and dietary restrictions than what we are used to.

3.2. From Travel and Tourism industry to Travelism

The travel and tourism industry nowadays is by far considered the biggest and fastest growing industry worldwide, with an average 6.5% growth annually in the last 50 years (UNWTO, 2005) is expected to see 1.6 billion people on the move by 2020.

Such an immense industry, however, is not a single and cohesive commerce, but rather the intrinsic sum of the most diverse segments that all together contribute to providing services and goods to the people who travel and reside in locations different from their original home. Tourism covers and impacts different fields and activities, from the simplest agriculture sector to services and heavy industries of construction, transportation and energy generation. No specific geographies are left aside in this industry, whether are sunny and warm seaside vacation destinations, mountainous and snowy sky resorts, urban and rural areas, eco-lodge in the middle of the Amazonian forest or multi decks mega cruise ships in the middle of the ocean (Chambers, 1997).

Moreover, the more people traveling and the more local authorities are becoming incapable of precisely defining why and from where tourists are heading to, and whether they are to be considered tourist at all (Terrier, 2009).

Because of this complex and interrelatedness sub-industries and reasons to travel, many experts in the field have proposed to shift away from the definition of tourism and travel, towards a more complete and holistic term such as travelism, as proposed by Professor Geoffrey Lipman, to identify the entire customer, company and community travel and tourism value chain (Lipman et al., 2012).

If we further take on this concept of travelism and how mobility, in general, is transforming the way we live on our planet, we can see how the future of humankind is today more and more pushed back towards a nomadic life. This time not for reasons such as hunting and foraging, but for chasing new economic opportunities, better living conditions and civil rights, or simply because of the sake of new and unforeseen experiences.

In a world where the cost of mobility is decreasing to almost zero – see the business model of Ryanair in Europe, which does not generate all of the revenues from the tickets sold, but from hyper-efficient fleet management and airports and local governments subsidies to increase foreign visitors (McFarlane, 2014) – likewise, technology is what exponentially is driving us towards a world completely different from what it used to be just a few decades ago.

3.3. Technology is (about) to change everything

Since the invention of technology, the life of humans has dramatically changed and allowed us to become the dominant species on this planet. Since the invention of tools such as the wheel, knives, and arrows to hunt or farming utensils, humans have been able to evolve with such a speed that many consider being exponential (Kurzweil, 2006). More recently, technology as we really intend it today - digital technology - has completely revolutionized the way we live, how long we live and how well (from a health standpoint) we do. Revolutions in production first, transportation and later communication have made so that humans could basically own everything, move anywhere and communicate with anyone on the planet for relatively low prices, or no cost at all.

Today, we are on the verge of a new and existential change in our history as humans on this planet, some call it the fourth industrial revolution (4IR) (Schwab, 2017) some others call it Singularity (Kurzweil, 2006). In all cases, this new evolution will finally converge humans (intended as their biological functions and intelligence) to machines (intended as digital processes and intelligence).

Inevitably, this dramatic change will affect travelism in ways we do not even fully imagine yet, new frontiers will be open for mobility and access to worldwide knowledge. However,

to fully comprehend the roots of this change, the next chapters will focus on having a deeper look at what are these new technologies.

3.4. Tools or the Fourth Industrial Revolution

As admirably illustrated by Klaus Schwab, the founder and executive chairman of the World Economic Forum, in his latest book, the Fourth Industrial Revolution refers to the current tremendous innovations period that is taking place and directly relates and depends on the previous three revolutions occurred since the second half of 1700's. Today, main aspects of the innovation relate to the following categories: artificial intelligence, Internet of Things, Augmented Reality and Virtual Reality, Drones and Blockchain technology.

As it will be broadly discussed in the following chapters, these new technologies will mostly allow us to connect the product of the first two revolutions, tools and machinery, to the digital world and intelligence developed in the third revolution. This process will allow us to reach unprecedented capabilities and productivity levels and allow us to initiate an exponential leapfrog towards a future where humans and machines won't just operate together but communicate and coexist together.

As Marc R. Benioff, Chairman and CEO at Salesforce, and a member of the World Economic Forum Board of Trustees, writes in the forward chapter of Schwab' book: "the "science fiction" of yesterday is today becoming a reality in new products and services that we won't be able to imagine having lived without. These rapid advances in technology, however, are doing more than providing us with new capabilities—they are changing the way we live, work and relate to one another. [...] The convergence of digital technologies with breakthroughs in materials science and biology means that we are seeing the emergence of entirely new ways in which to live. In both subtle and explicit ways, technology is also changing what it means to be human."

Schwab indeed, explains how the 4IR will profoundly shift and reshape business models of production, transportation, consumption and delivery systems in such ways that companies, institutions and private people will have now to drastically reconsider their position to avoid not be left behind, forever. This revolution will have a pace and scale unprecedented in history and because of its complexity across all sectors of our global

society it needs all stakeholders – public institutions, private businesses, academia and civil society as a whole – to understand the emerging trends and rapidly adapt.

As Schwab assesses: "The changes are so profound that, from the perspective of human history, there has never been a time of greater promise or potential peril. [The] concern, however, is that decision-makers are too often caught in traditional, linear (and nondisruptive) thinking or too absorbed by immediate concerns to think strategically about the forces of disruption and innovation shaping our future" (2017, p. 17). Some academics and business experts actually consider these developments to be simply part of the third revolution, which to our eyes, never really stopped or slowed its pace, but as explained in the next chapters, exponential development and evolution double size and speed at each step and the further we proceed, the less gap between one development phase and the other will be visible to human eye. Actually, as Ray Kurzweil explains in his book, 'the Singularity is Near' (2006), different revolutions and developments overlap one another so that when the previous cycle reaches its exponential peak, the next one is just about to begin (more about this topic in the following chapters).

To confirm this position, Schwab further explains that three are the main reasons why this revolution will be completely different from the previous we lived before:

"Velocity: Contrary to the previous industrial revolutions, this one is evolving at an exponential rather than linear pace. This is the result of the multifaceted, deeply interconnected world we live in and the fact that new technology begets newer and ever more capable technology.

Breadth and Depth: It builds on the digital revolution and combines multiple technologies that are leading to unprecedented paradigm shifts in the economy, business, society, and individually. It is not only changing the "what" and the "how" of doing things but also "who" we are.

Systems Impact: It involves the transformation of entire systems, across (and within) countries, companies, industries and society as a whole" (2017, p. 18)

3.5. Linear thinking vs exponential thinking: why it changes everything 3.5

This unprecedented epoch in which we are living, it's not easy to grasp if we keep looking at human development form a simplistic linear thinking perspective. Actually, nothing would really make sense if linear thinking was to be used to study what happened in the last millions of years since the human life started. Ray Kurzweil, considered to be the single most prolific inventor of our present times, and director of engineering at Google, is also the author of several books, among which The Singularity is Near stands out above all. Kurzweil, indeed, is one of the evangelists of the exponential thinking movements, which among many other concepts, explains how humans have always been used to use "intuitive linear" thinking to view history and explain and predict the pace of what was happening around them. However, especially now that we possess the tools and information we never had before, are able to actually understand how the "historical exponential" view is at the root of our life.

As Kurzweil explains and believes, the history on our planet has lived six epochs, which for the propose of this research will be briefly summarized and used to show how the exponentiality of life development on earth took place and then why the next developments will be so drastically faster and bigger than ever before.

Epoch One: physics and chemistry. This period initiated billions of years ago when the first atoms began to attach one another to create molecules. Above all atoms, carbon resulted to be the more stable and versatile thus giving the rise of more and more complex particles and three-dimensional structures. From these chemical bonds, our galaxy and life on earth started to exist and create the second epoch.

Epoch Two: Biology and DNA. This second period still initiated several billion years ago, molecules became more and more complex hence creating life as we know it today thanks to DNA. The most complex biological storage of information that made our life on earth repeatable.

Epoch Three: Brains. Relatively recently, this third epoch initiated what we consider now intelligence. Thanks to DNA-guided evolution, life produced organism able to process and store information in the brain and nervous systems. Thus, allowing whoever has higher

quantities of the brain, develop faster, adapt to new living conditions and especially, remember what "not-to-do" to guarantee a longer life expectancy. As we know, homo sapiens came out from this epoch as the animal with the highest density of grey matter and thus able to succeed over all other species.

Epoch Four: Technology. As Kurzweil explains this epoch is characterized by the combination of human "endowment of rational and abstract thinking with our opposable thumb. [Thanks to this combination] our species ushered in the fourth epoch and the next level of indirection: the evolution of human-created technology. This started out with simple mechanisms and developed into elaborate automata (automated mechanical machines). Ultimately, with sophisticated computational and communication devices, technology was itself capable of sensing, storing, and evaluating elaborate patterns of information" (2017, p. 83). Furthermore, something even more astonishing happened in this epoch: for the first time in history, humans have been able to outpace the rate of biological intelligence evolution thanks to the technological one. "Consider that the most advanced mammals have added about one cubic inch of brain matter every hundred thousand years, whereas we are roughly doubling the computational capacity of computers every year". Kurzweil obviously does not want to compare computer capacity only to brain matter size as precursors for intelligence, but as well known in biology, brain size represents the enabling factor.

The second last, Epoch Five: The Merger of Human Technology with Human Intelligence. This period, most likely the one we are about to live now, it's the official precursor of the aforementioned "singularity", as Kurzweil describes: "a future period during which the pace of technological change will be so rapid, its impact so deep, that human life will be irreversibly transformed" (2006, p. 58). The only way where humans will be able to keep up with this unprecedented speed of change and increase of intelligence will be through the combination of biological intelligence and technological intelligence. As already seen in different fields of the most disrupted industries, an example of the precursor can definitely be the category of "wearables" (intended as all those technological gadgets that we can wear at all time and they monitor, track and in many cases, predict the actions we take every day).

This epoch is yet to be fully understood, especially what are going to be the exact outcomes of the by-then-irreversibly changed human life. For the purpose of this research, it will only be discussed what directly relates to the understanding of how fast people's behavior will be affected and how consequently these changes will affect travelism and mobility worldwide.

Epoch Six: The Universe Wakes Up. This is considered by Kurzweil the last predictable epoch where new existential discoveries, capabilities and limits will be pushed towards something unimaginable and even the biological essence of us humans will be put into discussion.

Even though all this could be taken as a pure speculation and only good material for sci-fi movie directors; what is not to be taken for granted, is the ability of human beings to fully understand the speed of how our entire world and economies will be shaken up in the next few decades. As illustrated in figure 1 below it is clearly depicted how exponential our development has been in the past and how this pace is likely to continue for the future. This exponential path is explained by the Law of Accelerated Returns developed by Kurzweil and states that: "the rate of change in a wide variety of evolutionary systems (including but not limited to the growth of technologies) tends to increase exponentially". For this reason: "contrary to the common-sense "intuitive linear" view, we won't experience 100 years of progress in the 21st century — it will be more like 20,000 years of progress (at today's rate)"(2017, p. 71).



Figure 1: Countdown to Singularity nr. 1

Source: Kurzweil, R (2006).

