

# **PLANET 3.0**

HOW GAMING, BLOCKCHAIN, EDUCATION AND ARTIFICIAL INTELLIGENCE  
COULD SAVE THE PLANET

A SNAPSHOT OF TODAY AND A VISION FOR THE FUTURE

**- DRAF 1.0 -**

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My daughter Chiara, not only because she reciprocates my love. Now she is 21, the future we talk about in the book is her future, it is coming. Being a father makes me think about the coming years beyond myself. Now more than ever, we will see why.

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## FOREWORD

After a 30-year professional career in digital, last year I decided to delve into the topic of the metaverse. It was "the hot topic of the day." When I started this work, I was skeptical that this could represent a real disruption in the market. The result of this research was a published book, "Inside The Metaverse," in which I described all the key trends that are impacting the market: gaming, Web 3.0, VR and AR. Talking about this topic, like most topics related to the digital market, public opinion seems to be bipolar: either you believe, *or you don't believe* in these technologies, it is difficult to find moderate and objective positions and to understand that most of the things enabled by all of this have yet to be designed and imagined. My position after this work is that real and dramatic changes are happening and that we are really in a moment of singularity that can change a lot for humanity. I believe that we are in a unique period where technology has been able to deliver incredible results like never before while also bringing with it, as we will discuss, many risks and concerns on different levels. This is at least my perception and the result of discussions with people and professionals who have followed my book. Then something else happened.

In recent months we have witnessed the public launch of open AI and Chat GPT with an unprecedented rate of adoption. The media, policymakers, and even big personalities, including Elon Musk, have increased attention to the topic. Again, as in the case of the Metaverse, most of the discussions express relevant concerns about the future and dominance of technology over humanity or, even more explicitly, fear arising from the power and control that large technology companies or governments could exert over every aspect of our lives. This is to say that it is impossible to look to the future without considering that the effects and impact that all these technological changes are bringing to the world, anthropologically and sociologically, are extraordinary or even unimaginable.

I am not a philosopher, nor a scientist or anthropologist, but when we read the books by Harari, Kevin Kelly, Nassim Taleb, along with many others, it is hard not to question how humanity can keep track of, dominate and manage all these developments with a governance of technology that is for the good of the planet. Let's face it, when we imagine the future most of the time we envision a dystopian world, we see destruction, genetic control and whatnot; as in the case of the metaverse, virtual worlds in which we live experiences to escape from reality. A reality that, to be honest, already does not give us a high degree of optimism: climate change, energy, food, health and wars are some of the main problems that, as humanity, we have to face. Too bad we have not progressed much in the direction of finding collective and equitable solutions, at least in my opinion. The dystopian worlds of the future, as in many science fiction movies, are the ones we are sure to live in if we do not address another fundamental source of justified anxiety for humanity, besides technology, which is climate change.

Again, public opinion often has extreme positions, lacks the knowledge and skills to take moderate views: policymakers or leaders are faced with the problem of an unbalanced and polarized debate. The reality is that we do not know exactly how to

deal with these global problems and that key actors, such as policymakers, governments and institutions, responsible for managing these issues in the interest of the community, do not have control over the possible tools that could enable a stronger impact: they, in fact, do not master the technology and are fighting in a fragmented way, with different rules for different countries, for different markets, with often divergent goals and interests. All these actors must solve global problems and issues that clearly cannot be solved without collective coordination of resources, decisions, rules and technologies. But global coordination is something that does not work efficiently today, to be politically correct, or is simply not optimized: as humankind we should step forward. Quickly. In all of this, climate change is simply the most important issue because it will define the society we will live in tomorrow. Whatever that may be.

Going back to technology, I believe that what is happening in the metaverse market and Web 3.0 could be more than relevant to all of us in many ways: blockchain technology, the experiences of the gaming industry, and the logic behind virtual worlds, artificial intelligence, could be potentially disruptive tools that could be exploited for the good of all. Therefore, the idea for this book stems from a question I asked myself, being pretty sure I am not the only one: how could these new technologies really be useful? Specifically, in the case of climate change, but also in more general terms, how could these technologies be harnessed for the good of humanity? What might be a possible model of governance? These are fascinating questions, with no possible definitive answer, that prompted me to start this new adventure and research. I will try to explain why these technologies might be leveraged more and how they might shape a future ecosystem.

The book is divided into three sections: in the first one we talk about new technologies, their relationship to us and the potential innovations they bring to the global community, this is to have a common framework of understanding; in the second section of the book, we will look at how these technologies are actually adopted in the "green economy ecosystem," not from the point of view of the single specific technology to address a problem, but trying to have a systematic view, to understand how these are leveraged has a market for the common goal; in the third section of the book we will imagine a hypothetical and very ambitious project or idea, based on all of the above, that aims to help the world by addressing climate change through technology and a new governance.

I really hope that all this work can be shared and can be useful for the community, for policymakers, or for anyone who wants a better future. But before I start, I would like to mention one more thing: some months ago, while doing my research for this book, I came across the "Carbon Almanac" promoted by Set Godin but result of the collaboration of many individuals across the globe. The key message is that it is not too late, but to succeed we need everyone's collaboration, the input of all individuals and stakeholders, and we need to work together in the same direction. This book is intended to be a modest contribution to the cause.

## 1. TECHNOLOGIES FOR THE FUTURE

In this chapter we will have an overview of the technology trends and disruptions that are shaping the technology market and greatly affecting all activities and industries. The goal is to take a common high-level view and not to perform a technical analysis, nor to focus on specific technologies related to climate change. Rather than other aspects, we will focus our attention on potential enabling capabilities and the impact these technologies could have on business, society, and the innovation of strategic sectors and industries in general. We will try to frame a somewhat functional discussion for the subsequent chapter on climate change by highlighting just some of the potential applications that these technologies could play on peculiar issues. But before we begin, it is important to point out that a common element of all these technologies is the relatively early stage they are in: their full potential has yet to be expressed at scale and some challenges need to be solved but, at the same time, these technologies are the ones that could have the greatest impact on society and business.

We will start with the context and, as it were, the state of the art of the relationship between us, human beings, and technology and then examine the applications individually.

## 1.1 THE TECHNOLOGICAL BACKGROUND

"May you live in interesting times," said Confucius. Never in history have we been more in this context: the technological and anthropological changes, as well as the magnitude and complexity of the global challenges we are facing as humankind, have never had such a potential impact and have, unfortunately, no organized and effective global response.

In the Western world, democracies are showing clear signs of crisis, and on the other hand, in most of the remaining world, most of the population is ruled by centralized and authoritarian regimes that do not care much about global issues and human rights. It is there for all to see that there is no balance between the distribution of wealth, between developed and underdeveloped countries, between economies or religions, and so on. Tensions are everywhere, and leaders, governments and institutions that seem to be concerned primarily with their internal consensus are certainly not rewarded for anything beyond their electorate or short-term interest. We clearly notice these limitations by observing the hesitations and initiatives to comprehensively regulate the technological aspects of our daily lives, with issues such as privacy, data or transparency, not to mention what we have seen lately in the media, raving about OpenAI regulatory issues. Building on this and looking to tomorrow, it seems that we cannot foresee a particularly rosy future, and in this game, technology clearly plays a central role: it is the problem and the solution at the same time.

The relationship between humans and technology is part of history: technologies have been used significantly to improve our lives, to increase our efficiency, and to dominate and win over other less advanced cultures. Technology has been and is used as a competitive advantage in the marketplace and among different economies or nations so much so that different technological choices lead to different levels of power and independence of nations. The race to the moon between the United States and Russia in the 1970s is perhaps the clearest evidence of how innovation and technology is a key success factor for global leaders, a symbol of a nation's power or, when compared to others, superpower. Today, the United States probably still leads the technology game, while China is getting closer, other countries are following, including the European Union and Russia: I am not the one to say that there is a geopolitical-technological war going on today, although it is not generally so emphasized in the media. This war is related to data, artificial intelligence, blockchain, and even the internet infrastructure itself. In recent times we have seen several and numerous diplomatic crises over these issues, let me say mostly unresolved. The actions taken by the Trump administration against TikTok are a good example of how diplomatic cases related to digital issues can have geopolitical impacts. In August 2020, President Trump issued an executive order that would ban TikTok in the United States, citing concerns about the security of user data and the app's ties to the Chinese government. The order would give TikTok's parent company, ByteDance, 45 days to sell TikTok's U.S. operations to a U.S. company or face a ban and was part of a broader U.S. government crackdown on Chinese tech companies, which the Trump administration considered a national security

threat. However, the proposed ban was controversial and faced legal challenges, with many arguing that it was an overreach of presidential authority and a violation of free speech. The proposed ban had major geopolitical implications as it could have strained U.S.-China relations. The Chinese government accused the United States of bullying and interfering in the activities of Chinese companies and in fact threatened to take countermeasures against U.S. companies operating in China. Eventually, the proposed ban was shelved after ByteDance reached an agreement with Oracle and Walmart to create a new company, TikTok Global, with U.S. headquarters and U.S. investors. However, the TikTok controversy highlighted the complex geopolitical issues involved in regulating digital platforms and the difficulties of balancing national security concerns with the principles of free speech and open markets.

We see these kinds of tensions not only between governments but also between governments and big tech companies. In 2018, the European Union imposed a 4.34 billion euro (\$5.1 billion) fine on Google for antitrust violations related to its Android operating system. The EU accused Google of abusing its dominant market position by requiring phone manufacturers to pre-install Google's search engine and other apps on Android devices. In 2021, the European Commission launched two antitrust investigations into Meta in connection with its use of data. The first investigation focused on whether Meta used its advertisers' data to compete unfairly with them in the online advertising market. The second investigation focused on whether Meta unfairly used its competitors' data to improve its own services.

The European Union, as another example among many, has been at the forefront of efforts to regulate big tech companies on data and privacy. In 2018, the EU implemented the "General Data Protection Regulation" (GDPR), which is one of the strictest data privacy laws in the world. The GDPR applies to all companies that process personal data of EU citizens, regardless of where they are located. The GDPR is supposed to give EU citizens more control over their personal data and imposes severe penalties for companies that violate the law, but most, about 80 percent, of this data is stored in the United States without any real, practical control over its use. To recall other obvious instances of this sort of geopolitical technological warfare, China and Russia are building their own infrastructures: the Chinese government's "Great Firewall" and its control of online content have long been a diplomatic issue. China's censorship practices have been criticized by human rights organizations and have led to diplomatic tensions between China and other countries, such as, of course, the United States.

It is also a fact that the rise of digital companies such as Amazon, Meta, Microsoft or Google has led to debates about how they should be taxed and how taxation should be distributed among the various countries in which these companies operate. The Organization for Economic Cooperation and Development (OECD) has also been working on a global framework for digital taxation, but the negotiations have been complicated by the different opinions of countries. All this is to say that Internet governance has been a diplomatic issue for many years, with debates about who should control the Internet and how it should be regulated. New institutions have also sprung up to do this. Such as the United Nations Internet Governance Forum (IGF), a forum where countries can discuss Internet governance

issues, but there is still no global consensus on how to govern the Internet. In short, it seems that shared and effective solutions cannot be found. Leaders and politicians know that technology will define our future world in ways we do not yet fully understand, but they no longer control the game: they can only regulate part of the market since there is no "global" or shared governance that can act. At the same time, evidence shows that technology is clearly a key geopolitical strategic issue and may even be "the only one" in the very long term. Especially now, with the speed of innovation, different countries' adoptions of technology would generate growing inequalities between those who have and those who do not have access and skills to manage them.

Today we have technologies that were unimaginable just a few years ago; today we could begin to use this patrimony for a higher purpose than profit and control, if we so desired. What do we want to do with all this power? At one point in our history, we wanted to go to the moon, and we succeeded: what is our vision and challenge now? What can governments do? Because the power as we have said is only partially in their hands. Political control and markets are fragmented even in this globalized world, and unfortunately, a globalized world does not mean a perfect market at all. Again, we see this every morning when Western companies, for example, compete with Chinese manufacturing factories that have different rules and cost structures; in the financial market, where capital moves according to the different tax treatments offered; and of course, when we talk about climate change, where China and the United States have different positions from most other countries. Also, on key issues such as climate change, but not only, the governance model we have given ourselves makes the impact of initiatives limited and partial: in other words, the governance of global organizations such as the United Nations may not play a decisive role because of voting rights and composition logics. This is why we, as humanity, are still unable to solve global problems and are far from finding a solution.

My feeling is that we need to think to new models in the interest of all, these new models would take advantage of new technologies as never before but, if the context described above is the one in which technology plays out today, it will be difficult for us to properly manage the future; we do not yet have the tools or the awareness. So let us briefly look at what has happened in our relationship with technology and what some thought leaders have to say about governance on the subject. Note that I do not want to get too deep into philosophy or anthropology, but I think it is extremely relevant to the rest of our discussion.

A first consideration is that technology, along with the growing population of the world, has made the world smaller and hyper-connected: it has become almost impossible to control what happens in one's "backyard," and we live in a fragile society, as Nassim Nicholas Taleb argues. In his book "Antifragile: Things That Gain from Disorder," Taleb criticizes the idea of top-down centralized governments and global governance systems. He argues that such systems are inherently fragile and prone to failure and often fail to consider the complex and unpredictable nature of the world. Taleb also suggests that a better approach to governance should be decentralized and bottom-up, allowing for local experimentation and adaptation to

changing circumstances. He argues that this approach is more resilient in the face of unexpected shocks and disruptions and is better able to learn from its mistakes and improve over time. According to Taleb, a fundamental problem with centralized governance is that it often leads to what he calls "the dictatorship of the expert." He refers to the tendency of politicians and bureaucrats to rely on complex models and algorithms to make decisions, rather than trusting the insights and knowledge of people on the ground. This is an interesting point of view; it would be like saying that instead of or in conjunction with AI, leaders should make more use of the "collective intelligence" of people on the ground. Of course, it is not only Taleb who has a radical position, many other thought leaders also advocate the need to review or improve our governance model. Some among others:

- Yuval Noah Harari, who has written extensively on the need for global cooperation and governance to address the challenges of the 21st century, including climate change, inequality and the rise of artificial intelligence.
- Jacinda Ardern, prime minister of New Zealand, who called for a more empathetic and inclusive approach to governance, focusing on well-being and sustainability rather than mere economic growth.
- Amartya Sen, an Indian economist and philosopher, has advocated a more democratic and participatory approach to governance, stressing the importance of individual freedom and human capabilities.
- Vandana Shiva, an Indian environmental scholar and activist, has called for a decentralized and ecologically sustainable model of governance that prioritizes local knowledge and self-reliance.
- Naomi Klein, Canadian writer and social activist, who has advocated a more radical and transformative approach to governance, focusing on confronting the root causes of global crises, such as climate change and economic inequality.
- Kate Raworth, a British economist and author, has proposed a new economic model called the "doughnut economy," which seeks to balance economic growth with social and environmental sustainability.
- David Graeber, an American anthropologist and activist, who advocated a more participatory and decentralized model of governance based on the principles of direct democracy and mutual aid.
- Mariana Mazzucato, an Italian economist and writer, who called for a more mission-oriented approach to governance, focusing on addressing social and environmental challenges through public investment and innovation.