3.6. Another (biological) disruptor: Climate

As most of us are nowadays well aware of, climate change will likely be the cause for human extinction (Lambers, 2015; Urban, 2015) if we do not drastically change the way we produce energy on our planet and/or find a way to subtract CO2 from the planet atmosphere. Needless to discuss the fact that humans are the sole cause for this tremendous overheating of the planet (Oreskes, 2004) the effects that such change is already having on the majority of the populations, especially the ones that contributed the least to the emissions in the past, are terrifying. Although precise numbers have not yet been agreed by the scientific community (Gemenne, 2011), estimates published in the world migration report (International Organization for Migration, 2015) assess that almost a billion people

will eventually move towards more urbanized and prosperous areas due to unsustainable climate conditions in their locations of origin.

Surely not considerable as tourists or travelers for their own business or pleasure-related purpose, these people will sum up to the already migrating ones that will abandon the countryside to reside in cities and megacities around the world. A total of 9 to 10 billion people on our planet is expected by the year 2050 and 66% of them will leave in urban areas (UN, 2014); these numbers will drastically change the equilibrium of the demand and offer of travelism-related industries, such as the labor force in country-side destinations, urban mobility and much more.

Climate change is not only a direct cause for human displacement, but also flora and fauna – typical and unique of numerous "green" destinations – will be affected by the change of natural environments that characterize their flourishing or collapse. Enhanced emissions due to transportation and uncontrolled exploitation of resources will furthermore change very quickly the panorama of many destinations. Uncontrollable environmental disasters will be more and more jeopardizing the success or failure of many locations; just think about coastal resorts in the Caribbean destroyed by recurrent hurricanes. Persistent lack of snow in mountain ski areas. An ever-vanishing coral reef, and unreliable monsoon seasons in South-East Asia. All these conditions, and many more of course, make travelism in non-urban destinations more and more uncertain and, especially completely un-resilient to unexpected conditions (Williams & Ponsford, 2009).

As well discussed by Naomi Klein in her latest book 'This Changes Everything: Capitalism vs The Climate' (2015), we are now at a so-called, point of no return. We are indeed not anymore in a position where we can underestimate or delay our climate actions for drastically reducing the emissions of greenhouse gasses we disperse in the atmosphere every day. In the introduction of her book, Klein very specifically addresses the issue that most of the estimates of climate change indicate that a continuous rise of temperature will start an unstoppable process that will cause irreversible problems to our planet. Natural cooling processes and absorption of CO2 from the plant seasonal cycles won't be just slowed down, but *de facto* almost stopped. What before worked as irradiation reflector

from the forces of the sun, such as the ice cap in the Arctic and Antarctic, will be starting to absorb solar energy and thus exponentially increment the rising temperatures even more.

Also defined as "tipping point" (Gladwell, 2002), we are today risking to assist to an epidemic spread of irreversible climate hazards if we do not limit our CO2 emissions and we start restoring our environment. The threshold to which we can still operate has been defined by the international community at 2 degree Celsius, whose overstepping will bring us to consequences nobody is really able to explain clearly, but certainly will represent an exponential rise of existential threats to our environment and human existence.

We are about to assist to another "singular" event, one that will seriously change our lives as we know them today. An event all of us hope never to experience though.

Climate change is existential and potentially powerful – or disruptive – as nothing we ever assisted before. The exponential growth of technology managed to maintain its speed and curve regardless of wars, economic crisis or political instabilities in the past. This time, however is different. This time the potential risks to our societies worldwide are so tremendous that it's hard to believe we could be able to survive or maintain the level of developments we have been able to keep in the last centuries if we do not stop polluting our planet once for all.

3.7. Green growth and Sustainable Development Goals intro

As now understood that climate and the environment are topics we cannot leave behind anymore, the question that comes naturally is, how can we maintain economic development worldwide, without further compromising our chances to healthily live on our planet for the generations to come?

The answer to this question is of course not simple, but as seen in the political scene of the recent years, a new paradigm was proposed, green growth. By green growth it is intended all sorts of socio and economic developments that completely base their existence on activities that reduce or entirely ban CO2 emissions. As professor Lipman states in the book 'Green Growth and Travelism' (Lipman et al., 2012), the transition to a low carbon emission economy worldwide is "a multi-decade journey, with each country, locality and

individual coming from a different starting point, with differing capacities and reason to change – but ultimately we all have to get to the same endpoint by 2050". 2050 indeed is the date where scientists and politicians agreed on an ultimatum for temperature stabilization and where our global economy will have turned from unsustainable resource production and consumption to a renewable version of it.

Besides the real importance of a specific date such as 2050, by many just even considered too late from a climatologic perspective (Crowther et al., 2016; Y. Xu & Ramanathan, 2017) or not even reachable since the scarce availability of economic funding to push this enormous transition (Schmidt-Traub, 2015). The point is, that worldwide private and public stakeholders are now all aligned on one main goal, or better 17 goals for the sustainable development transition of our world (UN, 2015).

Differently from previous development goals set in the past, from the Kyoto protocol or the Millennium Development Goals, this time the UN has developed a clear framework composed of the 17 goals and specific list of 230 indicators covering all economic, social and climate/emission spheres and which the majority of countries and companies will have to fulfil in their respective fields of operation.

In this crucial plan, travelism has been formally recognized by the UN General Assembly (2012) as one more tool to decrease poverty, foster rural and regional economic development and promote sustainable practices. The question now is whether technology will be used to push this industry as the largest promoter of decarbonation or is it only going to be reactively used to cope with the different pressures from customers and policy makers.

4. TECHNOLOGY DEEP DIVE

Following along with the previous chapters where a broad introduction of the unprecedented technological and environmental time we are living in was made, this chapter will be finally going to focus on each specific technology that is on its way of development. Even though they will be presented in separate sections, to allow a better understanding of each of them, it is important to consider that every innovation cannot grow and evolve on its own. As specifically as in these times, each disruption is directly dependent from another one. Let's just take as an example the direct dependency of computing power and cost of computation cycles with the possibility for development of an Intern of Things sensory ubiquitous network. No economic sustainability will indeed justify the use of expensive sensors applied to massproduced goods if we did not have decreased its cost of 3,5 folds in the last 20 years, as shown in figure 2 below. At the same time, no use of cheap and ubiquitous sensors could have been made if at the same time powerful and distributed connectivity were developed for these "things" to be connected.

For this reason, the paper will describe each different technology in specific verticals and provide isolated examples of what these technologies can enable in terms of new travelism products and practices. In the following part of this research, the interviews with selected futurist leaders and experienced forecasters will lead to a more holistic and open discussion to picture all of these trends together and provide different scenarios.



Figure 2: The average cost of IoT sensors is falling nr.2

Source: The Atlas (2016)

4.1.Internet of Things

By 2025, 1 trillion sensors are expected to be connected to the internet (<u>The Atlas 2016</u>). These sensors will allow us to track, monitor and communicate with anything that will be worth to be connected to the cloud. Goods such as machinery for production and distribution of materials will be constantly monitored and programmed for the efficient running and use of resources. People will be able to monitor their parameters for almost anything that relates to their health, productivity, pure pleasure or serious risks to their security. Clothes will determine if we are warm or cold in a specific environment and automatically communicate to the closest thermostat in the hotel room and ask to regulate air conditioning accordingly. Automated check-in and check-out at airport security (WEF, 2017), towels that recognize bacteria load and sends orders to the closest cleaning operator to be replaced. All this and exponentially much more is already a reality and further increase in price-performance of sensors will allow us to manage everything we can imagine from a simple digital interface.

The beauty and huge potential of having things connected to the internet is not because we can simply avoid asking a guest to tell us when is the right time to wash a towel, but rather because from the millions of guests we might have over time, we can track all the data and then ultimately learn what the exact budget for laundry in that specific hotel is. We can understand with exact precision in which days the cleaning services are needed the most, schedule appropriately the personnel shifts and save consistent economic and environmental resources for that department. More money saved in laundry services and thus more money available for corporate social responsibility initiatives and, maybe, better working conditions for employees.

Of course, the example of a towel might not resonate so much, but if we make the exact same example on a plane engine, we find that today each motor can have up to 5,000 sensors generating around 10GB of data per second (Transducer, 1987). This constant real-time monitoring allows to perfectly predict performance, increase security on the flight, and especially, decrease the cost of maintenance due to what is called predictive maintenance interventions. Over engines that are used to function more than 15,000 hours per lifecycle, this translates in the end in millions of dollars of saving and CO2 emission. Imagine what can happen if the same concepts could be applied to all those tourism

facilities that are completely lacking new generation sensors and monitoring tools. It would take budget and new forward thinking policies to realize this potential, but also represent a huge opportunity for all those companies specifying in building automation products.

"Things" and sensors acquiring data at all time are what characterizes the simplistic term IoT, but what really makes these "things" smart and efficient, are the algorithms behind it that process enormous amount of information and specifically find out common patterns and errors, and develop new corrections to make these "things" work better. Thus, talking about IoT without mentioning its enabling factors of Artificial Intelligence and Big Data analytics would not give us anything more than just tons of digital bits and numbers that no human mind or Ph.D. in statistics will ever be able to efficiently understand.

4.2. Artificial Intelligence, machine learning, Deep Learning and Big Data

These four topics, rather than being technologies on their own, are more likely to be included in completely new categories. Probably what is the closest thing to a digital brain, AI and the other enabling factors, will be the force that will change each of every single aspect of our lives as we know it today. Through AI, indeed, we'll be able to finally have machines, or algorithms in general, that will have the capabilities to take autonomous decisions without being specifically programmed for those actions.

Of course, it could not even be possible to cover all aspects of AI and related technologies in one encyclopedia, most of them will not even be used anymore and already outpaced by some new breakthrough, but for the purpose of this research we will focus on a brief description and differentiation between the different branches of AI and how they are connected. Ultimately trying to inspire the reader imagination in what amazing results can be achieved in the field of travelism if new AI-driven paradigm will be brought to the market.

The popular term of Artificial Intelligence was initially coined in 1956 by John McCarthy, an American computer and cognitive scientist, and refers to the possibility that machines could perform tasks and actions that are specific of human intelligence (McClelland, 2017). Tasks such as recognizing sounds, objects, understanding languages and ultimately, learning and solving problems were all assumptions that scientists believed could be

performed by machines. However, besides the physical limits to computations power at that time – such an enormous power for calculus was indeed not yet affordable to everyone – programming and writing the necessary lines of code for those complicated tasks was not an easy thing.

For this reason, machine learning concepts have been introduced to the development not so long afterward. In 1959 another computer scientist, Arthur Samuel coined this phrase addressing the need for an algorithm to be able to learn without being explicitly programmed (Samuel, 2000). Thanks to this new algorithm architecture, programs could now run and develop new lines of code having just a few inputs from humans and increasingly refining the results and accuracy of their outputs. An example of this is the long-tested image recognition program that is able to detect specific objects in the picture without having any more humans giving precise inputs. These algorithms take a long time to "learn" how to take an action and require a huge amount of data – from here the concept of Big Data – and initial human's guidance to create the final template for taking accurate decisions. The step by step situation in the case of image recognition for animals can be millions of different pictures where a person would say "yes" or "no" to the presence of a "cat" and the resulting "training" of the machine will be an algorithm that did adjust itself all the way to becoming knowledgeable of the different possibilities of the presence of a "cat" in a picture.