This is to say that the topic is hot and widely discussed. Somehow, we are all wondering whether we will be able to find a new model for the governance of the world. It may seem like a long-term problem, but the time, as we will see, is getting shorter, and it is clear to me that whatever the governance of the future will be, it will be enabled by technology.

A second aspect to consider is that technology, together with the financial market, has built giants that now control most technologies, literally, to run the world: it is the big tech companies, the big tech that control business communications,

transportation, media, money, identities, social life, almost everything around us in the digital space. These companies are also able to buy all possible small innovative companies with their financial power, before they grow to significant size; they can determine the future shape of the market: we saw this recently with Microsoft investing \$10 billion in OpenAI. All current and future innovations are on the radar of powerful mergers and acquisition departments, a strategy widely applied over the past two decades by Apple, Microsoft, Amazon, and Meta, with the clear goal of killing or absorbing competitors when they are too small to harm and consolidate their dominant position. Let me say that this is natural and correct and is the immediate consequence of our capitalist and financial model for markets and the economy.

If we step back in time just forty years, we recall that the founding idea of the world wide web was to have a democratized place, accessible to all and controlled by no one: this vision has clearly failed. Tim Berners-Lee, the inventor of the World Wide Web, who loudly advocated its democratization and accessibility, is probably disappointed with the current form of the web: in fact, he has recently called for greater protection of user privacy and control of personal data, as well as measures to address issues such as online misinformation and the digital divide. Criticism also comes from Lawrence Lessig, who has been a leading voice in the movement for open access and free online culture: he has called for greater recognition of the importance of the Internet as a public space and advocated for legal and policy frameworks that support innovation, creativity and democratic participation. To cite another example in her book "Consent of the Networked," Rebecca MacKinnon argues that the Internet has the potential to be a powerful tool for democratization and free expression, but is currently threatened by censorship, surveillance, and corporate control. These thought leaders basically see a missed opportunity globally to manage and harness the technology for the good of the planet.

The reality is that the market is highly concentrated: the concentration is on finance, technological know-how, data, infrastructure, power of influence. We are subject and subjected to digital identity issues, tracking, behavioral influence, we are somehow subjected to technological filters programmed to increase our positive reaction to advertising and to learn from our choices, political messages and whatnot. All this power is delivered through data and algorithms managed and controlled by big tech companies.

Byung-Chul Han, a South Korean-German philosopher and cultural critic, has developed a concept he calls "infocracy," which describes the current social condition in which the proliferation of digital information and communication technologies has led to information overload and a flattening of social hierarchies. According to Han, infocracy has generated a society in which individuals are constantly bombarded with an excess of information, resulting in a state of constant distraction and fragmentation of attention. Han argues that this has also led to the loss of the capacity for concentration, deep thought, and reflection, which he considers essential for human creativity and critical thinking. In response to infocracy, Han calls for a new kind of "slow activism" that emphasizes the importance of critical thinking, reflection, and offline social connections. He suggests that individuals must regain control of their attention and cultivate the

ability to focus deeply and engage in meaningful reflection to resist the constant distractions and superficiality of infocracy. Indeed, there are many who feel that our relationship with technology today is in the midst of a radical shift in singularity. We, as individuals and as a society, find ourselves at a time when technology seems likely to dominate humanity. Machines and algorithms are defining our lives. This is frightening evidence.

In this scenario, I believe that *speed* is the key word to consider in the discussion: the speed of technological evolution has made it increasingly challenging for both individuals and organizations to keep up. Parents today face significant difficulties in educating and training children who are increasingly connected and immersed in a world and with digital languages that are native to them: new generations can perform activities, using technology, that somehow "cut off" anyone who is not up to date. We can easily guess this: it is obvious that, for example, a lawyer who uses ChatGPT will win against someone who does not know how to use the tool.

From this perspective, organizations and companies have also tried and are trying to follow digital transformation paths with great effort and investment and varying degrees of success; an effort that is often insufficient or late to the point that many times these companies have been disintermediated by start-ups with new business models and technologies. These "traditional companies" simply cannot maintain the speed of change imposed by technology. Somehow, only one "emergency" has shown how to be able to accelerate the technology adoption process—we saw this urgency during COVID. It usually takes years for an organization to change its processes, and even when they are changed, they are unlikely to be up to date or state of the art, as new technologies will have entered the market in the meantime: keeping up with technology is more difficult and challenging every day for anyone. Innovations usually come up against resistance to change our standard behaviors both at the individual and corporate level for this reason adoption within organizations requires significant investment and long lead times, which is why we are always lagging. The same for example happens with education, what you learn in college is already old by the time you graduate, we are in a world that needs continuous learning: the same should happen for business and technology. We will never stop evolving, and education is a key word for the future if we want to understand what is happening to us and what can happen.

In 2000, Evan Schwartz coined the term "digital Darwinism" with his book, and after 30 years of the Internet and the digital marketplace, we can say that he was right: the size and concentration of large technology companies is proof of this. We all know who the richest men in the world are and which companies have the largest market capitalization. These players are mostly digital and no more than thirty or forty years old when the Internet and the digital revolution began. Eugeny Morozov, in his "**Silicon Valley: the overlords of silicon**," strongly criticizes the promises of large technology companies and their behavior, which is also fostered by the unconditional trust that consumers accord to technology. This bonding has been made possible by the big tech's strategy of offering free services in exchange for data and, of course unspokenly, control. Data is the fuel of every modern

technology, the enabler of user behavioral tracking and, more importantly, of every new business model today: needless to say, but most of the world's data is stored in the clouds of big tech companies.

Another well-known thinker such as Yuval Harari in "Homo Deus" is very explicit in at least two notions: first is *algorithmic regulation*, the idea that algorithms will increasingly replace human decision-making in areas such as politics, business and health care. Second is *dataism*, the belief that the universe is made up of streams of data and that the ultimate goal is to process data more efficiently—all of which are now mastered and controlled by large technology companies. At the same time Harari writes about techno-humanism, that is, the belief that technology has the potential to improve human capabilities and well-being and should be used to achieve this goal. From my perspective, the questions are: who is responsible and ethically accountable for this? Is it a business or is it a collective interest of humanity? How can one assume this responsibility without having access to the resources we have just mentioned?

A well-known Italian philosopher, Maurizio Ferraris, argues that data and document flows are a "heritage of humanity," and he would be right, if all this heritage were accessible and geared for collective benefit. In my opinion, we do not yet have a "collective" vision on this issue, nor the solution or governance infrastructure to harness the full power of technology for good. Technology is not neutral, it is an ecosystem whose goal is to survive and expand its territory; it has no ethics, it merely performs its tasks as efficiently as possible: it is the responsibility of humans to steer technology in one direction or the other. Today the goal we have given technology is primarily profit and influence on consumer behavior. I am not arguing that there are no "good" technologies or actors, what I am trying to point out is the lack of an overall, shared ethical direction of these strategies. Today we are clearly driven by the rules of the market and finance, this is our society and the model we have chosen in our evolution to date.

Now, let me go back a few years, to the nuclear bombing of Hiroshima and Nagasaki. That was a moment, I think, when humanity became aware that the power of technology was a threat to everyone. What followed was the Cold War, which, from our discussion here, was a kind of collective understanding and "forced balance" between the two blocs in the interest of humanity and its survival. It started with an alignment of interests, both sides wanted the world to survive, and it progressed, certainly with great effort, with "forced" cooperation, that is, with both sides committing to reduce investment in nuclear weapons. The fear of nuclear technology is something that, as humanity, we have been able to control for over seventy years and fortunately it is still going on. I believe that, although in a different way, something similar is happening today with technology and in particular with artificial intelligence. Technology today is so powerful that it generates fear. We are influenced and filtered by "black boxes" in which everything is optimized to make us behave the way we want, governments have lost their clout in charting the course of society, and there seems to be nothing on the horizon to change this direction. In my opinion, and I will try to explain how in the last part of the book, technology itself is the path of change.

The latest technological innovations, from this perspective, offer a new possibility to design and develop incredible new approaches to handle global issues differently. This is not up to machines or algorithms, but collectively up to us. What we will do next is an analysis and commentary on some of the new technologies that, in my view, are relevant to innovating the context we have described. I will try to highlight why and how I believe these technologies can potentially be harnessed for a better tomorrow. The goal is not to delve into each technology technically, but rather to explain what new "things" are potentially enabled by these innovations, considering the discussion above. The point is that perhaps if humanity and leaders can harness all of this, the complex and conflicted relationship we have with technology will also improve for the better. We could address global issues such as global warming with new tools: the opportunity for all of us is to build new sustainable models for the future by making the best use of everything we have at our disposal.

## 1.2 TECHNOLOGIES AND MAJOR TRENDS

As I mentioned in the introduction, after some research and study, last year I published a book on the metaverse trying to find out whether there were substantial disruptions and discontinuities under this chapter. My answer after the study carried out is yes. But it is clear only now: believe me, when I started to delve into this topic, I was skeptical about the real relevance of the expected or professed impact of the applications of "web 3.0" and the metaverse. I will not specifically discuss the metaverse and its virtual worlds here, but there are some trends and areas that if exploited could have an incredible and positive impact for everyone.

Also, I do not want to be exhaustive about all the possible technologies that could change the world or solve environmental problems, but the attempt is to understand how these technologies might have the potential to address some of the fundamental issues and themes that we are facing and how all of this could be harnessed for the challenge to climate change.

The idea is to share with you some of the evidence already in the marketplace, facts that show how our behavior in digital has anthropologically evolved, insights into how new business models are growing, and, ultimately, try to understand how all of these may impact our future.

The three basic aspects we want to address are: first, our behavior as individuals and societies; second, technology and governance; and finally, education, which is not a technology but a kind of recurring element that we will cover in all sections of the book.

The first element, behavior, brings with it questions like these: how do consumers behave in the new environment? And what are the best practices for engaging them? The issue of consumer behavior and engagement is central to almost every industry: the time and attention of individuals and consumers is the real scarce resource today and will be even more so tomorrow. This is the battleground for the tech giants: having the attention of consumers means being able to influence behavior commercially, politically, ethically, and so on. The big tech companies compete on this by improving algorithms on a daily basis and collecting data, precisely to carry out this activity on their platforms. From this perspective, understanding and addressing human behavior within "technologically managed environments" is critical to define how to solve global problems or even just the "problems" of the future. We will shortly see what is happening from this perspective by discussing gaming platforms under two lenses: collaboration and collective intelligence and the drivers of individuals' motivation.

The second element is related to technologies that may impact governance and business models of the future. Here we will see how new governance structures and new business models are entering the market, thanks to blockchain technology and with very interesting examples even within the current perimeter of the metaverse. Blockchain is clearly a big disruption, we all know that, but I will try to highlight

just some of the most important features that this technology brings to the table without a definitive technical assessment, which I will gladly leave to blockchain experts. We will see how many of the experiences and companies in this area are in the early stages, how they are testing new models and logics that are very interesting for our discussion. I believe that Web 3.0, at this stage, is an important research and development laboratory that will soon show its full value, bringing concrete and solid novelties to the market.

The third topic of interest is education, another area where metaverse technologies such as AR-VR, but not only, have a huge impact. Education, as we have said, is a key topic to consider whenever we talk about the future. We're going to see some very interesting innovations that not only involve user interfaces, but also a strong application of what we're going to discover when we talk about gaming or AI.

Finally, we will talk briefly about AI and data, I think it goes without saying the relevance of the latter in all possible technologies and applications. This sequence of technologies is somewhat difficult to manage, since they are all interconnected and have overlaps with each other: my attempt, in giving the order just described, follows the notion that each one adds value incrementally over the previous one.

The goal is to establish a common basis of understanding, to see, in the next chapter, if and what has been applied to climate change or other global issues, and, finally, to highlight the path that, in the last chapter of the book, I will imagine trying to answer the ambitious final question: how could all of this potentially be harnessed for the climate challenge and in the interest of humanity? I would like to emphasize again that climate-impacting technologies can be endless on specific tasks and application areas: just think of possible applications of AI, or new green energy sources, etc., we are not focusing on these. Instead, we are focusing on those that could be transformative and disruptive to the governance, ecosystem, and citizen and stakeholder engagement model.

### 1.2.1 GAMING

The gaming industry is huge, which is nothing new. Games have gone digital since 1972 with *Pong*, the first arcade game, and are now, along with social media, the most advanced and populated user interfaces and engagement platforms for consumers. Gaming platforms such as Fortnite, World of Warcraft, Minecraft or Roblox attract hundreds of millions of people with massive dwell time within the platforms: the technology and sophistication of strategies used to engage users in gaming are state of the art. This is true up to the point where the predominant business model of these platforms is freemium where these companies are able to monetize the time spent by players with micro-experiences and micro-transactions, always keeping the level of user engagement high over time. In other words, these are the platforms where the most advanced visual and graphical technologies and infrastructure are being developed, as well as the places where the most interesting anthropological change in consumer behavior, especially in the younger generations, could be observed.

Reading Newzoo's "Global Games Market Report" released in 2022, what struck me most was the number of online gamers, which will be 3.2 billion this year, and these numbers are expected to grow steadily in the future, just as they have grown in the past. Today we are at 5 billion online users worldwide; therefore, gaming is one of the most popular entertainment destinations.

Even if online gaming has often been considered a segmented user niche, data show that the industry is now mainstream. The average age of U.S. online gamers is between 35 and 34, while 70 percent of those under the age of 18 say they regularly play video games, 67 percent of total gamers play multiplatform games, and another relevant aspect, in platforms such as Fortnite and Roblox 67 percent of users are under the age of 16. These are impressive numbers, and although the total number of online gamers cannot be related only to games with immersive experiences, it is clear that this market and these environments are set to grow significantly. Something that has already happened so far.

It is indeed very reductive to think of gaming environments as mere games, these are the new social networks, these are the places where users collaborate, interact, entertain, learn, earn, create, and express themselves: in fact, it is spontaneous to classify them as "platforms." Within these platforms, 60% of users are engaged in non-gaming activities such as concerts (we are probably all familiar with the case history of rapper Trevor Scot's concert on Fortnite in which about 20 million users participated in real time), events, fairs, tournaments and leagues, marketplaces and commerce, creativity, and experiencing a wide range of experiences. From this perspective, it is important to note that the very notion of gaming has somehow evolved into new forms of social interaction. Players are no longer forced to follow rigid patterns or levels, within these environments they can choose their own goals to personalize their experience, to find different solutions for the same problem or challenge.

A very interesting category of games is that of "massive multiplayer online role-playing games" (MMORPGs). MMORPGs are online games that allow players to take on the role of a character in a virtual world and interact with other players in real time. These interactions are very varied, such as:

- Chat: Players can communicate with each other through the game's chat systems, which may include public chat channels, private messages or group chats.
- Grouping: Players can join together to complete quests or face challenging enemies. Often this is done through guilds, which are groups of players who join together to support each other.
- Exchanges: Players can exchange items and resources with each other, either through the game's exchange systems or through direct exchanges between players.
- PvP (player vs. player) combat: some MMORPGs allow players to engage in combat with each other, in designated areas or throughout the game world.
- Cooperative play: Players can work together to achieve goals, such as completing dungeons or raids, building structures or exploring the game world.
- Role-playing: Some players engage in role-playing games, in which they enact the personalities and stories of their characters within the game world. This may involve creating side stories, developing relationships with other players' characters, and participating in social events such as parties and festivals.

In addition, in these platforms users can use a variety of tools to enhance their gaming experience, such as:

- Character customization, players can create and customize their characters, choosing elements such as race, gender, class and appearance. Players can also choose from a variety of skills or abilities for their character.
- Players can craft their own items, such as weapons, arms or potions. This may involve gathering resources from the game world, using crafting stations or tools, and acquiring recipes or blueprints.
- Auction houses and trading: Many MMORPGs have auction houses or other trading systems where players can buy and sell items to each other. This can be a way to acquire rare or valuable items, or to make a profit by selling items to other players.
- Missions and quests: MMORPGs often offer players a series of quests to complete, which may involve fighting enemies, collecting resources, or exploring the game world. Completing quests can earn players rewards such as experience points, items or currency.
- Guilds and social groups: players can form or join guilds, clans or other social groups. In this way, players can connect with other people who share their interests and work together to achieve common goals.
- Maps and navigation: MMORPGs provide players with maps or other tools to help them navigate the game world. They may include markers for quests or objectives, quick travel options, and tools for tracking progress or discovering new areas.

In fact, all these functionalities and features make these "gaming" platforms achieve incredible results. The numbers are impressive, with hundreds of millions of users (350M monthly Fortnite, 55M daily Roblox, etc.) and an average usage of over 5 hours per day per user. We all see our children spending their time in there, developing new jargon, meeting friends, and so on. Whether we like it or not, this is the current picture, without any consideration of whether it is good or bad. I think it is unnecessary to emphasize this point further, but in a surely widely shared phrase, the engagement of the younger generation, representing the "communicative and media language" used, is that of the gaming industries. This is an anthropological and relevant change.

Another interesting aspect of gaming platforms is creativity and "self-expression." Roblox is the most obvious example of this. Within Roblox there are more than two million different experiences and games available to users: these are created by the users themselves, thanks to the tools available on the platform, and each individual user is free to build invent and create new experiences to sell. The platform incentivizes user creation by returning 30 percent of the revenue from experiences sold to creators. In 2021, Roblox returned \$500 million to creators, or about a third of Roblox's revenue that year-this is the business model that works for Roblox and many other players in the Metaverse. In broad terms, including also the more traditional social media, the creators' economy is valued at more than \$20 billion last year: not small numbers, and even those are growing steadily. From this perspective there are at least two key aspects to consider: the first is the democratization of creative capabilities, and the second is the monetization opportunity for creators.

We know that today we are considered both "consumers" and "products." All social media platforms would not exist without our content, our photos, videos, stories and shares. Thanks to technology, we have begun, as users, to be able to produce content with a speed and quality unimaginable before. The game of technology has, in fact, been to provide us with the superpower to produce and use tools that are increasingly easy, accessible and require no technical expertise to execute. We see this clearly with the use of filters or video editors or anything that comes in our cell phones today. This trend or attitude is also becoming more and more relevant for more sophisticated tasks such as programming or building new games. The tool used by Roblox users to build new experiences and games has a "no-code" approach, and this is behind the incredible amount of content that users have created and pushed into the platform. In recent years and months, no-code and AI have emerged as two of the most promising technologies in the technology industry from this perspective. Indeed, no-code tools and AI apps now enable non-technical people to create websites, apps and other software without writing a single line of code, while artificial intelligence can learn and perform tasks that were previously only possible for humans, creativity, ideation or some analysis. The intersection of these two technologies is creating new opportunities for innovation and disruption, and it is intuitive to believe that the future of No-code and AI is closely intertwined, if not identical. Technology has learned that to be adopted, it must be easy to access:

that way it can penetrate and become part of us, offering us its superpowers in return. This trend is the challenge that many of the players in the metaverse are betting on: virtual worlds have yet to be built with the help of users. We will see later, talking about blockchain, how this topic is fundamental to the new business model to come. Let me say that this "democratization of technology" affects almost every field imaginable in the relationship between us and technology. Content and experience creation, software and coding will be accessible to all and will free our creativity and imagination as individuals and as a society. This is the key: technology allows us to contribute to the "platform" by covering our lack of skills and stimulating our creativity with superpowers, at the same time it leads us to follow the path of convenience and efficiency in our tasks and performance.

The second aspect to consider on this topic is the monetization opportunity for creators and contributors, significant elements in setting a long-term vision.

It is a positive fact, a direct consequence of the penetration of social networks and the creative democratization enabled by technology, that some users obtain gains by leveraging their skills, their content creativity, their performance within the platform environment. The consequence or enabling feature of platforms from this point of view, is the existence of an "in-game" market and economy, a very important element that we need to give due consideration to. In fact, it is significant that if we wanted to evaluate the performance of Roblox, probably the right metric would not be the total revenue generated by the platform, which is certainly the metric of financial valuation, but rather the total volume of in-game currency circulating, as a proxy for the volumes of interaction in the marketplace, which, again in the end, could be seen as a kind of GDP. This is also a key concept that we will explore in more detail shortly when talking about blockchain.

What we have discussed so far is happening to some extent in the most important gaming platforms. We could discuss and ask whether this industry, the gaming industry, is so important and strategic for the future or not. To answer this question, let me briefly outline what the major technology companies are doing. We can easily say that given the enormous importance of video games for the future of technology, all the big tech companies are developing their capabilities through the entire online gaming supply chain. Each of these companies is trying to acquire or build its own path to become a leading player in the gaming industry. For example, Microsoft, which already owns Xbox, AltspaceVR, Xboxlive, and of course all the cloud and infrastructure needed for gaming, is looking to acquire Activision Blizzard (the Minecraft production studio) for \$60 billion, the largest acquisition in its history. Amazon is also present with Luna, Prime gaming and Twitch; Google, Sony, Nintendo, Valve and Meta are also competing in this arena. But this is not just a game for tech companies; Netflix recently added games to its catalog, just saying. As we said earlier, the prize to be won for these players is user attention, user engagement, and, if you will, control of behavior through data and algorithms. This is what emerges from looking at games in the metaverse and the gaming industry more generally.

But gaming, in my view and I think in our context as well, represents other opportunities as well. An interesting and provocative Ted Talk I attended made me think about gaming in a potentially different light: Jane McGonigal, with her talk "Gaming can make a better world," explains how games like World of Warcraft can give players the means to save worlds and the incentives to learn the habits of heroes, so to speak. The message is fascinating: what if we could harness this power of gamers to solve real-world problems? There are millions of people who spend so much time in games facing challenges, unexpected situations, enemies and so on, what if we could direct this energy and creativity toward real-world problems? This is really inspiring, and we will see in talking about climate change that there are many initiatives in this direction. On the other hand, it is true that game mechanics have been applied to various more or less ethical goals, for example, to simulate real scenarios, as in the case of war:

- "America's Army": is a first-person shooter game developed by the U.S. Army as a recruiting tool. The game is designed to provide players with a realistic simulation of Army training and combat and to give players an idea of what it means to be a soldier.
- "This My War": It is a survival game that puts players in the shoes of civilians trying to survive in a war-torn city. The game emphasizes the difficulties of survival in a conflict zone and the ethical dilemmas that arise in such situations.
- "Call of Duty: Modern Warfare": It is a first-person shooter game developed by Infinity Ward that features a fictional conflict between the United States and Russia. The game has been praised for its realistic depiction of modern warfare, including the use of drones and other high-tech weapons.
- "Escape from Tarkov": It is a multiplayer first-person shooter developed by Battlestate Games that simulates a fictional conflict in the city of Tarkov. The game emphasizes realism and survival and has been praised for its attention to detail and engaging gameplay.
- "Weapon 3": It is a military simulation game developed by Bohemia Interactive that allows players to try their hand at realistic combat scenarios. The game is used by military organizations and other groups for training purposes and has been praised for its attention to detail and realism.

Or games developed to pursue more interesting and ethical goals:

- "MinecraftEdu": is a version of the popular Minecraft game designed for use in educational settings. The game has been used to teach subjects such as history, math and environmental science and is often used to encourage collaboration and creativity among students.
- "Foldit": is a puzzle game developed by the University of Washington that allows players to fold proteins to help scientists solve real-world problems related to diseases such as AIDS and cancer. The game has been praised for its innovative approach to citizen science and its potential to advance scientific research.
- "That Dragon, Cancer": is an independent game that explores Green's experience of raising a child with terminal cancer. The game is a highly

personal and emotional exploration of grief and loss and has been praised for its innovative approach to storytelling and its ability to evoke empathy and compassion in players.

- "Papers, Please": is a simulation game that puts players in the role of a border control official in a fictional dystopian country. The game explores issues such as immigration, bureaucracy, and authoritarianism and has been praised for its challenging gameplay and its ability to raise ethical issues.
- "The Walking Dead": is an episodic adventure game based on the popular television and comic book series of the same name. The game explores themes such as survival, morality and community in a post-apocalyptic world and has been praised for its storytelling and character development.

Of course, these are only a few cases among a multitude of possible examples.

I think it is useful now to understand that gaming is a complex art whose ultimate goal is to modify behavior. According to the gaming literature, there are so many elements that are key to consider when designing a game, excluding, as an obvious element, the attractiveness of the content and experience that the game offers the user, which is not an easy creative task.

A first fundamental and essential aspect for us is motivation: this can be both intrinsic and extrinsic. Intrinsic motivation is related to our personal goal, which can be fun, learning, contributing to a particular goal or challenge, etc. Extrinsic motivation, on the other hand, is related to practical and real returns: it can be money, visibility, status, and more. A successful game must have both motivational elements in balance, intrinsic and extrinsic. This is to say that, for example in the case of climate change, a game cannot be successful if it is based solely and exclusively on the intrinsic motivation to change the world: users expect to receive recognition for their time and effort. This is very clear in most gamification experiences even outside the pure game world such as in the case of open innovation, where collaboration potentially generates both status and revenue.

A second "must" for a successful game are the "so-called" game elements, such as points/money, levels, social points, redeemable points, leaderboards, scores, stories, challenges, and so on. These are all ingredients that need to be mixed and structured appropriately according to the goal of the game, and they also need to be balanced at the individual level to provide tasks that are, yes, difficult, but not impossible to accomplish. The different tasks or tasks the player is subjected to must have rewards that are balanced with respect to difficulty, and the user must be able to progressively improve with respect to the tasks and game elements to maintain continuous engagement. This is a key notion, for example in games applied to the world of education that we will see in a moment.

A third element to consider when designing the game experience is surprise and randomness, many times this is a key to keeping the user engaged, staying in the game could be rewarded by luck or having bad news or a new obstacle, all to keep the level of engagement high. The latter condition naturally comes into play when

it comes to these permanent, real-time virtual gaming environments in which other users or communities interact. To complete the picture of what makes a game a successful one, trust and transparency are necessary conditions: in fact, no one would accept being cheated while playing, that much is quite clear.

The growing importance of game mechanics in winning users' attention and engagement is also widely demonstrated in corporate or institutional settings. All these techniques constitute the toolbox, so to speak, of serious games applications that organizations use to make internal processes more efficient, for example, IT maintenance and support, sales force performance and incentives, or to incentivize and push open innovation projects, and these are just a few examples. Finally, and unsurprisingly, there are many instances of companies using gamification to better engage their consumers both online and offline, in customer loyalty programs, in various marketing events, within apps or websites, or for surveys and promotions with significant volumes and results.

The idea I would like to convey is that gaming is already a part of our lives; it is an ancestral tool that has been used, consciously or unconsciously, to guide people's behaviors throughout our history. Indeed, if we use the gaming perspective to structure the logics of engagement with individuals, we might be surprised at how pervasive game mechanics are in our society. In this regard, may I suggest another thought-provoking TedTalk: that of Seth Priebatsch. In his 2014 talk "The game layer on top of the world," Priebatsch shows how game dynamics are reshaping the world: he starts from a classroom in which students have grades, tests, problems to solve, and levels; in schools there are also just status accolades such as being the class president or being the best in math. This is to say that even the school system could be seen as a game: isn't it true that students receive rewards (grades) based on their performance? Do not different grades equate to different levels of play? He then dwells on the pervasive game called "happy hour," which you may already be playing with your friends at certain hours with defined benefits. Priebatsch's key concept is that game mechanics are unconsciously part of our lives and are normally accepted as rules of behavior in different social contexts.