Deep Learning, is the natural evolution of ML where there is not anymore a physical person guiding the algorithm to determine the presence or absence of an object in a picture, and therefore cutting down exponentially the time spent in "training" the machines. DL takes inspiration by natural structures of the brain, its neural network connections, and try to digitally recreate them in order to provide depth to the recognition phase of the outer world, therefore the decision-making process. In this case, every single digital neuron is specified in one task, for instance determining the curves and edges of specific images, so that several processes of recognition can be executed simultaneously.

Understanding how machines, through the access of Big Data and the processing power of ML and DL can increase exponentially their capability to learn, develop and refine by themselves exactly as a human learns new things throughout the journey of its life, is

crucial to perceive and hopefully later on master, the immense opportunities that lay ahead of us.

Several online travel agencies (OTA) already take advantage of these capabilities to provide customers with more and more efficient travel routes, but what's still executed by people at the time of inputting the different parameters can be soon be automated by a machine. Very recently, indeed, Google launched Duplex (Google Blog, 2018) one of the most sophisticated and "natural" (from a user experience point of view) digital assistant that applies natural language processes to mimic human voice, talk to human people and execute voice-to-voice tasks. This assistant, for instance, is able to call a restaurant and book a table for a specific date while conversing naturally with the interlocutor on the other side and interpreting all the nuances in her voice. Imagine a not so distant future where even the people with the least familiarity with OTA websites and thus very active clients of physical travel agencies, will use these tools to plan their travels. In just a few years we might even imagine an entire business event completely managed by such AI-driven tools leaving people more time to focus on more humanized tasks than scheduling and planning arrivals, keynotes or supply of any kind.

4.3. Augmented Reality and Virtual Reality

"By 2025 10% of reading glasses will be connected to the internet" (Schwab 2017:61), this is the prediction that lets us understand how quickly and heterogeneously this new industry is likely to take over daily activities. Not a bad achievement for a technology that was first developed in the 1970's for military purposes and only in recent years adopted by consumer goods developers thanks to the widespread use of smartphones that replaces expensive and bulky screens and sensors (Kelly, 2017, p. 267) Even though AR and VR are just at the beginning of their development, many are the companies developing contact lenses (Templeton, 2017) or even virtual retina displays (Wikipedia, 2018) that will bring to even more masses the capability to transport us in parallel digital worlds. This technology was first initiated by entertaining and gaming companies, but now has attracted a much wider variety of fields willing to implement existing tools for the education, knowledge sharing and management of information industry.

The basic differences between AR and VR are that, while the last recreates new realities in a complete virtual environment, much like what airlines are testing today to bring incredible user experiences (UX) to travelers, AR literally augments with digital information, the real analog environment. Both technologies use a mix of cutting-edge video processors and algorithms able to first recognize the movements and positions where you are moving, and immediately respond recreating digital images able to interact with you in real time (Kelly, 2017, p. 109).

For such a newly born multibillion industry (Digi Capital, 2017) it is difficult to understand which of the two technologies will be the most widespread, but sure is, that they will both have a tremendous effect on travelism-related industries and especially in the way travelers access information and experience their journey.

AR/VR will certainly affect how we learn and discover about a new place, tests and different platforms are already in use in the most innovative museums and galleries, making so that visitors can interact with sculptures and pictures (Gardonio, 2017). People can already have a 3D virtual tour of Rome and watch how the Colosseum was initially built (Ancient & Recent, 2018), and mainstream videogames such as Pokemon Go (2018) took just a couple of days to increase their user base to millions of them. Each user could walk around their cities on a quest to catch rare Pokemon which were very often hiding next to a popular point of historic interest. Thus people were not only participating in a game but were also inspired to learn about new sights they probably would have never had the chance to visit.

Planning and booking tools for travelers will all be adopting these technologies to show you a pristine and lush preview of the place you'll spend your next vacation at. While at the location, new navigation tools will show real time recommendations and information about each place to visit. The list can continue for long, but what is astonishing are the predictions that some futurists are making on the effect that virtual tourism will have on the global increase of travelers. As seen in figure 3 below – showing Cole and Razak's vision on alternative scenarios and projections in relation to UNWTO data – it is even probable that part of the pressure on tourism infrastructure due to the higher number of travelers worldwide, will be alleviated by the exponential increase of virtual tourists.

Mobility patterns will also be shaken up completely by this new trend, since the future of work will not contemplate any more billions of people commuting every day to get to the office. As illustrated by Kevin Kelly in his book "The Inevitable"(2017) many companies, from big corporates such as Microsoft and smaller startups such as Slack, are already reinventing people's office place with VR meeting rooms in which everyone can freely join from anywhere. Not only this trend will decrease commuting time, but it will even exponentially increase remote working. People will have the chance to mostly live anywhere they want as long as a good and stable internet connection is present. Who wouldn't love to live in a beach house all year?



Figure 3: UNWTO vision and alternative scenarios and projections nr.3

Source: Cole and Razak (2009)

4.4.Blockchain

Mostly known for its initial product, Bitcoin, the blockchain is a new cryptographic technology that essentially exponentially increase the security of digital assets in ways that still nobody has been able to hack (digitally corrupt or counterfeit) (Mougayar & Buterin, 2016). The blockchain is many things, but mostly a way to digitally secure any data on a decentralized network, thus meaning there are no central servers that own the source code, but essentially every stakeholder of the network is owning part of the copies of the original code. This might seem useless, but imagine that today everything that requires trust, or security, is directly managed by the company or public institution that is considered to be the trustee of that asset. Tomorrow it will be possible to manage that asset completely independently from a single trustee's will or control. As for airlines miles' programs, there is a single server, or source code, that stores all the information about the travelers and accordingly benefit the most traveled to earn more miles and so on. The same happens with central banks that act as trustees for determining the value of the currency and deciding whether or not to print more money, thus creating inflation.

The problem with these centralized operations, however, is that the enormous cost for protecting these activities and guaranteeing security over time are limiting scalability, and are moreover very inefficient. Just recently British Airways power outage to one of their data centers managing all the inbound and outbound flights' operations, forced the company to cancel around 800 flights, leading to a loss for travelers compensation of approximately $\notin 61m$ (Cox, 2017). This happened because of a single source of secured data was not operative for literally 72hours. Imagine what can happen if bigger and more serious catastrophes might happen due to an unexpected environmental hazard and harshening conditions of climate change?

This totally new economy and technology is relatively recent, so recent that no books on future megatrends published before 2010 even mentioned the topic. The whole concept of the blockchain, indeed, first started from the now famed whitepaper of Satoshi Nakamoto (2009), when he presented to the world his idea for a peer-to-peer electronic cash system in 2009. Bitcoin was the first product and it since then became the biggest cryptocurrency on the planet.

The reason for such an innovation was the urgent need to produce an electronic currency that could be used for online transactions, without the need of any clearance entity (basically the bank that states that there is X amount of money in your account and after the transfer there is X-y=Z and the receiving party has y+X=Z in his account) and thus with the certainty of not incurring in the problem of the double spending (Investopedia, 2013).

What happened right after the launch of Bitcoin is something that very few people could have ever imagined: the creation of a decentralized economy that can rely on no central entity of control, no money paid to middlemen services and no issues of the middlemen running away with the asset stored. A new economy that can finally reconnect users to each other and do not risk to be jeopardized by the will of corrupted politics, malicious trust-holders and private-purpose driven individuals that can always interfere with the management of certain assets without being noticed. Blockchain indeed is a globally distributed ledger that depends on the information and resources of the peer-to-peer network that constitutes it. All information added to the ledger is public, except for the holders' name, and once added to the ledger, no information can be modified or removed, only new information can be added and shared. This process allows complete transparency on the transactions of data and does not admit anyone to change or corrupt information because several chunks of the same information are copied and shared in other peers' ledgers. Thus meaning that if there is any incongruence with the information in one ledger, the original data get restored from the other ledgers containing the most recent information (Mougayar & Buterin, 2016).

Put it into biological terms, blockchain can be similar to a string of DNA that stores several lines of information in its genes. Each cell or nucleus stores a copy of the DNA and whenever a cell is corrupted it either dies or gets replaced by the string of original pure DNA information. Everybody owns several pieces of information and whenever there is a genetic change, all the DNA strings update to the new version of the gene sequence.

Once understood that blockchain technology is not only Bitcoin, or digital cash, as known as cryptocurrency, but relates to any current and future system that stores information worthy of being kept highly secured and now can be fully digitized and decentralized from the trustee's servers. It is easy to imagine what terrific new models can be created. For instance, the blockchain is used by the UN (Starkie, 2017) for alternative financing to Syrian refugees in Jordan camps to allocate food vouchers to the people living in that community and make sure there are no robberies or exploitation between members. Further pilots are being tested for digital ID and supply chain management. It is used by companies such as Siemens (2018) to provide efficient and reliable micro payment and tracking for Smart Grid and energy storage operations. Thus guaranteeing resiliency tools for any community living on or off the centralized grid that powers everyone's house or business.

Others can be the implementations in the field of people's mobility and their rapid identification documents. Blockchain and image recognition combined together can easily fasten up immigration processes at any border and provide seamless cross border passage. In countries such as Estonia, they are even piloting new solutions for e-vote and the so called liquid democracy (Blum & Zuber, 2016), where decisions are taken directly from the voters in costless constant e-lections. In all these cases, information would be kept completely anonymous, while still available to anyone to check the veracity of them.

4.5. Additive manufacturing: 3D printing

Another disrupting technology in the field of decentralization, is additive manufacturing, in which 3D printing is definitely the most known sub-category. By 2025 the first 3D-printed car is expected to go into production (Schwab, 2017, p. 61), but what is already possible to manufacture with different materials and printers, is even more astonishing. With just the use of relatively cheap, very light and space efficient printers, different plastics, eco-materials, food and metals are already ongoing a process of enhanced development for supporting anyone to manufacture almost anything they like, without the need of setting up a factory and production line before. 3D printing, indeed, allows to create objects by printing layers upon layers of material being guided by the original 3D drawing or model of the object (Schwab, 2017). This initially means that time for prototyping has been already completely cut down to zero, anyone can just acquire the necessary skills for digitally drawing anything they like and send it to production in a matter of minutes, not months. Moreover, as soon as this technology will increase capability for industrial production - a limitation of today is indeed the time that the machines require to print all the layers compared to the rapid industrial material injection in a pre-shaped mold -

anyone around the world will have the chance to install one of such printers and set up a decentralized production center. For anyone that ever worked in a remote touristic operation, such as an eco-lodge, for sure knows the benefit of having the possibility to print replacement parts for whatever might break on the way. Rather than having a fully stocked inventory for maintenance parts or wait weeks, if not months, before the new part arrives from some develop areas of the world, the operation could just print it on spot. New frontiers and opportunities can then open up for anyone willing to offer new experiences in remote places of the world, where no real supply chain is in place, and thus natural landscapes are still intact and pristine.