In the second chapter of the book we will see how all these techniques are being applied to the climate challenge today, and in the third chapter we will try to understand how we could make more systematic use of this powerful tool.

## 1.2.2 THE BLOCKCHAIN

Needless to say, blockchain represents one of the major technological innovations of the past decade. Our goal is not to go into the technical details or the different possible applications of blockchain, but to highlight the three main impacts and opportunities that blockchain brings to the table in our discussion.

The first element is the organizational model that the blockchain has generated or enabled: the "Distributed Autonomous Organizations" called DAOs; the second topic is the cryptocurrency and/or the token mechanism that connects to the last point i.e. the earn-to-play mechanics, adopted by most of the players of the "web 3.0 metaverse" and clear link to the game mechanics we have just discussed. The sum of these three aspects makes it possible to create a new "format" of business model that we will describe shortly.

Let's start with Distributed Autonomous Organizations. DAOs are organizations managed by computer programs or smart contracts on a blockchain. These organizations operate without a central authority and make decisions based on the consensus of their members. The voting and governance mechanisms of DAOs typically include a process in which members can propose changes to the organization or vote on existing proposals. These are some of the common mechanisms used for governance within a DAO:

- Voting tokens: DAO members receive tokens representing their ownership or participation in the organization. These tokens can be used to vote on proposals, with the weight of each member's vote proportional to the number of tokens.
- Reputation voting: similar to token voting, reputation voting assigns members a reputation score based on their contribution to the organization. Members with higher reputation scores carry more weight in the voting process.
- Liquid democracy: this system allows members to delegate their voting power to another trusted member. This creates a chain of proxies that allows members to vote on proposals based on their expertise or interests.
- Quadratic voting: this system allows members to vote on proposals using a quadratic formula, in which the cost of a vote increases as the number of votes increases. This incentivizes members to focus on the proposals they care most about, rather than casting a large number of votes on many proposals.
- Futarchy: this system involves predicting the outcome of a proposal and its impact on the organization's performance metrics. Members vote on the predicted outcome, rather than on the proposal itself.

I believe that the above flexibility and innovative models are extremely interesting for our discussion, in which the issue of governance is central and deepened throughout. Indeed, the governance model of Distributed Autonomous Organizations has several advantages, including the following, which I believe are the most important:

- Increased transparency: blockchain technology provides a transparent and tamper-proof record of all transactions and decisions. This means that members of the organization can see exactly how decisions are made and how resources are allocated.
- Increased trust: by using blockchain technology, decentralized organizations can create a system of trust that does not rely on a centralized authority. This can help build trust among organizational members and increase participation.
- Cost reduction: decentralized organizations can operate with lower overhead costs because they do not require a centralized office or management structure. This can allow more resources to be allocated to the organization's mission.
- Greater participation: because decentralized organizations are often open to anyone who wants to participate, they can attract a wide range of people with different skills and perspectives. This can lead to more innovative solutions and better decision making.
- Resilience: decentralized organizations are less vulnerable to disruptions, such as hacking or attacks on a central server, because there is no single point of failure. This can help ensure that the organization can continue to operate in the face of challenges or setbacks.

These features are all potentially very interesting and innovative factors for a different relationship among all stakeholders in a project. Transparency and "automation" of governance dynamics are realized from the very beginning of the project. In fact, all governance mechanisms are shared from the beginning in a "Public Manifesto" that outlines the basic principles, values and objectives of a DAO for all participants. The Manifesto is a kind of "constitution" for the DAO's governance and has smart contracts as its foundation. Here is an outline of the typical structure of a DAO's manifesto:

- Introduction: This section introduces the DAO and provides an overview of its purpose and goals.
- Values and Principles: This section outlines the core values and principles that guide the DAO's decision-making process. These principles should reflect the DAO's commitment to transparency, accountability, and decentralized governance.
- Governance structure: This section describes how the DAO will be governed and how decisions will be made. It should outline the decision-making process, the roles and responsibilities of members, and how conflicts will be resolved.
- Economics of tokens: This section explains the economics of DAO tokens, including how tokens are distributed, how they are used, and how they are distributed.
- Community Participation: This section explains how members can participate in the DAO's activities, contribute to its growth, and obtain rewards.
- Roadmap: This section provides an overview of DAO's short- and long-term goals, along with a roadmap for achieving those goals.
- Conclusion: This section summarizes the key points of the Manifesto and encourages readers to join DAO to help build a decentralized future.

In short, this new governance mechanism is a new kind of organization that simply was not possible before. As Kevin Kelly would probably say, "a new species has been born," and the impact of this innovation could be vast. Today we mostly live in a centralized world, organizations are still pyramidal, and decision-making is basically top-down: this is our dominant model.

The contrast between centralized and decentralized or distributed organization is an important topic of discussion as to whether one model is better or more efficient than the other. My opinion is that this depends on the specific goals or mission of the organization. To be clearer: decisions in a centralized organization are made in the interest of shareholders, in DAOs on consensus. Within a DAO, votes are cast via blockchain and made publicly visible. This requires users to act in the way they think is best, as their votes and decisions will be made publicly visible. This incentivizes actions that benefit the reputation of the voters and discourages actions against the community, and this is an important change.

The DAO governance model, within the Web 3.0 literature, underlies a vision of the future of the Internet that has the characteristic of being decentralized. A market no longer governed centrally or by oligopolies. This notion includes very significant and structural issues such as, for example, the management of user identity and privacy, which, in the Web 3.0 vision, should be totally controlled by the individual and on the blockchain, while today it remains in the servers of big tech and governments. This new paradigm is interesting and disruptive: it means completely changing the current model, which, however, is very difficult to achieve in practice. Can you imagine big tech accepting such a scenario by changing their centralized models and abandoning dominant positions? No. But let's continue with the DAOs: we have said that DAOs allow great flexibility, and there are examples of DAOs that are themselves members of other DAOs; this structure is often referred to as "nested DAOs" or "DAOception."

An example of a "nested DAO" is MolochDAO a decentralized autonomous organization that is responsible for funding Ethereum projects. It is composed of several smaller DAOs, each contributing to a pool of funds that is used to support projects in line with the group's mission. Another example is Metacartel Ventures, a DAO that invests in Ethereum-based startups. Metacartel Ventures is itself a member of MetaCartel, a larger DAO that focuses on supporting early-stage Ethereum projects. MetaCartel Ventures uses its funds to invest in startups while contributing a portion of its profits to MetaCartel to support the broader Ethereum ecosystem. These "nested DAOs" help create a decentralized network of organizations that can work together to support a shared mission. By pooling resources and expertise, these DAOs can fund and promote projects that otherwise would not receive support from traditional sources. This is a key point to remember for our further discussion.

Let us now address the second element of the blockchain: cryptocurrency and the so-called "tokenization." I guess we all know what a cryptocurrency is, so I will not

dwelling too much on this topic. In general, there are three categories of cryptocurrency:

- Payment cryptocurrencies are designed to function as a medium of exchange, like traditional currencies. Their purpose is to provide a fast, secure and low-cost method of transferring value between parties without the need for a central authority or intermediary.
- Platform cryptocurrencies are built on blockchain platforms that allow developers to create decentralized applications (DApps). These cryptocurrencies serve as the primary means of payment within their respective platform markets and often have additional features such as smart contract functionality. This is the case with most web3.0 metaverse platforms, such as Decentraland or TheSandbox.
- Utility cryptocurrencies are used to pay for specific services or products within a particular ecosystem. They are often issued by companies or organizations to incentivize users to participate in their platforms.

It is an evidence that the flexibility offered is very high and not even comparable to traditional currency (FIAT). However, if we look at the cryptocurrency market, we see something that is like the Wild West right now. There is indeed a lot of speculation, there are still many regulatory issues to be resolved to protect consumers and investors from fraud, and also technical challenges to be addressed. Although some governments and institutions are exploring the use of cryptocurrencies, the level of adoption and development varies widely around the world. On the one hand, some governments and institutions have been cautious or even hostile toward cryptocurrencies because of concerns about their potential impact on financial stability, consumer protection, and money laundering. For example, some countries have banned or restricted the use of cryptocurrencies, while others have imposed strict regulations on cryptocurrency exchanges and businesses. On the other hand, some governments and institutions have been more open to the benefits of cryptocurrencies, such as their potential to improve financial inclusion, reduce transaction costs, and increase transparency. Some nations have launched their own digital currencies or are exploring the possibility of doing so, such as the European Union. In addition, some institutions, such as central banks, are exploring the potential use of blockchain technology to improve their operations and systems. Some examples related to institutions and governments are:

- Chinese Digital Yuan: Since 2014, the People's Bank of China (PBOC) has been developing a digital version of its national currency, the yuan. The digital yuan is designed to improve payment efficiency and security, reduce transaction costs, and improve financial inclusion. The PBOC has conducted several pilot programs to test the digital yuan in various cities, and it is expected to be introduced nationwide soon.
- The European Union's digital euro: the European Central Bank (ECB) is considering launching a digital version of the euro. The digital euro would be designed to provide a safe, secure and accessible means of payment for

Eurozone consumers and businesses. The ECB is currently conducting a public consultation to gather feedback on the potential benefits and risks of a digital euro.

- JPMorgan's JPM Coin: JPMorgan, one of the largest banks in the United States, has developed its own cryptocurrency called JPM Coin. JPM Coin is designed to enable instant settlement of payments between institutional clients, reducing settlement times from days to minutes. The cryptocurrency is built on JPMorgan's private blockchain network, which offers enhanced security and privacy features.
- Fidelity has launched a cryptocurrency service for investors
- BlackRock has partnered with Coinbase to give its institutional clients access to cryptocurrencies.
- Goldman Sachs is creating a cryptocurrency data service.
- UNICEF Cryptocurrency Fund: UNICEF, the United Nations children's agency, has established a cryptocurrency fund to support innovative projects for children around the world. The fund accepts donations in Bitcoin and Ethereum, which are used to support projects that leverage blockchain technology to improve access to basic services such as health care, education and clean water.
- Corporate adoption of cryptocurrency has also been happening at a rapid pace, with Disney, Starbucks, Adidas, Nike and many other well-known brands embracing blockchain.

Of course, the design and success of a cryptocurrency, given the flexibility it offers, is a delicate process, but the fact that already many institutions are implementing solutions is very interesting from our point of view and shows that the technology is robust and applicable to different contexts.

Along with cryptocurrencies, blockchain also introduces the notion of tokens. Tokens can be used in parallel with cryptocurrency or they can be designed to be a currency themselves, depending on the design of the platform. In general, and for our discussion, we can say that tokens are very similar to some of the gaming elements we discussed earlier in that they have many flexible features and can be used to represent various types of privileges within a decentralized network or ecosystem. Here are some examples:

- Voting rights: tokens can be used to represent voting rights within a decentralized organization or governance structure. Token holders may be able to vote on proposals, network changes, or the election of representatives.
- Access to services or features: tokens can be used to grant access to specific services or features within a decentralized platform. For example, a decentralized storage platform may require users to own a certain number of tokens to access premium storage services.
- Earning rewards: tokens can be used to reward users who contribute to the network or ecosystem. This can include rewards for participating in a token

sale, for staking tokens to support network security, or for contributing to network maintenance or development.

- Discounts or incentives: tokens can be used to offer discounts or incentives to users. For example, a decentralized marketplace can offer discounts to users who make purchases with the platform's native token.
- Property rights: tokens can be used to represent property rights, such as ownership of a digital artwork or a portion of a real-world asset that has been "tokenized." This is a critical aspect.
- Governance rights: tokens can be used to give users a voice in the governance of the network or ecosystem. Token holders may be able to propose changes or vote on changes to the network's governance structure.

The impact of cryptocurrencies and tokens in building the virtual worlds of the metaverse has led to the notion of a token economy, again a concept that deserves to be quickly highlighted. A token economy is a system that uses tokens (cryptocurrencies, in the case of blockchain-based platforms) to incentivize behavior, reward contributions, and facilitate transactions within a decentralized network. Key parameters of a token economy include:

- The distribution of tokens/crypto refers to how tokens are initially distributed and who receives them. The distribution of tokens can affect their value and the overall distribution of power and control within the network.
- The token/crypto supply refers to the total number of tokens that will be created. The supply of tokens can impact the value and scarcity of tokens, as well as the overall sustainability of the token economy.
- Token utility refers to how tokens can be used within the network. Token utility may include voting rights, access to services or features, or the ability to earn rewards.
- Token speed refers to the frequency with which tokens are used within the network. A high token speed may indicate a healthy ecosystem with active participation, while a low token speed may indicate a lack of interest or usefulness.
- The value of the token/crypto refers to the market value of the token. The value of the token can be affected by a number of factors, including demand, scarcity, and network effects.
- Token/crypto governance refers to the rules and mechanisms by which decisions are made within the token economy. Token governance can include voting mechanisms, consensus algorithms, and rules for issuing and distributing tokens.
- Token market dynamics refer to the behavior of buyers and sellers within the token market. The dynamics of the token market can be influenced by a number of factors, including news events, technological advances, and regulatory changes.

These parameters can be adjusted and optimized over time to create a sustainable and effective token economy aligned with the goals and values of the network.

Adjusting the parameters of the token economy is typically the responsibility of the token development community or group. The community of token holders can participate in the governance of the token economy by using their tokens to vote on proposals and changes to token parameters, such as changes to the token supply or utility of tokens. In a DAO, for example, token holders can vote on changes to the governance structure of the DAO itself.

The development team of a blockchain-based platform may also have control over some token parameters, such as initial token distribution, token provisioning, and token utility. However, many blockchain-based platforms are designed to be decentralized, which means that the development team does not have complete control over the platform or its token economy. Ultimately, adjusting the parameters of the token economy depends on the specific governance model of the blockchain-based platform. We can only mention that in a decentralized system, the community of token holders typically has a significant role in the direction and evolution of the economy.