This technology might seem just a toy for tech savvy now, but prices are decreasing exponentially, and easier and more automated software are helping out amateur people to get acquainted with the potential of this new trend. Libraries of pre-designed parts are already available on the internet and most likely in the next years, companies will start providing replacement services through the newly generated network of FabLabs around the globe (Fab Foundation, 2018). FabLabs, indeed are decentralized hubs that look more like a communal warehouse full of tooling machinery and provide support services to the community for learning how to use them. The idea of these FabLabs started as a way to share the costs of the machines and increase the operation rate of them by adding more and more prints capacity to each of them. Thus lowering the total cost of management of the machines and offering more and more capable printers to the community. This trend will likely expand to any corner of the planet and will probably represent a great opportunity for all locations that need to increase resiliency strategies to cope with unexpected circumstances. Companies such as New Story (2018) are already creating thanks to the donations of their first customers, 3D printed houses in developing countries and they are able to print each new shelter in just a few hours for only \$4'000. How long should we expect to see the first fully 3D printed eco-hotel in the world?

Moreover, because 3D printers can generate profit since the first print, and do not really represent a huge upfront cost and investment from the owner of the machine, we can easily expect these tools to be deployed in all sorts of markets and empower all sorts of people with the minimum required technical skills. Imagine the power of rural communities and villages that learn how to 3D print basic objects and start create local markets for
replacement of parts and from there further develop new business models that mostly adapt to the single real needs of their community members.

4.6. Drones

These machines are probably the most direct precursors of the robotic revolution we are about to experience (more details in the next chapters). Drones, indeed, are automated flying robots that thanks to the enhanced development of hardware and software (especially AI) capabilities can now perform several tasks where humans are somehow unable to go, because of dangerous conditions or simply for a cost-opportunity issue. Drones are for sure very known in the field of aerial photography, everyone in the field of travelism for sure has had something to do with beautiful landscape pictures were taken from very high above, somewhere so high where only Discovery Channel producers could afford the use of a helicopter to record those scenes.

Today drones are being used in almost anything, from recreational purposes, to very technical activities, such as recovery instruments in areas where it is too dangerous to fly humans (Flyability, 2018), or automated medical supply in African villages where roads are so often wiped out from heavy rains (Matternet, 2018).

Once again, as for all the previous technologies, the more the prices decrease and the more software increase UX and management tools of these machines, the more likely we are going to see the applications of drones everywhere, by everyone.

Wherever the supply of resources is not efficient because proper roads are non-existent and where schedules are so rare that only weekly or monthly deliveries can be an option, drones will surely take advantage of the situation and provide people with more efficient and effective solutions. Shipping, supplying or transmitting analogic goods that are vital, in some cases, for the survival of certain individuals will all be replaced by drones.

As 3D printing can allow the efficient running of new remote operations, imagine what the two technologies together can achieve in fulfilling the needs of those areas without the need of investing any money in road construction, hence deforestation, or other facilities. As it happens with wireless telecommunications in Africa, whose application was directly preferred to old practices of wiring thousands of miles, drones can easily replace the enormous investment for building physical infrastructure in many locations.

5. GENETICS, NANOTECH AND ROBOTICS: A BRIEF OVERVIEW

Following the line of thought of Ray Kurzweil in his previously cited book 'The Singularity is Near' - that is referred to the period of life where technological advancements will be so rapid and digital intelligence will be exponentially outpacing the human biological evolution, that human-machine merger will bring us to a dramatically new understanding of life – we are now living in the early stages of epoch five, where Genetics revolution is starting to open us the gates to the deepest knowledge of our biology. "By understanding the information processes underlying life, we are starting to learn to reprogram our biology to achieve the virtual elimination of disease, dramatic expansion of human potential, and radical life extension" (Kurzweil, 2006, p. 403).

For instance, costs in genomic sequencing – basically the decoding of DNA gene sequences that define our biology – have dramatically decreased in just the past 50 years (Kurzweil, 2006, p. 397) and we'll soon be able to provide anyone with his own decoded gene sequence. We will then be able to design highly customized lifestyles, diets and drugs that can exponentially increase our life quality and expectancy (Diamandis & Kotler, 2014). Just an example of how next generation 3D printing can work together with Genomics, is the possibility to produce these tailor-made drugs and make us resistant to any kind of disease known. Imagine what these can mean for a mass tourist that will then avoid to be infected by any kind of stomach illness, because his digestive apparatus is already predisposed to adjust to the different bacteria in the food and environment of the visited destination. What about more revolutionizing cheap drugs for rapidly healing rural communities and low-income populations?

The second revolution that is following in parallel, is Nanotechnology: new inventions in this field "will enable us to redesign and rebuild—molecule by molecule—our bodies and brains and the world with which we interact, going far beyond the limitations of biology" (Kurzweil, 2006, p. 398). Ideally, we won't just redesign micro-machines that will work in

different unimaginable spaces, but we'll also be able to design next generation blood cells that will work tens or thousands of times better than our biological ones. Imagine then new frontiers of extreme tourism, maybe on top of the highest mountains, where humans won't need any more Sherpas and oxygen tanks to help them climb the peak, but would easily do it on their own. What about extreme deep diving or anything else that require long preparation, training and experience. Probably massification of these experiences will not be unusual.

Nanotechnology does not only mean biological cells engineering, but many can also be the applications for addressing pollution challenges we face today. Nanofiltration systems can be developed to filter air, remove toxins from the atmosphere or filtrate water from the unhealthiest sources on the planet. Thus restoring or creating new living conditions in places unimaginable and unhospitable before. This revolution will affect all materials we use today in industrial and agriculture practices, potentially making them completely sustainable and more efficient.

Lastly, Robotics is considered to be the most significant transformation as it will empower with unprecedented intelligence any sort of machine. Kurzweil considers robotics more like the embodiment of strong artificial intelligence, an "AI that exceeds human intelligence" in computational power and that can be beneficial – and dangerous too – for millions of different applications in the future (2006, p. 507). All the technologies that were mentioned before then are completely dependent on this last revolution. Because ultimately, all technologies will be governed by powerful algorithms determining their functions and eventually self-ameliorating thanks to much faster iteration processes that biological intelligence and capabilities cannot reach. What many futurists, including Kurzweil, are predicting is that thanks to this human-tech merger we will finally be able to access many more communication capabilities that will clearly enhance human-to-human and human-to-machine interactions.

Google glasses – that provides you graphical information of objects and places you see – or Google Pixel Buds (Stein, 2017) – earphones that seamlessly translate into your language whatever you are hearing from the external world – are already tangible examples of how our sociological functions will change in the next years. If we add strong AI to the equation, we'll be soon sharing data in a sort of Wi-Fi telepathy, understand each

other no matter of the culture or language and, hopefully, even have at hand some sort of digital etiquette that can guide us through cultural misunderstanding, body language reading and much more. Put all these gadgets in the hand of new Millennial travelers and you will see how quickly all this will happen. They will be able to travel anywhere and always know where to turn to find the greatest hidden food experience, or they will recognize languages and smells that will let them integrate into the local populations' culture even more deeply than we ever imagined. Will it then be really considered authentic anymore?

6. HUMANITY GRAND CHALLANGES

We live in a world where 10 billion people are about to be, where we already produce food for all of them (Holt-Giménez, Shattuck, Altieri, Herren, & Gliessman, 2012), but somehow still 900 million are undernourished (McGuire, 2015). We live in a world where the energy of the sun reaching Earth's surface is five thousand times more than the total amount of energy we consume in a year. But somehow, we still rely on fossil fuels and non-renewable sources to power our houses, and 13% of the world population has still no light (World Bank, n.d.). In this world there are six billion people who have mobile phones, but only 4.5 billion have access to toilets or latrines (UN, 2013) and where "a Masai warrior with a cell phone has better mobile phone capabilities than the president of the United States did twenty-five years ago" (Diamandis & Kotler, 2014, p. 36). This world still has a long way to go in order for technology to be evenly distributed, and especially forging proper education systems so that everyone could fully benefit from it.

After an extensive deep dive in each of the different innovations that are occurring in parallel in the world, it is now time to focus on what are going to be the benefits for the biggest challenges our world is facing. Challenges that from different figures coming from the public and private sectors have been categorized in different ways and with different names, but they all directly refer to the basic principles of human prosperity.

These challenges, or goals if we want to refer to the UN SGDs, are going to be briefly discussed in the next chapters in relation with different technologies that are being implemented around the globe. In this first section, this research will mainly focus on a

private business perspective and the book written by one of the most prolific entrepreneurs and impact-driven innovators Peter Diamandis (2014) will be taken as a guideline. Diamandis indeed is one of the supporters of the idea that we are about to embark on a very unique stage of our civilization, a period of unprecedented abundance of resources for all and thus potentially a new era where societal paradigms of private property and uneven distribution of goods will be heavily rethought.

This new era will be also characterized by the rise of new world leaders and agents of change: private impact-driven individuals that thanks to the newly acquired technological tools will be able to create new social businesses. These new businesses will not only be the reason for profit generation but mostly for social innovations and sustainable product development. Throughout the next chapters, this paper will evaluate several readings and books deriving from the field of private business development rather than public institutions, and it will try to explain how and why traditional ways of social projects implementation do not work anymore. It will be specified how individuals can now have full access to any knowledge tools they need to create independent activities and how local people empowerment and private entrepreneurship are now the most efficient and impactful ways to create new forces for good, for all. Within this framework, of course, it is clear that these innovations would not easily take place without a political and economic freedom that yet not every country has.

6.1.Water

The element that is probably the most basic of human life, besides oxygen, is definitely water. We know water is used for almost anything we do and produce and we know our planet is mostly a water immersed planet, indeed 71% of the Earth is made up of it. Yet 1 billion people lack direct access to clean and safe water (Gleick, 1993) and in some destinations tourism is among the major consumers (Gössling, 2002, 2013).

Besides the normal use of water for food, kitchen operations, toilets and laundry, water is mostly used in cooling, swimming pools and garden irrigation (Gössling et al., 2012). Many touristic areas, such as the Caribbean and Mediterranean destinations are already suffering from water shortages that often apply only to locals and not to the touristic facilities.

However, these issues might soon be solved through the massive application of several innovations on their way to the right cost-effectiveness. From social companies such as Ethos (2018) now acquired by Starbucks, which contributes \$0,05 for each water bottle sold to the Ethos Water Fund, a development fund that builds water filtration and supply facilities for underserved communities in Africa. To more sophisticated machinery for local filtration and depuration. This topic is anyhow very contradictory, as water on our planet is present in different ways and from different sources.

Where water is closer, but salty, desalinization systems are in place, providing clean sterile water through the effect of filtration of special membranes or distillation, both processes that actually require a high amount of energy as input, thus the average size systems and costs are limiting for small independent communities.

On a completely different scale, companies such as LifeSaver (2018) have developed water bottles containing a membrane with 15 nanometers wide pores for active filtration of any particle that might be inside the liquid. Each filter can last up to six thousand liters of water and it then automatically shuts down when it reaches the limit, thus preventing any user to further drink contaminated water from it. This company has now designed several sizes and is able to provide customers with the biggest need a tank of up to 750 liters, translating into 2 million liters of clean drinking water. These systems are used by schools, refugee camps, but also remote tourism operations around the globe. Unfortunately, such affordable technology is not yet available for salty water, thus limiting the scale of impact and not providing solutions for other industries needing no-contaminated water: *in primis* agriculture.

Last in this category and definitely worth to be mentioned, are the technologies developing systems for harvesting water from air moisture in any dry environment where either desalinization nor filtration can be an option. These innovations are being tested in the deserts around the globe, but the real driver for funding these startups is the potential for using these systems on Mars.

Much can be said about the importance of clean water, how is it going to change and which technologies will allow this transition towards water resilience either. What is sure, however, is that advancements in nanomaterials for filtration, smart sensors and AI-powered supply, and especially decentralized systems will soon allow us all to have enough water for everyone, for almost anything. What are going to be the consequences then? Will this mean that even more remote areas will be open for men's colonization? What will be the rate and speed of development of those communities who are dependent on clean water for basic needs and growth? As for what happened with connectivity in Africa and what could also verify if drones and 3D printing will reach mass distribution, the potential for water filtering technologies are a huge potential for making any industry and community that is currently strongly dependent on water to leapfrog exponentially. Suddenly water costs and availability will not be an issue anymore and we will be able to take advantage of the enormous reservoirs that our oceans are, and ideally use this abundance as a new force for good. Moreover ending many of the world conflicts related to water control.

6.2.Food

As previously mentioned, we currently produce enough food to feed 10 billion people (Holt-Giménez et al., 2012), however, we actually waste 50% of it in the long run that occurs from harvest to consumption every time (FAO, n.d.). Moreover, the UN states that we need to increase food production by another 70% to meet the demand of the rising population by 2050 (UN, 2018). Within these astonishing numbers, 925 million people are currently undernourished around the globe (FAO, 2010) and millions of miles are traveled to ship food supplies from the origin areas to touristic destinations which offer any kind of restaurant experience to their guests.

Land is not anymore an option for cultivation, as we already farm 38% of the total soil available on our planet (Matt, 2010) and the increase in urbanization and desertification rates keep eating out what remains fertile. For this reason, some companies have now started farming vertically: instead of the usual horizontal landscape, indeed, new plants arrangements allow to grow in 3 dimensions. New vertical farm ventures furthermore include technologies such as aeroponics – where roots develop freely in the air and fine

mists of water and nutrients are sprayed on them so to allow plants absorb 20'000 times more oxygen and 98% less water than traditional farming. Highly efficient LED lights for horticulture and climatically controlled environments to remove any sort of pathogens in the growing process. Thanks to these innovative solutions, we are now able to grow in any place, regardless any external environmental condition and, especially, guaranteeing a constant yield per harvest because we completely removed any uncontrollable variable that might slow down or destroy the natural growth of the plants (Diamandis & Kotler, 2014, p. 215). If we add to this paradigm of vertically grown vegetables, the potential for lab-grown clean meat (Beyond Meat, 2018) and highly nutritious superfoods (Christopher, 2015), the potential for abundance and ubiquitous production and access of fresh food can become a reality in the next few decades.

These new practices for producing healthy food will be drastically affecting the status of our agriculture system today. Land for mass breeding animals today may be abandoned or maybe converted into the natural landscape, or maybe be used for other purposes? What will happen if almost no people were needed for the rural food industry of tomorrow?

Maybe it can be a huge potential for new eco-tourism operations to be used for restoration purposes and thus recreational open-air activities can be developed to keep entertaining stressed people from the cities. But at the same time, what about the local people that were employees or smallholders of those farms? Maybe we will need to rethink education in those rural areas so to foster young people to become tourism operators in those who were once farming lands of their parents.

For example, how would such a trend affect gastronomy tourism? One of the fastest growing niches, especially in Europe. What about ago-tourism?

Once again, what about those remote areas where no direct connection for electricity, water nor food supply are set up. Will these technologies be a spear for tourism, help them become more resilient and more widespread?

6.3.Energy

Energy production is both the reason for our rapid industrial development and one of the main causes of death and inequalities around the globe. Besides the obvious international tensions for controlling the raw materials used for generating it, it is even more impressive that three and a half billion people still rely on archaic sources such as wood and coal for basic house activities such as cooking and heating (UN Secretary-General's Advisory Group, 2010). These intensive fossil fuel combustions are furthermore the cause of several respiratory diseases and cancer among these people whose access to proper healthcare facilities is for sure limited or non-existent. Relying on secure, stable and safe sources of energy generation are mandatory for the future development goals set by the international community. Moreover, renewable and environmentally friendly ways to produce it must be the only solution for guaranteeing proper living conditions for the today's populations and the generations to come. As Diamandis states "energy is arguably the most important lynchpin for abundance. With enough of it, we solve the issue of water scarcity, which also helps address a majority of our current health problems. Energy also brings light, which facilitates education, which, in turn, reduces poverty. The interdependencies are so profound that the United Nations Development Program warned that none of the Millennium Development Goals aimed at reducing poverty by half can be met without major improvements in developing countries' energy services"(2014, p. 332).

Of course, solutions to cope with these challenges are well known and what is happening within this specific industry of green energy production is likely to be among the most incredible examples of exponential development. A rapid look at the solar panel production industry illustrated in figure 4 below shows how in the last 40 years only, costs per watt of these systems have dropped from \$101,05 to \$0,37 representing a reduction in prices of more than 270 times. Solar panels can now be installed anywhere there is enough sun to justify the costs of installation and are produced in any size imaginable. Thanks to this market expansion, now people in India and Africa can access systems so cheap and reliable that they can power their entire villages without the need to be connected to the central grid.

Figure 4: Solar on Fire nr.4



Source: Lindon (2016)

At the same time, previous limitations to energy storage, and thus the impossibility to access energy during the night, are being disrupted by two main innovations: new generation batteries for efficient storage and the smart grid. The first segment, probably mostly leads by the innovative electric car manufacturer Tesla and its Tesla Super Charger (2018), is driven by the immense steps ahead taken into new materials development and the resulting increase in battery density. Many of these products are not only used for powering the developed world, but as shown in Pandey's study (Pandey, 2017), who will most benefit from these innovations and lowering costs are indeed the developing countries, whose climate is well inclined to exploit sun exposure during all seasons of the year.

The energy smart grid, on the other hand, finally represents the ultimate step towards electricity independence and decentralization. Solving the huge infrastructural cost that the main central generation centers have because they require a much more sophisticated network of distribution, and are thus limited to cope with the exponential growth of

demand occurring especially in developing countries. Smart grid means that each of the members of the network can both become consumers and, or producers of the energy shared along the grid.

These new systems are powered by efficient algorithms determining the flows of demand and offer and regulating accordingly where the energy goes to, how much should the network produce or keep as a reserve for later periods (H. Xu, Huang, Khalid, & Yu, 2016). Micropayments to producers from consumers are automatically managed and cleared by smart blockchain contracts, guarantee that all payers are equally contributed to their efforts in keeping up the grid. Add to the equation the newly developed wind turbines (Konstantinidis & Botsaris, 2016) able to produce much more energy with much less wind, and we can easily picture in our mind the huge potential and feasibility for the independent, resilient – and even remote – villages, towns and cities of tomorrow that will flourish around the world and will ideally run on zero carbon emission for all year long.

Following along the concept of decentralization, these newly generated grids can be much more powerful and resilient than traditional centralized systems. Thanks to these state-ofthe-art technologies, indeed, many more locations can become environmental hazard-proof and no power outage might occur if any of the generators will eventually shut down, because thousands of others will be easily able to compensate for the loss.

This new concept of energy independence can surely open many opportunities in the tourism sector as limits to energy usage, environmental constraints and rural development can be issues of the past.

6.4. Healthcare

In a recent study published by Orbis Reseach (2017), the global medical tourism market size in 2016 was worth \$19.7 billion. In 2021 it is expected to reach \$46.6 billion worldwide, an increase of almost 240% in just 5 years. Not bad for an industry that only considers travelers those who move to a new country, seeking medical care that for different reasons are not able to find in their origin country. But how this relatively new industry might be impacted by current healthcare innovations and developments? Probably for many years nothing will change, as this industry usually takes very different paths and

timings than traditional markets due to governmental regulations and very powerful private interests of corporations. But what is expected to happen in the next decades of medical revolution is nevertheless fundamentally important today.

Companies such as Tribogenics are bringing to the market 1\$ machines able to generate X rays and thus provide customers with almost-free diagnostics services (Diamandis & Kotler, 2014, p. 383). AI-driven platforms such as Watson, the renowned supercomputer developed by IBM (2017), are now able to support doctors in elaborating diagnosis for patients in matters of minutes, by accessing billions and billions of scientific papers published during the entire history of humankind. Very soon, new companies will release inexpensive gadgets that will be installed directly on our smartphones and will provide us with complete blood, urine and skin tests so that we can easily know what is happening to our body at anytime, anywhere we happen to be (Kelly, 2017).

As we mentioned earlier in this paper, nowadays 4.5 million people own a cell phone and very soon this number will be reached by smartphone with internet connectivity. Imagine what will it be the impact of ubiquitous healthcare services for almost no cost or affordable service fees. These new technologies will exponentially increase our life expectancy, boost our daily performances and productivity. Where will all the people whose income and health allow to travel around the globe go?

How many more people should we expect traveling during their retirement years, which will inevitably last much longer than our predecessors?

Imagine what can then happen once ubiquitous intelligent machines will be installed in medical centers around the world. Machines such as the Da Vinci, developed by Intuitive Surgical (2018) which enables doctors to operate delicate surgeries from remote. Will it then really make sense to travel long distances to find the right medical facility?

What will it be the destiny of the ever-growing retirement homes' market if "robo nurses" (Diamandis & Kotler, 2014, p. 390) will be provided to assist elderly people directly in their houses? These robots are already in the market and soon will reach enough cost-performance that anyone will afford them and even save a considerable amount of money in the current understaffed and overpopulated retirement homes. Would these savings result in more money for families to further travel around the world?

The UN (UN General Assembly, 2001) estimates that by 2050 2 billion people will be aged over 60 - almost 400 million of them will be over 80 - 85% of the global population will be living in developing countries, and by then will already have had the chance to increase their economic status and now willing to travel internationally. Global tourism numbers will be dramatically signed by these health improvements, generating an enormous new market for future travel businesses.

7. EDUCATION

Having previously discussed the basic innovations that are increasing the most essential needs for human livelihood, it is now important to mention the second step of the ideal pyramid that will bring us to the era of abundance and prosperity for all: education.

Besides access to water, electricity, food and proper healthcare, indeed, education is following right behind as a powerful tool to guarantee that each individual can have the right capabilities for increasing her social status and contribute with her own means to the growth of the overall economy.

We are all well aware of the importance that internet had on our lives, we are now capable to access such an enormous amount of information with just a few clicks and, especially, we can access those data essentially for free, thus democratizing even more the right to learn for all of us.

This uncontrolled flow of data, however, can be considered as both the greatest and the worst condition we have ever had. Having the right skills to distinguish from what is true and what is false among them, indeed, is becoming the real challenge. Exactly like what happened with food in the developed economies, where instead of having issues because of too less to eat, now we have obesity rates that soared for the last 50 years (Patel, 2012). Today one of the most fundamental skills to have is the ability to filter through information, and avoid to be overwhelmed by fake data (Kelly, 2017, p. 200).

At the same time, the UNESCO tells us in its latest EFA Global Monitoring Report (EFA, 2014) that none of the education goals set worldwide have been met. 25% of children under 5 are indeed suffering from stunting. In low income regions, 37% of teenagers only

have completed secondary school, thus meaning they lack foundational skills for their personal development in life. Adult illiteracy keeps being too high, with almost 800 million people not able to read nor write. When existing, education quality is still considered to be poor, with 250 million children who do not learn basic skills even if they are actually frequenting school. Moreover, these numbers continue to be widely more spread among women.