To conclude this brief snapshot on cryptocurrencies and tokens, we need to emphasize two other points that might be understated for our purpose. The first is that, in metaverses, cryptocurrencies and tokens are tied to game mechanics and are different from the in-game coins used in traditional games. The second, fundamental aspect is that the business model that emerges from all these considerations is the concept of "self-sustaining economies" based on currency circulation/volume and DAO governance. This is, in my view, a disruptive innovation. These organizations, to live, do not necessarily need to grow forever like traditional businesses. New jobs and virtual worlds will be created in these economies with a self-sustaining balance between domestic supply and demand, such that they will have their own GDP. Somehow this means new wealth created.

The concept of a self-sustaining economy brings us to the last topic on blockchain: earn-to-play mechanics, which link together games, tokens and cryptocurrencies. The model that is emerging in these platforms, which need the effort of contributors and creators to be populated and attractive, is a bold step toward winning over user engagement to the point where it pays off. "Earn to play" refers to the concept of earning cryptocurrencies, tokens or other digital assets by playing or participating in other activities within a platform. All of the above structure, articulated in the DAO manifesto, establishes ex ante the amount of cryptocurrencies or tokens, defined by features, distributed to players. In Decentraland, for example, users can earn the platform's native cryptocurrency, MANA, by participating in various activities such as content creation, event participation, and game play, for completing certain tasks or achieving specific goals. The resulting mechanism is not only a potential impact on user engagement, which is obviously much stronger, but also a potential for real job opportunities for specific skills or tasks. If the virtual world economy were stable, contributors and players could first, potentially gain new revenue, second, have profit opportunities if the value of cryptocurrencies increases over time. Virtual worlds must have new content, new experiences,

everything we can imagine must be filled and populated, and yet, there you have the workforce: you can earn while "playing."

Of course, this is possible because, as we have said about gaming, it is no longer just gaming. Imagine a virtual world in which users can access various "no-code" tools to unleash their creativity or skills, receiving a reward for doing so: it is a nice dream, already present, that could have a global impact. With a simple cell phone an individual user, especially in underdeveloped countries with low average individual incomes, could earn a living from the micro-activities and tasks required by the game. There are several possible jobs that we can imagine, and I am sure this is only a small part of what is possible: one job is for example labeling data in images, which is a fundamental activity for artificial intelligence, another could be, as in Roblox, building new experiences, another could be simply playing in simulation scenarios, there are really hundreds of possibilities. All of this is still in its early stages, however if we consider the gaming framework we described earlier, we can say that earn-to-play could be another relevant tool now available to increase user adoption, retention, and engagement.

To close the blockchain topic I will try to summarize the new model that is emerging. The potential is that we already have a logic and technical infrastructure that can enable different governance, different business models, different levels of user involvement, self-sustaining economies in a reliable and transparent technological environment. In addition to this, in fact, blockchain has created the notion of digital property, so-called NFTs or non-fungible tokens, and is able to manage personal identities and privacy in a decentralized way. In my opinion, this is a game-changing opportunity for the entire market.

### 2.1.1 EDUTECH

Let's talk about education and edutech: here we need a quick description of the context and the reasons why this is so crucial, then we will look at the technologies that are impacting this issue. We could start by saying that we live in a world where continuous learning is necessary, we constantly need to be up-to-date, to be able to take advantage of new tools, to deal with complex topics, and so on. In fact, the Internet has given users the ability to participate in online courses, and educational content is more widely distributed and accessible to all in an easy way and at limited cost. The Covid pandemic has given the education market and the digital educational infrastructure an incredible boost especially in terms of adoption, as we have all seen, but also in terms of teaching methodologies, we can say that it is now customary to experience both physical and digital classes and exams.

But technology is not only impacting the distribution of educational content: it is changing the form and structure of educational language. Let me explain further with two well-known and perhaps overused examples:

- Khan Academy is a nonprofit educational organization founded in 2008 by educator Salman Khan with the goal of providing a free, world-class education to anyone, anywhere. The organization offers an extensive library of online resources, including more than 10,000 video lessons, hands-on exercises, and assessments covering a wide range of subjects, from math to science, from humanities to computer programming. Khan Academy's approach is based on the idea of personalized learning, where students can work at their own pace and receive immediate feedback on their progress. The platform offers adaptive technology that adjusts to the learner's skill level and provides personalized recommendations on what to learn next. In addition, Khan Academy partners with schools and districts to offer support to teachers and students.
- Ecole 42 is a free computer programming school founded in Paris, France, in 2013 by French billionaire Xavier Niel. The school is based on a unique peer-to-peer learning model that encourages students to work collaboratively and share knowledge to solve programming challenges. The curriculum focuses on project-based learning, in which students are given a series of increasingly complex programming challenges to solve. There are no teachers or lectures, but students learn by working on projects and helping each other. The school aims to create an engaging and challenging environment in which students can develop critical thinking, problem-solving skills and teamwork.

In general terms, over the past decade, the education industry has faced a great deal of innovation made possible by technology, which began with e-learning platforms more than 15 years ago. In my opinion, the main trends that are impacting the education market right now are:

- The rise of online and blended learning is disrupting traditional classroom instruction. Online learning platforms, such as Coursera and Udacity, offer

- access to high-quality courses from top universities and institutions, while blended learning models combine online learning with in-person instruction.
- Personalized learning is an approach that tailors instruction and learning experiences to the individual needs and interests of each student. This approach is made possible by advances in technology, such as adaptive learning software, which can adjust the pace and content of learning according to the student's abilities.
  - Competency-based instruction is an approach that measures student learning by demonstrated mastery of skills and knowledge, rather than by class hours or course completion. This approach is gaining popularity as a method to better prepare students for workforce needs.
  - Gamification, as we know, is the use of game elements and mechanics, such as points, badges, and leaderboards, to make learning more engaging and interactive. Gamification is used in both online and traditional classroom instruction to increase student motivation and engagement.
  - Artificial intelligence and machine learning are being used to improve education in various ways, from personalized learning to automated assessment.

Underlying most of these new ways of learning there are many different enabling technologies. Firstly the Learning Management Systems (LMSs): these are software platforms that provide tools for managing and delivering courses, training programs or learning content. LMSs can include features such as online course creation, student tracking, assessments, and collaboration tools. Cloud-based technologies are also a relevant technology since allows students and educators to access educational content and resources from anywhere, anytime. Cloud computing can include online storage, collaboration tools, and learning analytics platforms. Needless to say, artificial intelligence can be used to personalize individual students' learning experiences based on their preferences, interests and learning styles: AI-based tools can include chatbots, virtual assistants and adaptive learning platforms. But if we look specifically at the latest technologies that are changing the "language of learning," we must also highlight the role of AR and VR and the potential of immersive gaming experiences that the "Metaverse wave" is bringing.

As we said earlier, a key role is played by game mechanics and gamification. I will not elaborate further, but simply point out that gaming has brought the places where this can happen, virtual and persistent worlds, environments and tools. Places where global collaboration can take place. The metaverse can allow students to collaborate with others from around the world and learn from different perspectives. Students can work together in virtual classrooms, participate in group projects and discussions, and build relationships with people from different cultures and backgrounds. Environments that can offer these kinds of experiences are very rich in content. Of course, AR and VR devices are the "hardware" battleground for the tech giants, as they will control access and the back market. Let me now open a parenthesis: Oculus, as we know, is Meta's big bet from this point of view

competing with Microsoft's HoloLens, Apple is rumored to launch its own visor very soon, while Google might come back after the Google Glass experience; but a key aspect to consider when talking about hardware is the adoption rate. VR market penetration, according to Statista, had about 171 million active VR users worldwide in 2021, and this number is expected to grow to more than 400 million by 2025; the growth rate is good and driven mainly by "enterprise" adoption, which reasonably will have a wide scope of practical application in education. AR and VR are, however, key factors for a totally different educational and learning experience by creating immersive and interactive learning environments, but they will not, realistically, have sufficient penetration to have a massive impact in the short term. However, it is worth mentioning some potential benefits of using AR and VR in education:

- **Experiential learning:** AR and VR can provide students with hands-on learning experiences that simulate real-world situations. Students can explore and interact with virtual environments and objects, thereby improving understanding and memorization of complex concepts.
- **Engagement and motivation:** AR and VR can increase student engagement and motivation by making learning more interactive and fun. Students can participate in interactive games, simulations, and scenarios, which can make learning more enjoyable and rewarding.
- **Accessible Learning:** AR and VR can expand access to education by providing virtual learning opportunities to students who may not have access to traditional educational resources. Students can access virtual classrooms and courses from anywhere in the world, eliminating barriers such as physical distance, economic status, or disability.
- **Collaboration and communication:** AR and VR can enable students to collaborate and communicate with others in virtual environments, regardless of their physical location. Students can work together in virtual classrooms, participate in group projects and discussions, and build relationships with people from different cultures and backgrounds.

For on the topic of education, we can clearly see the opportunity to harness all these new technologies for something that is fundamental to shaping the future of all of us as individuals and as a society. Education means skills, understanding, behaviors, intelligence and culture. Education means investing in us as humanity, specifically we can evolve and develop a conscious approach to technology by harnessing technology.

#### 1.2.4. ARTIFICIAL INTELLIGENCE AND DATA

I left as the last topic Artificial Intelligence, which of course is a key milestone in shaping the future. Although the development of AI has been going on for years, it is only in the last few months that we, as the "public," have begun to worry and fear the possible implications and consequences. Since OpenAI launched its ChatGPT into the market a few months ago, a lot has happened both in media coverage and discussion and in companies. I don't want now to do a deep analysis in artificial intelligence technology, there are many books and references that explain, or try to understand, the impact that AI will have at different levels or in different sectors: but it is essential to have a vision on this.

It is clear, in fact, that artificial intelligence affects and has significant impacts on all the technology trends and applications that we have seen above. Artificial intelligence is already supporting all the optimizations of the gaming experience, as well as all the user interfaces and graphical and visual effects found in gaming platforms, but it is also optimizing the rendering of digital advertising on platforms, e-commerce propositions, and pricing, just to name a few applications that are already present behind the scenes of our experience as digital users. Artificial intelligence is, as we just mentioned, another key tool for education as well, and will probably be from now on for most business and organizational functions of companies. More than the possible applications, however, I think it is important to emphasize two key elements of artificial intelligence: the first, I would say practical, is the data sources on which AI is trained; the second, more anthropological, if you will, is governance and the consequences of AI on governance.

Artificial intelligence and algorithms need data to learn: this means that any actor that can exploit this incredibly powerful tool at scale must feed it with data; the more data the model gets, the better the AI's performance and reliability will be. Artificial intelligence without data is not so smart; it can generate errors, misunderstandings, false indications, and ultimately wrong and dangerous support for us. With big data, artificial intelligence can expand the range of knowledge and speed of learning compared to humans-this is, fundamentally, its competitive advantage and mission. So, on the one hand there is the ability to build the algorithm and the AI model itself, and on the other hand there is the availability of data that makes a good part of the difference. But when you start talking about data, the scenario is crystal clear: data normally stays in silos, it doesn't have the same formats, it's not aggregated, it's not deduplicated, labeled correctly, cleaned up, and so on: there are different activities that are critical to make the data work, to give the data the right format to feed the algorithms correctly. So, we could say that in AI, the power of the data goes hand in hand with the sophistication of the algorithm.

We know that the use of artificial intelligence is widely spread within the products and services offered by large technology platforms that leverage their data assets: this is a "network effect," in which there is a constant improvement in the performance and learning capabilities of AIs that are getting smarter and smarter.

Access to data, therefore, generates a huge competitive advantage for certain actors or certain applications over others that, because of their size, only have access to a limited set of data. The bottom line is that data sharing activities should be a common practice among institutions, organizations, and companies to address issues of public interest. The more this is done, the more positive impact artificial intelligence can have.

Scientific data sharing during the COVID-19 pandemic relied heavily on technology to enable rapid and widespread collaboration and communication among researchers and institutions around the world. It is worth pointing out some of the ways in which technology enabled the sharing of scientific data during the pandemic: cloud computing platforms, such as Amazon Web Services, Microsoft Azure, and Google Cloud Platform, provided researchers with the infrastructure needed to store and process large amounts of data related to the virus; this allowed researchers to access data quickly and easily from anywhere in the world and to collaborate on research projects. Many organizations have created open-access data repositories, such as the COVID-19 Data Portal and the Global Initiative on Sharing All Influenza Data (GISAID), to enable researchers to share data, and these repositories have provided a centralized place for researchers to collaborate on research projects. Video conferencing and collaboration tools, such as Zoom, Microsoft Teams and Slack, have enabled researchers to communicate and collaborate with colleagues around the world in real time. Standardized data formats helped ensure that data shared among researchers were consistent and compatible, allowing research teams to easily combine and compare disparate sources. Finally, machine learning and artificial intelligence technologies helped researchers analyze large amounts of shared data, such as genomic data and patient records. Ultimately, these technologies have enabled researchers to identify patterns and relationships in the data that would have been difficult or impossible to identify manually. In two words, the emergence of the pandemic has shown us: first, that data sharing and the use of technology generate incredible value and impact; second, and more importantly, that "collaboration and collective effort and intelligence" is the way to address global problems.

The second key aspect related to AI is the governance model, which is one of the most discussed topics in the media nowadays. AI governance is the idea of having a framework to ensure that machine learning technologies are designed and developed with the goal of making the adoption of AI systems fair and ethical for people. It is important to note the distinction between AI governance and AI regulation. AI regulation refers to the laws and regulations issued by a government or regulatory body regarding AI, which apply to all organizations within their purview. This is clearly a key global issue, as different governments with different regulations on this topic would end up with different geopolitical clout. AI governance, on the other hand, refers to how AI is managed in an organizational context. AI governance is an overall framework that manages an organization's use of AI with a broad set of processes, methodologies, and tools. The goal of AI governance is not limited to ensuring effective use of AI. In fact, the scope is much broader and includes risk management, regulatory compliance, and ethical use of

AI. It is clear, at least in my view, that global problems need global governance or, if impossible, at least strong cooperation; this is clearly a hot topic to be discussed at different levels. The process of figuring out how to move forward is ongoing, and of course there are many initiatives and institutions addressing a topic ranging from philosophy, human rights, government policies, industries, etc. So, it is not such a new issue on the agenda of policy makers.

In 2016, the Obama administration announced the White House Artificial Intelligence Future Initiative. This was a series of public engagement activities, policy analysis and expert convenings led by the Office of Science and Technology Policy to examine the potential impact of artificial intelligence. The "Ethics and Governance of AI Initiative," a joint project of the MIT Media Lab and Harvard's Berkman-Klein Center for Internet and Society, is also actively working. Another interesting case is the Center for AI Governance (GovAI), founded in 2018 by Allan Dafoe, then an associate professor of International AI Policy at Oxford University. GovAI was initially part of Oxford's Future of Humanity Institute (FHI) before becoming an independent nonprofit organization in 2021. Its researchers have advised decision makers in government, industry and civil society. In addition, its alumni have held policy positions in the U.S. government, top artificial intelligence labs including DeepMind and OpenAI, and think-tanks such as the Center for Security and Emerging Technology.

My personal view is that, once again, collective intelligence and cooperation are the tools for humanity to manage all this technological power in the interest of the planet. This does not mean that businesses should not use artificial intelligence, that is simply impossible, the point is that, at least on critical and global issues, there should be global governance of artificial intelligence and data, and technology in general: this should necessarily be collective, transparent and interdisciplinary. Any other solution, in my opinion, will lead to discrepancies, inequalities and abuses. Data and artificial intelligence are, after all, the most important accelerators for any innovation or enterprise today: we must harness them all together, as humanity for the same goal, as we face the same difficulties. As we showed in the chapter's introduction, the prize at stake is the highest possible: it is our future as humanity.

### 1.3 CONSIDERATIONS

To summarize what has been said so far: the goal was to describe the key technologies and trends that are impacting, in my view, all of today's global issues and, specifically, the issue of climate change, which we will address in the next chapter of the book.

We have begun to see how the latest advances in gaming are shaping new forms of social behaviors and interactions, and how these experiences are becoming increasingly engaging for users. Gaming is an ancestral way of learning, socializing, and practicing our skills to achieve goals. Technology has taken gaming to a new dimension, and it is potentially becoming a key tool for obtaining the most critical resource of all: individuals' time, attention, and engagement. Engagement is the key word. Game mechanics are key elements in pushing individual motivation and getting the "wheel" of collaboration, creativity and open innovation "turning." This is not something that will happen in the future: as we have seen, there are already massive audiences and significant evidence of the anthropological shift in behavior that is taking place in gaming platforms. Platforms that today are more than just platforms for gaming but are "real virtual worlds" where new markets and economies are emerging. Let's say that in the list of tools to be used and exploited for common and collective goals, gaming mechanics will have a significant impact.

We then talked about blockchain, from three perspectives: first, governance models, second, cryptocurrencies, and third, earn-to-play mechanics. These aspects add to the previous one, gaming, elements that have been envisioned by many of today's great thinkers and leaders. These elements are: the decentralized, transparent, consensus-based governance model; the opportunities presented by the creation of a cryptocurrency and token economy; and finally the earn-to-play mechanics that could be a strong driver of user engagement. It must be said that beyond the fact that many of the experiences implemented are in the early stages and often subject to many doubts, operating in still unregulated contexts such as cryptocurrencies; it is quite clear that blockchain brings a new framework to the market. This new framework could be used as an infrastructure to address global issues in a different way. The point is that even though the blockchain or cryptocurrency market may seem very speculative and risky today, the tools, infrastructure, and logic of blockchain are here to be used, the technology is available, and its use is up to us, and it can be of great value if managed in a more controlled environment with credible actors. I will imagine something like this in the last chapter of the book.

Edu-tech was the third topic we discussed. I tried to highlight the main trends and technologies that have an impact on such a fundamental topic for our future. Whatever an individual, or all of humanity, will do in the future is related to the level and efficiency of our learning capabilities. New technologies that help us achieve this, such as AI, AR or VR, along with the logic and mechanics of gamification, are already an incredibly powerful tool for improving our learning performance. Education will take place in interactive environments with

interactions, not only with dimensional objects in vertical spaces, but also with other people through collaboration and sharing.

Finally, we have discussed only some of the topics related to artificial intelligence, which, as we have already mentioned, is something that cuts across all of the above topics and technologies. Artificial intelligence is definitely a technology that has the power to shape the future of all of us. Since this is not a book about artificial intelligence, we have focused our attention on data and governance. These two aspects are key to designing our journey into the future through AI. From this point of view, we are in a moment of strong singularity: we are no longer able to discuss something of global relevance without talking about the ethical and practical consequences of technology and artificial intelligence. This is a fact of life. We struggle to find common frameworks and shared views. My provocative answer to the question "how will we control artificial intelligence?" is that we can only achieve this by leveraging our potential and unexpressed collective intelligence. We, all together, have more power than the technologies that are, and should be, born to improve our quality of life has humanity. If it is true that all these technologies collectively have the power to make us draw new scenarios, then we need to think together, collectively, about how to harness the value of it all. We need to connect the dots, bring to all stakeholders the technological capabilities, skills and vision to a level where they can be used and scaled collectively. On these issues we cannot rely solely on the initiatives of individuals, who will never have enough skills, critical mass, data and, why not, intelligence, to best manage, for all of us, the problems we face.

I think it is very important now to look at what are the critical success factors that are needed to really leverage all these technologies in practical terms. I think, without being exhaustive, these are the main aspects that we need to consider if we want to think about something that will have a global impact.

The first is technical know-how, skills and capabilities. Behind all the technologies we have seen are resources such as engineers, developers, physicists, or scientists, which are key factors for the success of any technology project today or, if you will, any project tout court. The gaming industry requires game designers, 3D developers, visual artists, augmented and virtual reality development capabilities, etc. The same goes for blockchain projects, where there are specific technical skills, such as knowing how to design economies, infrastructure, and logic, e.g., smart contracting requires both legal and development skills. In each of these technology fields, there are specific software development skills and domain verticals. Now, because this is all very new, the volume and quality, globally, of such resources is not high, or rather, we are in chronic shortage of capabilities. We have seen in recent weeks, for example, how there is a very high demand for artificial intelligence engineers, with major technology companies competing to grab the best experts on their teams. Resources, moreover, since demand is far greater than supply, are very expensive and difficult to retain in the company. The effect of this situation on the market is a kind of "polarization" in which only a few players can build and pursue

these technologies to the fullest by having the necessary skills. It is also clear that having resources and talent in these areas means being able to keep up with all future developments, which will be rapid and disruptive, and will require constantly evolving technology and development capacity. Here again, education emerges with dramatic urgency as a key tool.

A second element that I think is critical in this scenario is scale. This is relevant to the topic of data. The more data you provide to feed algorithms and artificial intelligence, the more these technologies can learn and optimize processes and products, thus generating a virtuous circle of self-growth. As well described by Ash Fontana in his book "AI first companies," this circle generates a "network effect" and an "exponential acceleration" of learning capabilities and algorithm performance. The long-term effect of this dynamic is that the natural end and final shape of the market would be a monopoly. Those who start with more data can accelerate more than others, generating more data, being more pervasive, and eventually controlling *all* possible data. Getting the data to scale is a key pillar for doing anything with global reach. Today we observe that only large technology companies are playing this game. Scale, of course, also affects the marginal cost structure, which progressively decreases, creating an additional competitive advantage for the leaders and creating barriers to market entry.

Critical mass is different from scale, but it is also a key aspect to consider from at least two perspectives: the first is related to social dynamics, and the second to the notion of cryptocurrency. Critical mass from the perspective of social dynamics highlights the fact that if a network does not reach a certain number, which depends on the goal and scale of the network, it simply does not work. Therefore, to generate a positive effect of social activities, such as collaboration, co-creation and sharing, the platform must attract enough users to be meaningful. Creating the right critical mass does not, from a social perspective, have a "standard size," meaning that communities can be small but work very well, depending on the plans, content, goal, and "mission" for which users should socialize. Critical mass must also be considered when talking about cryptocurrencies and, in general, any currency. Currencies must have a minimum circulation volume to be significant enough to be traded and to gain market consensus on the value they represent. In this case, the size of the critical mass depends on the specific characteristics of the individual currency in the market, impacting its stability, price, and, ultimately, attractiveness.

Trust and transparency. This might seem like an obvious element to consider, but I would like to emphasize that this will increasingly be a key competitive advantage. Only under this condition will users be willing to share and cooperate within a platform. Only under this condition can cryptocurrencies be successful in the long run. It is clear, looking into the future, that these issues will be a significant component of any commercial or consumer application of algorithms and data. Finally, trust and transparency are essential requirements of any cooperative governance model.

Culture and management: education again. We live in a hyper-connected digital world where companies, institutions and even individuals struggle every day, hours, minutes and seconds between established behaviors and the adoption of new behaviors enabled by the technologies around us. The "digital transformation journey" of most of the companies I have encountered in my professional career has been greatly threatened by the cultural environment. Decision makers, managers and generally "non-digital" organizations struggle to compete because of a lack of understanding of the new dynamics that technology imposes. As decision makers, we are faced with the need to manage more and more complexity, which requires not only technical skills but also new attitudes and methodologies. In recent years, since the Internet has been around, the concept of digital transformation has affected all of us and all companies. We have begun a journey in which the ingredients needed for successful projects have changed dramatically. There are many new organizational models that have been applied with great success by digital companies of all sizes: these models are in the process of being adopted by innovative companies, large corporations, institutions, and more traditional businesses. What I want to emphasize is that we need to take a further, and possibly faster, step in this direction. Smart working, agile or lean organizations, horizontal organizations, the concept of digital nomads, but also the simple process of open innovation, are just some of the words that describe the new context. Whether it is a large company or a small start-up, an institution or a nonprofit organization, attracting talent requires a clear answer to these questions. I have a feeling that if someone were to read these last few sentences and work in a large traditional organization, they would probably still feel some frustration.

To close on the topic of technology: anyone entering innovation faces a very high level of complexity, as all these aspects must be managed in parallel, consistently, and supported by investment and vision. Time is obviously a critical factor needed to achieve critical mass, scale, or build culture-this is normally a long-term process, requiring a great deal of effort from each company, each individual stakeholder, and the entire ecosystem. Being able to reduce the time to market, however, is critical to maintaining the pace of innovation, which is critical not only to extract value, but also to be able to survive and grow in the new environment. It is a challenge that requires solutions.

In the next chapter we will discuss climate change, trying to understand what the state of the art is of using these technologies and methodologies in the green economy ecosystem. We will continue to focus on the ecosystem, looking for the common use of resources and assets. My goal is to provide a high-level picture of how the green economy market is performing from this perspective.

## 2. THE CHALLENGE TO CLIMATE CHANGE

In this chapter we try to get a high-level view of the key topics that are relevant to understanding how the "green economy and green ecosystem" are managing technologies and innovation in general, what the state of governance and collaboration looks like, and how they are addressing game mechanics, blockchain, education, and AI and data sharing activities.

The question, in other words, is to understand, within this ecosystem, how and whether companies, institutions, associations, and stakeholders in general are really leveraging innovation to achieve a better outcome. We will try to see this at the "market level," since for the individual company or association the state of the art of technology adoption and best practices may be very different. It is also clear that the application of what we saw in the previous chapter, in vertical and specific climate change-related activities and businesses, is not exhaustive of all technologies that could have an impact. Technologies such as nuclear fission, solar energy, other green energy sources, or very specific areas of research and application are obviously very active in the field, attracting interest and investment. The research and development effort related to climate change in recent years has been enormous, supported by governments, politicians, and institutions, and it is also a significant area of investment for venture capital and investment funds, and several start-ups are already applying many of the innovations we have seen to their own activities. As we all know and can see daily the commitment made by most or many stakeholders is impressive: the topic is at the top of the agenda of any discussion table in the world. Institutions, personalities, associations, scientists, activists are building the "civic culture" to change our consumerist behaviors with a more responsible attitude. We are taking significant steps by reducing plastic consumption, buying electric cars, managing waste more appropriately, trying to recycle what we can, saving and trying to protect oceans and forests, and so on. We have created the market for carbon credits and ESG criteria, which are now the main platform for influencing industries and financial markets internationally. Governments themselves are using regulation and tax incentives to promote and advance the green economy. We have, at least on paper, a global road-map established with the Kyoto Accord and later the Glasgow Agenda.

I think never in human history has there been such a major effort and commitment. The questions are, "Is this enough?" Or "Can we do more?" Because time is getting shorter and shorter, and we have no certainty that the ambitious goal we have set for our survival on this planet will be achieved. So, the answer to the first question is "it is our big bet as humanity," the answer to the second question is very simple and it is "yes, of course, more can be done."

## 2.1 THE CONTEXT OF THE CLIMATE CHALLENGE

In 2021, from October 31 to November 12, all eyes were on Glasgow for the 26th United Nations Conference of the Parties (COP26). Humanity waited with collective expectation, hoping that world governments would commit to emissions reduction targets sufficient to keep warming below 1.5 degrees Celsius and imploring developed countries to fulfill climate finance pledges to help developing countries deal with disproportionate climate impacts. World leaders have negotiated, strutted, blamed, pleaded, and threatened in an effort to unite to avert catastrophic climate change. UN Secretary-General Antonio Guterres opened COP26 with an urgent warning, "We are digging our own grave.... Recent announcements of climate action may give the impression that we are on track to turn things around. This is an illusion. Even in the best-case scenario, temperatures will rise well above 2 degrees Celsius." He added emphatically, "We are still heading for a climate disaster.... Failure is not an option. Failure is a death sentence." The cost of our inaction and procrastination has drastically raised the stakes in our fight against climate change: to keep warming below 1.5 degrees Celsius, the world must reduce annual greenhouse gas emissions by 45 percent over the next eight years.