Developed countries are not immune to challenges, old minded schools' systems indeed are not providing the right capabilities to the new generations for what today's life requires. This is generating more and more students well educated but not really employable. And this will only result in the end in a further increase of disparity among rich and poor. This topic is of course complex and dependent on many other variables such as civil rights, funding for upgraded educational systems and more. But for the purpose of this paper, there will only be a focus on how technological advancements are helping in different ways people of all ages to overcome this problem.

7.1.Self-Organized Learning Environments

SOLES is the acronym developed by Mitra (2017) in his several studies and attempts to provide computer skills to children in poor communities such as Bhutan and India. Mitra, an Indian physicist, was one of the first to try innovative and unconventional methods to teach kids some basic digital skills by setting up a "playground learning station" – basically a computer in a wall, as he explains – and allowing several children to start playing with it. The results were astonishing and Mitra understood for the first time, that small groups of people and one occasional facilitator could achieve incredible learning outcomes. From there, Mitra proposed a new model of decentralized education, a model where several low-cost stations could be installed in any village, connected to the internet, and provided with one occasional facilitator – in his case he chose to engage bored and time-available English grandmothers. If basic knowledge could be taught to these kids without the need of setting up conventional education facilities and leveraged highly experienced assets – such as retired professors or remote assistants – imagine what can be done with the implementation of ubiquitous artificial intelligence bots and new learning apps.

7.2. Personalized education

Bots are simply a version of interfaces in which an AI program can assume appearance. These specific AIs are leveraging what is called natural language processing (Algorithmia, 2016) to understand and communicate with biological people. Immediate examples can be already seen in several applications in which bots assist us: Amazon Alexa (Amazon, 2018) or even without noticing it, many of the digital customer services from any corporation. In the next years, we'll assist to the rapid development of the field called EdTech, education technology, which is focused on bringing to consumers of any pocket and culture the most advanced assistant tools for learning and upgrading personal skills.

What once was a difficult and long process to train and forge teachers of any subject, in not so long these people will be supported – if not disrupted in some cases – by AI-driven machines that will provide students with customized learning courses. They will recognize the strengths and weaknesses of every single individual and will help them become more mature and knowledgeable following the natural different steps of development for anyone. Personalized education will be able to be offered to anyone, regardless their income, and cheap smartphones together with AR/VR headsets will increase the UX of students engaging them in more interesting and appealing ways (Diamandis & Kotler, 2014).

7.3. Gamification

Gamification will be the next method for effectively teaching people on specific subjects. Engaging and "addictive" stories, challenges and hands-on projects will make students much more willing to carry on studies rather than being obliged to attend school every day, even if the subject of that class has already been completely understood by the scholar (Diamandis & Kotler, 2014). Besides the new job creation needed for teachers that will likely become learning-games script editors, the most interesting challenges are related to teaching practical studies on the field. Imagine how many more people might be taught by games such as Pokemon Go (Pokemon Go, 2018) and involved in visiting new places, relive ancient stories through digital tools and learn about people's culture in diligent and insightful – hopefully not biased – ways.

This new paradigm will on one hand increase exponentially the number of travelers because of their higher and educated standards, but will also expose many more existing tourism operations to keep up with these technological advancements. Most probably a museum that will not have any augmented reality entertainment will not be included in destination guides. Rural communities that will want to become more renown internationally will just need to upload the proper information online, and get immediately in contact with thousands of potential new visitors. But how will manage such a rapid growth and how will they maintain control over their lifestyle and safeguard their origins and cultures and avoid becoming a mass tourism destination? And who will create the business environment and educational structure that makes this growth sustainable?

8. FREEDOM AND TRUST

It probably comes fast to mind that with education comes freedom, but probably in this case freedom means much more than not living in a tyranny or having the universal human right to travel (Claiming Human Rights, 2018). Freedom today depends on many things, from the most basic needs that are covered in the previous chapters – freedom to access good food, clean water, electricity to power your house or business and affordable healthcare to guarantee proper living standards. To the most sophisticated ones that are sometimes more an issue of developed countries than anything – such as paid vacations, freedom of speech and strike. These feelings of freedom will inevitably keep increasing the more we will move towards the future, thanks to internet for sharing information, secure and public blockchain for guaranteeing transparency in all transactions – both economic and civil, such as voting – and many more innovations that will inevitably expose whoever will try to work on behalf of a limited crowd rather than the overall community.

We can already see what happens if a malicious hotel owner is promoting fake images for selling you the next vacation. Social media reviews and press coverage – in the worst cases – will completely destroy their reputation. How will we then make sure that everybody is

aligned with our common goals? How do we make sure, for instance, that tourism operators are not hindering local residents' freedom to live in peace?

How do we make sure that platforms such as Airbnb are beneficial to homeowners that want to share their apartments and profit some money from it, while at the same time not inflating a renting bubble for local residents in search of a new place to stay?

In an old and classical mindset, probably the answer would be the institutions. Governments or regulators that impose taxes, privacy standards or compliances to which all stakeholders have to adhere accordingly. These solutions are of course powerful and very effective in some cases, probably one of the clearest examples is Europe and its continuous work for protecting consumers' rights. But in a more futuristic and – some would say – utopian view, many more are the trends and ways in which the overall human society is using technology to create a crowd-powered global system of civil-, digital-rights for everyone. These systems are both driven by a newly discovered passion for private individuals in doing good – especially good business – powerful crowd based and open source projects – such as Wikipedia – and of course the now available impressive computing power enhancing our capabilities of monitoring and overseeing what is happening around us.

8.1. Social Entrepreneurship and Impact Investment

The last 30 years have seen a magical trend growing up from tiny garages and unconventional laboratories where people were building new and revolutionaries ideas. Better known as the rise of Silicon Valley and entrepreneurship, this new race of people was very different from what usual workers used to be. They wanted to build something new and use it to change the world. Nowadays, the same race of people, entrepreneurs, are looking at the world with new eyes and instead of seeing catastrophic problems around the world, are only looking at the many opportunities on how their innovative ideas can be solving them. Today, entrepreneurs are not only willing to build new ideas that can change the world, they want to change it to a sustainable and just one. Social entrepreneurship is probably one of the fastest growing trends along innovation and thanks to current technologic advancements and the ones on development, the potential for people to first discover, and then solve the most varied problems affecting our society are immense.

As Diamandis (2014) and many other innovators, including the author of this research, believe is that social entrepreneurs, more specifically DIY - do it yourself – social entrepreneurs, are going to be the most disruptive force for eradicating the grandest challenges our species face.

These innovators have now the unprecedented possibility to access billions of data and information for free. They can access a network of like-minded peers via online communication, groups and forums of more than 3.2 billion people connected to the internet worldwide (ITU, 2017). And thanks to the technologies mentioned in the previous chapters, passing from ideas to prototyping and market launch has never been so rapid and easy in the history of humankind.

What is really the most powerful key to turning this trend of entrepreneurship into a positively disruptive system, is not the technology available *per se*, but it is the freedom that anyone of us has to take on a new challenge based on deeply cared problems that a big corporation or a centralized government official usually cannot even think of. As illustrated by Salim Ismail in his book "ExO" – Exponential organizations (2014) – what is driving new successful companies today, is their "massive transformative purpose". This burning unstoppable vision of solving specific issues, drives founders towards the development of new products regardless of the severe constraints in which they work. Hardly any other institution would be able to compete in recruiting so many committed employees – in some cases they can even be considered followers – in working for that goal.

In this new panorama of socially driven individuals willing to change the world, we need to insert the figure of the impact investor. These investors, are indeed very different from normal bankers or financial associates driving old style funding institutions such as banks or public organizations. These investors have their own money to bet in the game and are incredibly committed to bringing to the table their former entrepreneurs' life to support new generation innovators in doing good. Also denominated techno-philanthropists by (Diamandis & Kotler, 2014), these people have literally billions in their hands and have

successful first-hand experiences on what means creating new companies, thus representing real assets beyond the sole money to achieve great results and further evolve towards green growth. A very famed example of such investors, is Bill Gates whose Gates Foundation has already committed \$28 billion for future investments, grants and donations to the may social projects around the world.

If we add to this privately initiated niche of impact investment, the general change of direction that conventional investment institutions are taking – especially after the recent "letter to CEOs and investors" from Larry Fink, CEO of the world largest asset management fund, calling for the urgent need of socially driven investments (2017) – we can start feeling the potential outcomes that this new investment mindset can have on the economy and hence our lives.

As cited by Lipman (Lipman et al., 2012), the role of impact investment in the travelism industry and especially the developing countries is potentially huge. To respond to these trends and to provide a platform where travelism-related ventures and clear investment and sustainability criteria could be published in order to further facilitate private capital flows towards those projects, the GATE Global Impact's Tourism Responsible Investment Platform (GATEtrip) has been initially launched in 2013. Albeit no longer operating, the platform aimed to contribute massively to the growth of this sector through the application of innovative financing strategies to the different areas of tourism development and education.

8.2. The power of the crowd: Open source, Crowdfunding and Initial Coin Offering

Once we put social entrepreneurs and impact investors together, they can create a product, then they need to find a market. Leveraging technology and this newly generated crowd of people that believe in much more than just buying cool objects or cheap goods, will be the most important skill of the next generations. As we already see that today without a positive "online reputation" there is no way for a tourism operator, nor any other company, to successfully maintain its position on the market (Horster & Gottschalk, 2012). At the same time, the crowd can be leveraged for much more than just online reviews and co-

marketing. Nowadays, indeed, crowd-based development is the key to a fast and sustainable growth. Platforms such as Kickstarter and Indiegogo allow you to validate your market even before starting developing a new product. Open source platforms such as Wikipedia and Linux are rapidly becoming the leading source of information and operating system respectively. Both these platforms have never been incorporated as a private company and beside the limited economic funding, they completely rely on hours and hours of free time dedicated from the crowd members that apply their personal skills to generate content and increase the capabilities of these tools. As Kelly (2017, p. 325) writes, Wikipedia is an outstanding example of open source knowledge for all: "at last count in 2015 it sported more than 35 million articles in 288 languages. It is quoted by the U.S. Supreme Court, relied on by schoolkids worldwide, and used by every journalist and lifelong learner for a quick education on something new". What can it be the power of such tools for the emerging bright minds all over the planet that can have the immediate and free access to this information?

Imagine the impact of billions of people that autonomously self-organize online and decide to work together on seemingly impossible projects. As Ismail (2014) describes, a small team of the smartest people hired in a corporation, will never be smarter than the entire potential of a community of thousands of passionate and driven individuals that team up for solving a specific problem.

Crowdfunding is surely a tool that works fine for new products and prototypes, companies that want to try out something new and need a limited amount of money to finance the first development. What is happening through the blockchain, however, is the next level of crowdfunding though. New companies with immense and disrupting visions, whose main innovation relies on the application of the blockchain to solve the problem addressed, are now fundraising using this tool: similar to crowdfunding, but with much more enormous spectrum. The ICO – initial coin offering – are something that can probably be best described in-between crowdsourcing of capital and an initial public offering – the process that now-mature corporations do to be listed as public companies and access further sources of finance. What is different in an ICO, however, is that people do not purchase real stocks of the company, but "coins" that can be ultimately used later in time to access the services the company offers. Imagine you are buying X amount of coins from a casino and then wait for the casino to be open and use those coins to play, buy beverages or more.