According to the World Resources Institute, the plans and commitments that emerged from COP26 would limit warming to 2.5 degrees Celsius by 2100, a far cry from what scientists believe is a safe goal. Many countries have made zero commitments, but most have not even adopted policies to reach their updated 2030 commitments, much less zero. In all, 197 nations signed the Glasgow Climate Pact, the final COP26 agreement with strengthened 2030 emissions reduction targets to align with the Paris Agreement goal. The pact also calls for countries to commit more resources to provide aid to vulnerable countries suffering the most devastating impacts of climate change. But several countries, including high-emitting countries such as Australia, have already stated that their targets are already set and that they have no plans to submit strengthened targets in the near future.

Global governance of the climate change problem is by far the necessary condition for achieving meaningful and concrete goals; we should have all countries working with reciprocity, because reducing emissions has a very different impact on the economies of individual countries. We need all neighboring countries to have the same incentives, but they do not: the problem with reciprocity is that the countries that emit the most have the least need for reciprocal behavior from others because they are the richest. All countries are affected by climate change, but not all are equally responsible for contributing to the problem. Global institutions are actively working on this: the United Nations Framework Convention on Climate Change (UNFCCC), founded in 1992, aims to find equitable ways to reduce emissions, especially in the most developed countries, while providing support for developing countries to grow sustainably.

The effort, as developed countries, to change our behaviors, made so far is significant in many ways but not sufficient: the process requires time that we may not have. The complexity to be addressed is staggering, and the solution necessarily comes through a collective effort to pursue both a strategy of "mitigation" and "adaptation" to climate change. "Mitigation" involves finding ways to slow carbon emissions, store them or absorb them in forests or other carbon sinks. "Adaptation," on the other hand, involves coping with climate change by taking measures to reduce negative effects or take advantage of positive ones by making appropriate changes in our behaviors. The latter issue is strongly linked and to our lifestyle as citizens, now and in the future. It is clear, however, that mitigation and adaptation are not alternatives; both must be actively pursued in parallel. Mitigation is essential and adaptation is inevitable.

Addressing these issues means working on many different levels. On the one hand, there are all the specific solutions for each problem related to climate change, think for example: bioplastics, carbon dividend and taxes, electric vehicles, zero-emission houses, solar energy, wind energy, green steel, blue carbon, hydropower, recycling, nuclear fission, etc.... just to name a few of the individual verticals where innovation and new technologies are focusing and improving a lot. On the other hand, there is a tremendous effort to create awareness and understanding of the risk of climate change in the world population, to change our daily routines and lifestyles towards more eco-friendly behaviors.

Most of this second goal is addressed by the United Nations' ESG (Environmental, Social, Governance) criteria and SDGs (Sustainable Development Goals). ESG criteria and data are used to demonstrate a company's effectiveness in reducing carbon emissions; while companies using the SDGs normally create a "Progress Report" that includes non-financial data and information on what the company has done to achieve these goals. These criteria, in broad terms, represent a list of "performance indicators" that should in some way define the "new" way for everyone to behave. Although these criteria are not yet truly standardized, as different companies may interpret them differently, they are "de facto" a key guide for the market and for all educational programs dedicated to climate change. Let's say we have a framework, along with the titanic challenge of pushing ESG adoption on a global scale, we are just at the beginning of the process with the challenge of standardization. Indeed, ESG criteria may not consider the specific cultural or social contexts of the regions in which a company operates; a potential over-reliance on ESG assessments, which may be subjective, may not provide a complete picture of a company's actual practices. In my view, it is already a good thing that ESG criteria are widely adopted by companies and institutions, already have significant weight in financial market investment criteria, and finally, are already influencing consumer choices about products and services. However, standardization and specific local adaptation of ESG criteria is needed if this is to be our true "code of behavior."

Let's say that, in many of the more developed countries, sustainability is becoming part of the economic value of the companies themselves and a kind of "competitive advantage" to build a relationship with the consumer, this is certainly positive. We could discuss this at length, whether or not a consumer is willing to pay more for a sustainable product, but what I want to point out are some of the progresses that has been made so far, even if it is not equally positive in different regions, nations, economies or industries. I would say that "everyone" is trying to do the best in their specific context, which is good but not good enough.

We must also say that along with the awareness came some negative effects, such as the misuse and instrumental use of data for political or commercial reasons, the phenomenon of green washing (making misleading or exaggerated claims about the environmental benefits of a product, service, or company to attract environmentally conscious consumers). In general, we have witnessed the abundance of misleading information, which can result from misinformation campaigns deliberately spread by groups or individuals, from misinterpreted scientific studies, from the selection of data often used by politicians who claim that climate change does not exist, and, finally, from lack of understanding, since some people may spread misinformation simply because they do not have a good understanding of the issue. Climate change is a complex topic that requires scientific background to be fully understood. This is to say that somehow part of the problem is to align everyone on the fact that the problem exists and is dramatically urgent. Confusion and anxiety are thus a widely held sentiment when it comes to climate change. On this issue, as on most topics today, information is often superficial and sometimes false. Of course, the best way to combat misinformation is to seek reliable sources of information, but this requires individual effort to select and obtain adequate information: this requires engagement capabilities. Trust and transparency of resources, clear data and proven facts are therefore key elements in building consistent awareness and individual commitment.

In the book "The Carbon Almanac," coordinated by Seth Godin and produced by 300 contributors worldwide, it becomes clear how policy makers, scientists, NGOs, schools at all levels, artists, etc. are actively contributing resources, programs, activities, and ideas to help the cause and build the necessary culture. The collective effort of the book is to easily describe what is happening to the climate and to aggregate some of the most relevant and accessible sources of information for people to better understand and then possibly contribute. I found it very useful and comprehensive, yet the number of topics to be addressed is somewhat daunting. The impact of climate change is literally all around us: population growth, threats to coastal communities, food production and availability, human migration, desertification, forests, wildfires, sea level rise, glacier shrinkage, flooding, soil loss, extreme weather events, loss of biodiversity, and, of course, temperatures are some of the most obvious consequences and risks we face. In this condition, we also see a growing anxiety and a pervasive sense of instability and worry about the future that is widely spread throughout society. As consumers in developed countries, we are surrounded by disjointed messages in the media, emergency calls

related to extreme events, calls to change behavior, and so on. Communication about climate change is everywhere, in the media, in product advertisements, on social networks and whatnot, yet asking people to give up convenient lifestyles and habits and actively participate in the effort: it's not that easy, we are asking a lot of each of us.

A key first element in engaging individuals and organizations is education, which is, after all, the goal of the "Carbon Almanac," as well as many of the initiatives we will see below. But climate education is not sufficient in itself-it is a key element in increasing understanding and long-term responsible lifestyles-but it is not evenly distributed globally. Developed countries are making significant progress, but if we take a global view, underdeveloped countries, which by the way are the ones most affected by climate change, are far from being able to take advantage of education adequately. These countries lack infrastructure, have low literacy, low economies or resources, and sometimes governments with priorities other than climate. On the other hand, underdeveloped countries should be the ones where new technologies and specific solutions, such as for water management or food production, should bring the greatest benefits. It is very important to be sure that local ecosystems are ready and able to effectively implement actions and projects at scale. Within this framework, developed countries need to lead and support the least advantaged with all possible tools, which is only partially happening. This message has been given clearly by most international institutions and thought leaders. UNICEF's water game project is a good example. UNICEF works on climate change and disaster risk reduction in many of the more than 190 countries where it operates. In East Asia and the Pacific, the goal is to build the resilience of education systems and improve the sector's contribution to climate change reduction. "The Water game project's mission is to increase the number of people with access to safe drinking water services through UNICEF-supported programs"-they work on the ground, with a global vision.

Another direction to work on, as said, is to increase the level of attention and engagement on climate change by decision makers and policy makers. We have witnessed an incredible number of grassroots movements demanding stronger actions from governments and institutions. The increase in attention and growth of public activism in recent years is not only due to Greta Thunberg: "The Carbon Almanac" cites some of the most important NGOs, numbering in the tens of thousands globally, a list of leading scientists in each country, a list of political leaders who support the cause, artists, activists, etc. It is a fact that the position on climate change of any political leader influences election results. We are witnessing a kind of "global call to action" that confronts everyone with the responsibility to consider the issue; as stated in the "Almanac," "to make a difference we must first understand what is happening." In other words, we must first educate ourselves. Again, this is only the beginning; we also need to collaborate, share and work together collectively if we are to find a solution. We are in progress; the struggle is once again against time.

Since our goal is to look at innovation in the ecosystem of the climate change challenge, I will not go into the climate challenge itself, but rather highlight what are the key needs or success factors for being more effective as an ecosystem in pursuing the mission of saving the planet. "The Carbon Almanac" is a perfect reference, in my opinion, to get the full picture and understand the complexity and scale of the challenge if you want to have a complete, simple, and comprehensive view. We now want to emphasize what is needed to win; we could say that the key success factors for climate change are:

- Reducing greenhouse gas emissions: This is clearly the most critical success factor in addressing climate change. Countries, industries, and individuals must act to reduce emissions through measures such as transitioning to renewable energy, improving energy efficiency, and reducing waste. This is done through the mechanism of carbon credits, incentives for renewable energy, incentives for low-carbon transportation, energy efficiency standards, and generally through regulations and directives at the national, regional, and local levels.
- Climate Change Adaptation: Success in addressing climate change will depend on our ability to adapt to changes that are already occurring, such as sea level rise, extreme weather events, and changing precipitation patterns. Key areas and actions related to adaptation measures are infrastructure investments, early warning systems, agricultural and land management practices, water management, disaster risk reduction, and community participation and empowerment.
- Research and innovation: advances in technology, science and policy are needed to address climate change. Success will depend on our ability to develop and deploy new technologies and advance our understanding of the complex climate systems that affect our planet. There are many tools used and to be used in this direction: research funding, promotion of collaboration, intellectual property rights, competitions, and awards to incentivize innovation, education and training, public and private partnerships, and regulatory incentives.
- Global collaboration and cooperation: climate change is a global challenge that requires collective action by all nations, we have already said. Success depends on international cooperation, collaboration among industries and the efforts of individuals. So, we need to leverage knowledge-sharing platforms, networks and partnerships, joint action plans, funding mechanisms, and diplomatic engagements.
- Communication and education: raising awareness of the impacts of climate change and the actions individuals and communities can take to address them is critical to success. Effective communication and education can help motivate action and build public support for climate action. Possible tools include education and training programs, engagement with the media, incentives for behavior change (taxes, rebates), and community-based initiatives.
- Economic and financial incentives: economic and financial incentives can obviously drive actions to address climate change. Success depends on policies and mechanisms that incentivize sustainable practices, such as carbon pricing,

renewable energy subsidies, and green financing. Carbon pricing, green bonds, green investment funds, renewable energy subsidies, and energy efficiency incentives are among the tools to be used here.

- Political will and leadership: Finally, success in addressing climate change will require strong political will and leadership at all levels of government. Governments can set ambitious goals and implement policies that drive action to address climate change, while leaders can inspire public support for climate action and drive progress toward a sustainable future. I will just highlight two points. The first is public engagement: engaging the public and civil society can build support for climate action and help shape public policy; for example, public consultations and town hall meetings can provide opportunities for stakeholders to share their views on climate action. The second is transparency and accountability: ensuring transparency and accountability of climate policies can build trust and credibility with the public and help ensure that policies are effective in reducing greenhouse gas emissions and building resilience to the impacts of climate change.

The first thing to remember is that all these success factors are interrelated and interconnected and must possibly function as a coordinated ecosystem at the local, national, and global levels.

The second point to note is that technology plays an extraordinary role in at least two different dimensions: the first is to provide new solutions to reduce greenhouse gas emissions and adapt to the impacts of climate change; the second is to enable many of the critical success factors mentioned above. Here are some examples of the first dimension of technology:

- Renewable energy: the development and deployment of new renewable energy technologies, such as solar and wind power, can reduce greenhouse gas emissions from the energy sector and contribute to the transition away from fossil fuels.
- Energy storage: improved energy storage technologies, such as batteries and hydrogen fuel cells, can enable greater use of intermittent renewable energy sources and help reduce dependence on fossil fuels.
- Carbon capture and storage: the development of new carbon capture and storage technologies can help reduce greenhouse gas emissions from power plants and other industrial sources.
- Electric vehicles: advances in electric vehicle technologies, including batteries, smart grids and charging infrastructure, can help reduce greenhouse gas emissions from the transportation sector.
- Sustainable agriculture: the development of new agricultural technologies, such as precision agriculture and sustainable land use practices, can help reduce agriculture's greenhouse gas emissions and improve resilience to the impacts of climate change.
- Circular economy: the advancement of circular economy technologies, such as recycling and waste-to-energy processes, can reduce greenhouse gas emissions

from waste management and contribute to a more sustainable and resource-efficient economy.

As mentioned, the second level of technology and innovation is to improve governance and collaboration, which is the perspective we would like to have here:

- Data collection and analysis: advances in data collection and analysis can support evidence-based decision making on climate change. For example, satellite and remote sensing technologies can provide accurate and up-to-date information on carbon emissions, deforestation, and other climate-related indicators.
- Climate modeling: improved climate modeling and forecasting technologies can help to better understand the impacts of climate change and inform decision making on climate policies and adaptation measures.
- Transparency and accountability: technology can help improve transparency and accountability in climate governance by enabling greater access to information and real-time monitoring of progress in climate action.
- Climate finance: technology and innovation can help improve the governance of climate finance, enabling more efficient and effective financing mechanisms. For example, fintech solutions such as mobile banking and digital currencies can help improve access to climate finance in developing countries.
- International cooperation: technology can support international cooperation on climate change by enabling greater collaboration and information sharing across borders. For example, virtual meetings and online platforms can facilitate international dialogue and cooperation on climate action.
- Citizen engagement: technology can foster greater citizen engagement and participation in climate governance by providing new opportunities for public consultation and feedback. For example, online platforms and social media can enable greater public participation in climate policymaking.