At the same time, of course, many of those coins become a security, thus like real stock price can increase and investors make profit reselling them to new buyers (Catalini & Gans, 2018).

This new way of funding allows small and large investors to play at the same table, and especially people can pre-buy coins that will later be used to actually benefit the company's services. Even though this topic is currently under serious critique, its novelty and uncontrollability are indeed increasing the risk for malicious use of funds or improper diligence in securing the money raised. Give it a little time to properly structure and standardize, and blockchain technology will disrupt our life like internet did just a few decades ago (Mougayar & Buterin, 2016).

Especially in the field of travelism where international transactions, flows of people and legislations are involved, having a standardized way of dealing with all that bureaucracy will make us wonder in a few decades how have we ever lived without seamlessly operated digital transactions and smart contracts.

Imagine moreover the power of small developing communities that can then access direct funding for their projects. They can completely bypass middlemen and tourists can clearly see where the money is going and for what is being spent. Wouldn't you like to see your holiday destination being built or maintained with the money you spent on visitor taxes? Or what about completely new products funded by thousands of future visitors that because of their contribution can have first option to spend their vacation time there and use the coins pre-acquired to pay for services in that destination?

8.3. From ownership to access

In March 2015 Tom Goodwin, a TechCrunch journalist wrote "Uber, the world's largest taxi company, owns no vehicles. Facebook, the world's most popular media owner, creates no content. Alibaba, the most valuable retailer, has no inventory. And Airbnb, the world's largest accommodation provider, owns no real estate. Something interesting is happening" (2015).

Something very interesting indeed is happening, and it's all about the power that technology is giving us to be capable of having – almost – all we want without actually owning it. This is the power of "accessing" as opposed to literally possessing a good. This drives us more dynamic and, especially, makes us try many more things than whatever we ever had the chance to.

This chapter will not focus much on how Uber or Airbnb specifically have disrupted travelism, but will reflect on how accessing goods drives exponentially down the cost to travel and this will be among the reasons many more people will be able to afford it.

Not owning a car, indeed, means that you are not tied to a specific kilometer rage where you will be able to drive. You can embark on a cheap flight to a new destination and rent a car from a local person. This person will even be more kind and welcoming that a car rental office and will provide you with insightful information about your next destination. Maybe you don't even need to fly, but you can just book a Blablacar ride and meet new people during your trip. What if when you finally arrive at the new destination and you already have the right app for booking a taxi ride to the accommodation without the need to exchange currency?

What if you want to rent a boat for a trip to the ocean or a caravan for a road trip with your family? These are all things you can do with platforms such as holaboat.com (2018) or shareacamper.com (2018).

Any sort of material good will be potentially offered as a service. No one will ever have to possess anything if their specific need does not require it. Vacation-as-a-service business model can even become a new trend, where people can assign certain budgets and schedules per year, and the platform will automatically book and manage different vacations based on their specific tastes. Business people traveling a lot will even decide to just pay a monthly fee and have full access to a network of private accommodations worldwide that will always resemble like their own place, can be always furnished with the favorite grocery and cleaned clothes will be waiting in the guard robe at any time. Synced calendars will be already communicating with the different AIs managing the facilities and announcing last minute changes and suggested availabilities for taking a break, based on physical stress – registered by the wearable sports tracker – and personal genetics.

The main challenge, however, will to guarantee full access to these technologies to the developing countries who are already exponentially growing their economies thanks to affordable mass manufactured products. If the power of selling billions of very low cost smartphones to these populations has already produced the birth of millions of new jobs, services and business models. What can be achieved with ubiquitous distribution of AI computing power, sensors and all the other innovations, will certainly guarantee incredible new developments in those regions.

9. OPEN DISCUSSION: THE FUTURE OF TOURISM

In this chapter, the author of this research had the chance to interview three experienced and knowledgeable futurists, that since many years are working on understanding and teaching companies and individuals worldwide about the future of our society and economy. The three interviews have been conducted without a specific set of questions, but rather the author of this paper tried to stimulate an open discussion aimed to understand the specific point of views of the different people interviewed and their views on the future of mobility. As a result, indeed, the conversations reported very different opinions on what the future of travelism industry will look like, and especially whether or not we are going to meet the sustainable goals our community set for the next years.

Although all of the conversations leaned towards the irrefutable fact that tourism flows are increasing exponentially, it was very interesting to see how three different scenarios were identified by the experts as the outcome of this enormous pressure on destinations in the next decades. While the positivistic and economic-driven perspective of Ian Yeoman, (tourism futurologist and Professor at Victoria University of Wellington, New Zealand) was extremely convinced that destinations will keep evolving their offer in relation to the type of visitors they can receive. Thus, like the example of seasonal tourism or destinations afflicted by wars, tourism flows keep flowing, but the products offered in those locations are different. And thus again, the total number of travelers worldwide keep growing regardless of the specific condition of one place.

On the other hand, Rohit Talwar (CEO Fast Future and keynote speaker for different panels on future trends) is convinced there is a serious threat to the travelism industry and

that might not have more than 20 years of business before the ecological and societal collapse will occur and from there a new society, based on new values and ethics, will regenerate. Very few leaders are indeed brave enough to admit it, but we are barely doing what is needed for keeping global temperatures within the 2 degrees Celsius. And the ecological collapse will only fall into a huge societal revolution that will completely change the way our societal principles work – especially the capitalistic ones.

Lastly, in a more reconciling way, Ignace Schops (environmentalist and Director of the NGO RLKM in Belgium) asses to be confident that a new systemic change is already occurring. It will not only be the key to a more engaged society and industry, but especially he believes consumers, rather than strictly the suppliers, will drive this fast change to increase sustainability and social justice to guarantee a more prosperous future for all – but especially for travelers.

The following chapters will focus on one common specific theme, or question made to the people interviewed, and the three different point of views from the interviews will be reported and commented by the author. The attempt will be to come to a general conclusion on the specific topic by merging the knowledge presented and discussed in this research and what each specific expert thinks of the future trends.

9.1. Reasons to travel and how does it affect the future flows of travelers

Starting from the provocative perspective of Rohit Talwar, the travelism industry might only have 20 years left of business. This because of the two main factors analyzed in this research: the environment – in this case the collapse of it – and the exponential rise of technology. Surely in the next coming years travelers will keep increasing because of the economic prosperity and the need to move for work, but this condition will inevitably contribute to further degenerate the environment we live in. Moreover, the increase of technological advancements is putting us in the position to start playing and interacting directly with our senses. Besides what we already discussed on AR/VR, the rise of embedded sensors in our body will probably allow us to even combine visual perceptions with feeling perceptions such as tactile, smell or directly in a cerebral level such as pleasure and other chemical reactions. Since we will most likely be able to recreate the same brain processes that occur while we travel, thus the feeling of discovery, sense of being far away from home, or simply feeling relaxed while sunbathing on a tropical beach. The real question will be, why do we still need to travel? Will we just assist to a global border close-down in order to restrict the number of travelers, hence the potential harm they cause to the environment, and we will only travel with our mind?

Will we limit our travels to nearby green locations and then we will decide to only discover new places with technological tools? One potential scenario pictured by Talwar, is that very few people will really afford to travel as countries will increase costs of visas and requirements to land in. Thus pushing the majority of people, without a real incomegenerating job due to the AI machine take over, to find comfort in virtual reality experiences. What is today the common practice of reading a travel blog, tomorrow will most likely include many more VR user experiences and even digital connections to our senses in order to perceive what the real person is feeling in the exact moment of her travel.

What on the other hand, Ian Yeoman says, is that regardless the technology advancements and the environmental damages, we must look at travelism from the lens of why people want to travel and how do they perceive – including from a social status point of view – the act of traveling. People travel – in this case specifically for the sake of a holiday – for a pure hedonistic purpose. Especially in China, rising middle classes perceive traveling as one of the most important factors in their scale of wellbeing and prosperity. Billions of new people will have resources to travel and will keep visiting the real physical places, maybe only for the sake of showing they have been to a specific destination. What the role of technology in all of this will have, is strictly related to the augmenting capabilities and experiences we will be able to live. As already mentioned when speaking about Nanobots, new tech gadgets will allow us to reach unreachable places and offer to new customer segments packages that they would not have imagined before. Hiking the Himalaya thanks to the support of a robotic exoskeleton, or mountain biking with e-bikes for the inexperienced and untrained people. Diving into deep waters without requiring a specific license. All these will be the products available for the industry of tomorrow.

Thanks to technology we will also be able to recreate destinations even if the external climate conditions would not allow us. A very clear example made by Yeoman, is indeed

the future of gastronomy tourism and the specific case of Napa. California is already a very deserted area where agriculture plays a big role for tourism and without the proper conditions to grow in the future, not only the agro sector will be eradicated but also the related tourism one. New evolutions in such areas will be to start creating indoor recreational facilities, much like what Dubai and the middle east have already developed, or simply re-designate those areas to different industries.

In Yeoman's opinion, as we already see every year in destinations such as the mountains of Europe, where the less snow falls and the more they shift their main activities during the summer – which on the contrary is increasing of length and temperatures, thus opening gates to more warm-seeker travelers – the same will happen with every destination in the next years.

Ignace Schops looks at the current situation with a more philosophical view and does think that consumers are really changing their behaviors and thus traveling for them will more and more represent a sense of stay within the destination's culture, understanding and respecting the locals' values. Technology will surely play a big role, but will not be the main factor of a sustainable development in the next years. As opposite from Yeoman's perspective – which asses that the sustainable change in tourism will come from the supply side – Schops is positive that the real drivers will be the consumers. As we are already seeing in many different cases, destinations are offering what customers want, and now we see countries such as Italy or Spain which were only promoting their sea-and-beach façade and now the main drivers are culture, heritage and food. Supported by consumers' trends such as SlowFood, more places are turning to the greatness of their past to drive innovative sustainable developments and attract more green-minded audiences.

"Nearby will be the faraway for the future" according to Schops and sustainable initiatives for protecting local and regional areas will increase the cohesion of different green industries to keep supporting rural destinations. National parks that combine organic agriculture, gastronomic tourism and other green experiences will be the norm and – probably – the only solution to preserve economic prosperity for the people living outside of cities, and for the overall environmental stability of our planet. 9.2. The role of technology and the education needed to prepare for the Singularity

During the interviews, the experts were questioned about the importance of technology for the faster development of our societies and especially which role it plays out in the specific field of education. As previously discussed in this paper, education is the key to a sustainable development and to guarantee the increase of civil rights, freedom and socioeconomic development for all. Especially in the topic of travelism, the education of consumers, suppliers and local population is fundamental to avoid the increment of the disparity gap between the rich and the poor. In this research one main assumption is that technology will be the most important driver to increase education among all, it will be able to bring resources and knowledge to anybody regardless their social status or economic possibilities. However, the three people interviewed had slightly different opinions in admitting that technology was the real main factor for enabling this change.

Talwar is convinced that the education issue is not only dependent on tech, but it's much more about social interaction and ethics. We could be able to fix this in 5 years if we only educated properly teachers and mentors to then provide knowledge to the kids and students around the globe. In his opinion, the real issue is related to the lack of awareness from the industry leaders and political institutions in admitting the importance of making people ready for the Singularity.

However, it's hard to imagine a professor in a poor country with limited skills in using basic functionalities of a computer teaching kids about how humans and technology will merge together in the next 20 years. It's true of course that we can teach them more prioritized knowledge, such as writing and reading, acting sustainably by caring about the environment or simply how to use tools for farming, buildings and maintaining objects, math and economics basics. But all this won't probably be necessary anymore in very few years, at least not in the form as we intend it today. New startups are creating self-managed farming systems able to grow food anywhere without the real need of human intervention, or at least skilled labor. Machine learning, as we previously discussed, is now able to reprogram itself to learn new things and processes, thus people should actually be learning how to ask proper questions to technology rather than focusing on answering problems we already know how to solve. Much of the labor that will be really needed in the future –

actually already today – is related to the skills required to design and develop new products. How do we assure poor communities to learn how to code, how to hack IoT objects and build new robots? How can we ensure that they will be able to receive the necessary skills to launch new businesses in the era of entrepreneurship?

In the specific case of travelism, how do we teach people to master new technologies for creating more sustainable and appealing products – whether they want to create them or simply apply them to their business?

To answer these questions, Schops cited the example of international organizations such as Ashoka (2018), whose he is a proud fellow, that is working around the globe to share knowledge and good practices to social entrepreneurs on how to drive systemic change. Ashoka does not hire engineers to build new products or software, it does only use very "human" and analogic resources to train their people, they are not indeed technology providers. They do however work closely with fellows that are actually developing new technologies, thus the immediate doubt, known as the chicken and the egg problem, arises. What comes first?

How does Ashoka share its knowledge and train people around the globe without having at its disposal tons of technological resources to connect with them seamlessly? We surely have to say that not everybody must learn how to code new software – not everyone must be an inventor indeed. But they must at least be able to recognize the development patterns of these trends and be ready to apply the resulting newly developed products for the sake of developing more social and impact driven initiatives. At the beginning there is always the need for some innovative mind that create a new source of code to solve a challenge – see what relatively recently happened with the blockchain – but as soon as this technology is on the market, business leaders must be conscious of the infinite possibilities for how they can apply that to their specific cases. Didn't it just happen with the example of the UN using blockchain in refugee camps?

How then can we really spread around the concept of Singularity if we don't realize that whether we like it or not, technology will be so impactful to us humans that will even make us question about the sense of humanity as a whole? Yeoman, for instance, is very confident that technology will improve our freedom of movement, access to information and hence education. But when specifically questioned about the Singularity, the immediate answer he provided, was to ask ourselves what is the meaning of humanity. In his opinion, this technology revolution and the impact on humans will only play to enhance and increase what we can do today, how long we can live and which places we can travel to. Probably the more we develop and the more other economies and emerging countries will have the possibility to move and educate themselves in other places and cultures. This will increase our overall sense of humanity and thus maybe reconcile our communities.

Technology will increase how fast we can connect to the world, but surely will not replace the role of humans in our planet. We must not forget about the importance of real people and their role in society.

The hypothesis related to the increase of technology in our society, is indeed the related increase of free time that people can spend in useful and meaningful jobs or activities. Probably having a professor that spends the majority of her time to challenge, inspire and question her students would be much more productive than spending the same time on checking exam results and assignments. A machine could do this repetitive job much faster and efficiently than a human and it will free us to just focus on creativity and worthwhile interactions.

10. LIMITATIONS AND NEW FRONTIERS

This research represents a very broad overview of the current scenario on technology trends and climate change. The intent of the paper was to provide basic but substantial knowledge of what can be the future outcomes on the travelism industry and how industry leaders can take advantage of these changing conditions.

This thesis should of course be implemented of much more precise studies on the very specific applications and specifications of every single technology. As discussed in the introduction of this paper, however, the research specifically wanted to cover this topic from a holistic point of view in order to provide a wider understanding of how technology

megatrends are affecting the travelism industry. For this reason, further research on more precise applications can be implemented to fully illustrate the readers what can be achieved by applying these innovations in different travelism fields.

The limits to this research are certainly the impossibility of assessing with confidence what is going to happen and, especially when. The Singularity is predicted by the year 2045, but many other researchers and thinkers are not really convinced that we can easily achieve the inflection point in this exponential curve by simply relying on the growing computing power at our disposal. As discussed by Talwar, much more work on our biology and physics must be advanced before we will really be able to leverage the computing power to hack our life and existence. It will be therefore matter of more research understanding how computing power is affecting other biological innovations and how the two paradigms – biology and digital technology – will interrelate and create new systems for us humans to live in.

The same question will have to be answered in relation to travelism and mobility, especially once AR and VR will really become the norm. How do we distinguish between virtual tourism and physical tourism?

In the overall work that must be done by tourism researchers, industry leaders and future students, the different technology applications that can be used to create new tourism products are definitely what the author feels more urgent. The hope of this paper, is indeed to stimulate further innovators, creatives and entrepreneurs to take on the challenges that we face today and disrupt the current unsustainable systems with more innovative, engaging and just products. Hence taking an active role in supporting our society to the greatest shift humanity has ever faced in its existence.

CONCLUSIONS

As previously anticipated by the research paradigms used to guide the outline of this research, there is not a definite answer to the question of how tourism will change and what the travelers and destinations of tomorrow will develop. The future is always quite uncertain, and because of the very particular moment in which we live nowadays,

technology and exponential development will disrupt what we are used to contemplating as normal. Thus leaving us very few inputs to build on what we are already used to. Innovators and entrepreneurs around the world are already taking this enormous chance to set new roots for a much more equal and sustainable future. We have seen how the tools of the fourth industrial revolution are changing how we live, what we can achieve in our daily life and while traveling. Most probably we won't even distinguish anymore when we are traveling or when we are commuting, since travel and tourism are now transitioning into travelism and tomorrow they will maybe just be described into the category of mobility. Technology will enable borderless spaces and supersonic travels will allow us to live and leave to anywhere in a matter of hours. Decentralized energy grids, 3D printing delocalized production plants or food produced indoor will allow anyone to set up operations wherever they want, thus on the one hand pushing the limits of remote tourism and on the other, increasing the resiliency of many destinations that now only depends on obsolete energy sources.

We will also be able to increase our living conditions in ways we never experienced before, thus potentially decoding our genome to find the perfect cure for any illness we might contract. Or we can even push social and technological innovations to exponentially guarantee education for all, everywhere. Thus not only increasing lifestyle from a health perspective, but also by having new bright minds at the forefront of creating more solutions to the problems humanity faces. We will be able to push the limits of entrepreneurship so that we won't depend anymore on institutional investors or barriers to enter the market. AR and VR will also create a parallel market – a parallel life to some extent – that will let us travel with our mind and with our sense.

All this innovation, however, it only has one real limiting factor today: climate. What is clear from this research is that regardless of what new technology we want to develop or what tourism product we want to launch. The stability of our environment must be controlled and raising temperatures must be stopped. If we do not reduce the impacts we have on our planet, indeed, the irreversible mechanism that would start will probably sign the end of our species as we know it today.

It is sure that having the right political and social infrastructure to embrace this change is a tremendous facilitating element for the rapid speed and widespread of technology among

people. But as shown in several situations in the past and current politically unstable geographies – where technology is used to maintain communication, drive social riots and build new economies on untraceable and decentralized digital infrastructure – the force of disruption that digital innovation represents and the power that entitles masses will very likely stand against any human-led repression.

Wars and economic crisis have already tried to scrape the exponential growth of digital innovation in the past indeed. However, what is represented today by the impact that climate change can have on our planet, is nothing the like and will seriously threaten our entire existence.

By reading this research, the tourism leaders of today and tomorrow must understand what are the great possibilities that can be achieved with technology and at what real speed shall we all forecast them to be fully operational and usable in the market. This research does not imply however, that everyone must become an engineer in order to understand and take advantage of these innovations. But does try to call the attention of all those who want to prepare themselves and their community for the future shock these changes will bring.

Anyone must understand how sustainable development is the only key to succeeding personally – and as well as a human species in general – but should also realize that technology will be the main driver for enabling all activities in the future.

Referencing the conversations had with the three people interviewed in this thesis, many initiatives that today are considered impactful for society have been considered not dependent on technology. However, this research shows very clearly how in any activity technology is always very present and represents one of its most important enabling factors. For this reason, what has to be clearly understood is that digital innovation cannot be considered *per se* but always needs to be put into the specific context of where, how, why it is being used for, and what benefits does it bring to the overall social and economic shift.

Technology is the only way we can achieve zero emission growth, ubiquitous access to information, and abundant resources for all to thrive. However, it has to be considered as the basic infrastructure to empower people to further implement specific solutions to cope with their specific problems. Pretty much as we are taught how to read and write in order

to communicate with the world, anyone must learn the basics of technology to then be able to use it at his purpose. Anyone must be trained to understand the implications of exponential technology development in order to prepare accordingly for this immense change we'll experience in the next decades.

Travelism industry leaders cannot afford to neglect these trends and, especially, must seriously include technology roadmaps for their businesses in order to effectively cope with the issues related to climate change and the sustainable development goals to be achieved.

To conclude this paper, the author wants to highlight how important it is to take a break from what we have been taught so far, influenced by or just educated to. What is about to happen in the next decades is something of such a drastic change that we will never be able to fully predict. We can only train ourselves to become as adaptive and proactive as possible in order to avoid being overwhelmed and increase our chances to become new leaders of the system that will be created.

As historically advocated by the worldwide renown inventor and systems theorist Richard Buckminster Fuller: "you never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete"(McElroy, 2013). Thus an appeal to everyone: learn about the exponential trends and start building the infrastructure to welcome this change. Several models to follow have already been developed – such as Circular Economy, Impact Travel and the theory of the Singularity and the SDGs themselves – and probably many more will come. What is absolutely important, however, is to become deeply knowledgeable of the holistic implications that technology will have. How different innovations can have great impact on any activity, but at the same time can represent new forces for even more powerful destruction.

Genetics and nano-robotics can be used to develop cures for cancer, but can also be used to generate lethal chemical weapons that would destroy entire populations in matter of days. It has been mentioned how drones initially were created by the military to avoid humans in the battlefield, but this research also clearly showed how massive can be the benefits if their application is focused toward social implementations.

The list of examples is of course very long, but future leaders now have to fully understand that the only way to keep evolving towards a sustainable future is to create models in which green growth and social impact is prioritized above anything else.

New technologies and their business applications must be aimed to solve the humanity grandest challenges in order for us to finally make the transition from a society where resources are limited and controlled by the few, to a new era of abundance where there is enough for anyone at the right price.

Travel, tourism and the travelism industry in general must be at the forefront of this change because they are the most complex and interrelated industry and therefore would drive an immense pressure on the collateral ones. Sustainable activities taken in the hospitality industry will also automatically affect the food industry. Breakthroughs in the aviation sector will immediately impact the energy one. New green transportations will affect infrastructure development and smart city projects for travelers will inevitably impact the local residents. For these reasons, travelism must be a very important key for sustainable change.

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