Saving the planet is not an easy task, we might think. But the ultimate mission, in my view, is not the planet itself that will exist after us: it is the survival of humanity and the preservation of our way of life as much as possible. The challenge, then, is even greater, because it involves addressing the issue of how to build a new world order, at least as far as climate change-related policies are concerned. As humanity, we have never faced anything like this before. We were not so many, so connected, so interconnected financially, commercially, and politically, and we can no longer look only at our own backyard. The inequality between developed and underdeveloped nations is something we cannot ignore if we are to work consistently to achieve climate outcomes and maintain our lifestyles. We need to manage global resources efficiently and intelligently; we need to understand that climate change could lead to mass migration; we need to help less advanced nations build sustainable economies and efficient transition; we need to share the interest of all innovations and technological advances; we need to build a global culture on

sustainability and virtuous habits. Well, whether we like it or not, we are all on this challenging journey together; this is already happening. It is clear, then, that we must use all possible tools and means at our disposal, leveraging technology as much as possible. Indeed, the use of technology is, in my opinion, the only way to achieve more than what we have done so far, which is already impressive.

First, technology is time-synonymous, as it can help us get better results faster, share best practices, educate faster, and ultimately scale the positive impact we can generate. I believe we need a systems approach and a shared, collective vision to frame technology as a key area for cooperation. The opportunity in front of us is not to survive, but to find, as humanity, a sustainable way to live together on this planet; to find different ways to handle global problems; and, finally, to make the world better for our children.

The climate challenge is the greatest opportunity that humanity have to build a "new level" of governance, a vision for future societies, and also a sustainable relationship with technology. We will discuss this last point at the end of the book; while now we will give an overview of how the green ecosystem is moving today with the new technological disruptors we described in the previous chapter: blockchain, gaming, education, AI, and data. The goal is to see best practices and concrete applications of these technologies to see if and how we can improve. I truly believe that all stakeholders are individually committed to doing their best to leverage the technology; I am not as sure that we are having the systemic approach and vision needed to really scale the technology benefits. We have seen how the critical success factors, from a technology perspective, are critical mass, scale, technical know-how, and culture and management; elements that, as in other industries, are undergoing digital transformation processes. Each of the players in the ecosystem has faced the incredible speed of innovation and is trying to adapt to new technologies and new markets: this requires long lead times, investment and a strong long-term commitment from organizations and decision makers. From this perspective, time adds up to time: the little time we have for the climate challenge goals and the little time we have, as stakeholders and ecosystem, to digitally transform ourselves, which is necessary to leverage the technologies we have on the table and pursue our goals better, faster, and more efficiently.

### 2.1.1 GAMING IN THE CLIMATE

In the previous chapter we discussed how gaming and gaming platforms represent real evidence of the anthropological and technological change that is taking place. The struggle for consumer attention and engagement, which is a key battleground for many, if not all, market players, has become increasingly sophisticated and efficient due to the engagement mechanics that gaming has brought to the market over the past fifteen years. In addition to being key tools for many industries in their marketing and communication plans, gaming and gamification are also an incredible educational tool and are embedded in many of the calls to action to consumers that are geared toward changing their behaviors. So, it is no surprise that even on climate change issues the focus on the gaming industry is already strong. What we will try to understand in the next few pages is whether the "climate change ecosystem" is making the best use of this tool: how institutions and stakeholders are applying gaming techniques to achieve their goals.

Although awareness of the climate change problem is now pervasive and actions are being taken at all levels of society, there is still much to be done to achieve international goals. Games and gamification offer one approach to promoting behavioral change and education, but a distinction must be made between "gaming," which refers to video games or any game involving competition, strategy, or skill, for entertainment or fun, and serious gaming, which refers to the use of gaming technologies and game-like environments built for educational or training purposes. In climate change serious gaming, players engage in simulations and scenarios that reflect real situations related to climate change, such as developing sustainable cities, reducing carbon emissions, or responding to natural disasters. The goal is to help players develop skills and knowledge that can then be applied in the real world to address climate change issues. Another key difference between simple games and serious gaming is also the target audience. Gaming tends to appeal to a broad audience of all ages, while serious gaming is often aimed at specific groups, such as policy makers, educators, or professionals in environmental fields. We must say that these boundaries are often blurred and mixed in most of the games we discovered in our research.

Why is this so important? First, gamification supports motivation by enabling long-lasting engagement, that is, by completely capturing the player's attention and then keeping it alive. Second, learning occurs when information received from the experience is assimilated and applied in behavior, an aspect that underlies any game where there are interactive spaces in which reality can be experienced and transformed. Third, games facilitate social engagement, as we have already mentioned, in multiplayer games or through fictional characters. According to major social theories, ideas are constructed through social interaction, a strategy that can really be important and effective in terms of climate change education. Fourth, the typical visual representation of the game provides several learning aids and benefits for users, including immersiveness, interaction, and self-assessment of climate change knowledge.

As we will see, there are several very interesting cases and initiatives and significant experiences that are yielding concrete results, which is a sign that the green ecosystem is paying close attention to the topic of gaming. Anticipating some conclusions, we clearly noticed that all the games we saw do not exploit the notion of a platform, as we described earlier in the chapter on games. We also noted that none of the games incorporate the notion of tokenization, as blockchain is not yet widely adopted in gaming applications related to climate change. Finally, something we will not discuss here, but in the education section, many of the game applications we have seen are heavily used to create student awareness and understanding of ESG goals. Given that gaming works for user engagement, let us now see how and with what specific goals or objectives gaming has been applied to climate change projects and activities:

- Playful experiences and creative speculations to engage users in an imaginative and creative exploration of sustainable development through a playful learning activity with the aim of creating deeper associations and new relationships with the topic.
- Exploring interconnections and systems thinking to improve forms of data analysis and interpretation, with the goal of intervening across entire ecosystems and developing the ability to work with targeted intervention points by identifying the best levers of change.
- Link personal actions to ESGs to understand the influence, both positive and negative, that our actions-individual and collective-have on the world around us.
- Future thinking and solution-finding, enriching evaluative and strategic skills by evaluating alternative scenarios and forecasting change in a way that fosters creative problem-solving skills.

In my view, these are just some of the applications that gaming is potentially generating: the facts tell us that a growing number of stakeholders are investing in and betting on gaming as a key tool that can be used to solve climate change problems. Let's have a look to some of the most significant examples and projects implemented by institutions, associations and private companies.

The Atlantic Council, building on the Atlantic Community's central role in addressing global challenges and providing an essential forum for navigating economic and political change, is one of the benchmark institutions. Through the documents it publishes, the ideas it generates, the future leaders it shapes, and the communities it nurtures, the Atlantic Council has a mission to shape policy choices and strategies to create a freer, safer, and more prosperous world. Climate change is naturally at the top of the list. The Atlantic Council is collaborating with the Adrienne Arsht-Rockefeller Foundation Resilience Center (Arsht-Rock) as part of growing efforts to give policymakers a visceral sense of urgency about how their decisions on climate change could impact the future. Arsht-Rock uses gaming technology to educate and inform players of all ages about new knowledge and skills essential to protect themselves and their communities from climate change. Some of the climate challenges that are addressed as part of the game designed and

promoted by the Arsht-Rock include extreme heat, rising seas, coastal flooding, flash floods, drought, wildfires, earthquakes, and unplanned urbanization. Through the video game, the player experiences and learns how to implement climate resilience solutions. To develop all of this, the Arsht-Rock worked in partnership with major video game publishers and game production studios and industry veterans such as Chance Glasco and Grant Shonkwiler, developers of two of the most successful games of our time, *Call of Duty* and *Fortnite*, with game design experts, developers. Arsht-Rock has a goal of reaching 300 million players worldwide.

Launched during the momentous 2019 United Nations Climate Summit, the "Playing for the Planet" alliance has made headlines in recent years and is a testament to the commitment of some of the gaming industry's biggest names, such as Microsoft, Sony, and Ubisoft, as well as dozens of other well-known game studios, to challenging climate change. "Playing for the Planet" aims to work with these companies on two fronts: first, by reducing the carbon footprint of their industries; second, by harnessing the power of their platforms to include pro-climate action messages or initiatives. Playing for the Planet also hosts, among other things, an annual "Green Game Jam," a competition to produce games related to climate change and an opportunity for game studios to be especially creative and integrate green activations into their most popular games or create new ones. This means including environmentally themed features and messages, educating users and inviting them to donate or participate in UN conservation and restoration campaigns.

The United Nations Development Program's (UNDP) Mission 1.5 mobile game allows people to learn about the climate crisis while communicating to governments solutions that could be put in place to address it, all while exploring virtual universes. Through an inter-agency effort and a partnership with a video game company, the UNDP game challenges users to make the right decisions to keep the world on track to limit global warming to 1.5 degrees. The game went online in early 2020 in seventeen languages. The video game asks users to cast a vote on what strategies they think would be most effective in addressing the climate crisis, and the responses collected became the source of what is now known as the "People's climate vote", the largest public opinion poll on climate change ever conducted. This information was shared and discussed by parliamentarians around the world and at major international meetings, such as the recent G20 summit and the UN climate conference, COP26. The findings were even included in the latest set of reports published by the United Nations Intergovernmental Panel on Climate Change (IPCC), a highly influential institution for intergovernmental climate negotiations.

Another interesting example is the non-profit "think tank" "Climate Interactive", in collaboration with the MIT Sloan Sustainability Initiative, has created two freely distributed tools to make the scientific aspects of climate more accessible on the one hand and possible actions on the other. Users/players can take a role in UN

climate negotiations or calculate the emission reduction potential of favorite "planet-saving" initiatives. En-ROADS, Energy Rapid Overview and Decision Support, is Climate Interactive's online simulation tool that examines, and models global warming data based on inputs from climate actions, initiatives and policies, such as taxes, subsidies, economic growth, fuel mix, energy efficiency, technical innovation and other factors. En-ROADS is both fun and depressing to explore: depressing because even with the combined set of actions needed to keep warming below 1.5 degrees Celsius, it quickly becomes apparent that there is no solution without impacts. The game plays out as a simulation of an emergency climate summit organized by the United Nations to establish a concrete plan to limit global warming, bringing together representatives from government, business and civil society. In the simulator, users can enter any combination of scenarios, from carbon pricing to reducing deforestation, from electric vehicles to ending fossil fuel subsidies, and immediately visualize the impact of these solutions on outcomes such as future warming and sea level rise. This game is a fun format for large groups to explore solutions to climate change and see what it would really take to address this global challenge. C-ROADS, Climate Rapid Overview and Decision Support, on the other hand, is a climate change policy simulator that tests countries' emission reduction commitments to determine if they are sufficient to stay within the planetary limits agreed upon by scientists. In this case, Climate Interactive provides resources for game facilitators and materials for sharing: groups that form within the simulation environment can represent developed or developing countries in breadth, or individual countries, such as the United States, the European Union, China, and India; representations of climate activists, fossil fuel lobbyists, press organs, and the U.S. Climate Alliance can also be added to the game, allowing for a representation of the various stakeholders involved.

Among the many interesting examples of initiatives and games and devices distributed by institutions, there are some particularly interesting ones:

- "Climate Challenge": is a game developed by the British government that allows players to take on the role of prime minister and make decisions on energy, transportation, and other policy areas to try to reduce greenhouse gas emissions and mitigate the effects of climate change. The game aims to raise awareness of the importance of climate action and encourage players to think about policy choices that can help address the climate crisis.
- "Sea Hero Quest" is a mobile game, developed by the University of East Anglia and other partners, that collects data on human spatial navigation to help scientists understand the early signs of dementia. The game is set in a virtual ocean and challenges players to navigate through mazes and avoid obstacles while collecting data on their spatial awareness and memory. Data collected through the game are being used to help researchers develop new treatments and interventions for dementia, as well as to understand the impact of climate change on marine ecosystems.
- In 2014, UNESCO Mahatma Gandhi Institute of Education for Peace (MGIEP) launched its first international Gaming Challenge, inviting proposals for video

games that promoted peace, sustainable development and global citizenship. In October 2015, after a rigorous evaluation process by an internationally renowned jury, "World Rescue" was chosen as the winning project. "World Rescue" is a mobile game that teaches players about the Sustainable Development Goals (ESG) and challenges them to make sustainable choices in their daily lives. Set in Kenya, Norway, Brazil, India and China, players meet and help five young heroes and help them solve global problems such as mass migration, disease, deforestation, drought, and pollution.

- The World Wildlife Foundation's "WWF Free Rivers" is an augmented reality game that offers the chance to observe and interact with five different river habitats in the comfort of your own home. The game is designed to teach how ecosystems depend on healthy, flowing rivers. Players are immersed in simulated environments based on the mountains of the Himalayas, the grasslands of South America, and the deltas of Southeast Asia. The game is an in-depth interactive storytelling experience that uses the latest immersive technology to bring environmental learning into the palm of the player's hand.
- "Eco" is an online multiplayer survival game in which players must build a civilization using the resources of an incredibly responsive ecosystem, and whatever actions players take affect everything within the world. The game allows players to interact with both the world and each other, pushing them to recreate a sustainable lifestyle in a detailed wilderness simulation. Players must concern themselves with a balanced diet and must control the harvesting of natural resources or else damage or destroy the environment. Echo is funded by the National Science Foundation and the Department of Education, has been played by more than 250,000 players, and encourages players to actively collaborate with other players to create a sustainable civilization.
- "Ice Flows" is a science simulation game about the impact of climate change on the Antarctic ice sheet. Players are tasked with controlling the size of the ice sheet to allow penguins to reach their destination. The project combines fieldwork and computer modeling to study the relationships between changes in the atmosphere, ocean, and ice sheet in this region. Computer simulation models of the ice sheet are used by scientists both to understand how the ice behaves and to make projections about future behavior. "Ice Flows" was funded by the Natural Environment Research Council (NERC) as part of a project that aims to study what might happen in the near future in the Weddell Sea region of Antarctica and the impact that changes in this region might have on global sea levels.

Interestingly, those interested in applied climate change gaming are not only institutions, but also some publishers, who have developed climate gaming initiatives, in this case, leveraging AR and VR technologies to provide more immersive and engaging experiences for their users. We discussed how immersive technologies that combine imagination and industry have experienced rapid growth over the past decade. Inspired by the role of gamification in driving environmental engagement, VR technologies have been leveraged to highlight the problems and symptoms of our current extractive economy, with the goal of inspiring collective

action. The future of climate change can be difficult to comprehend: immersive VR video games are taking players "physically" there, offering them a choice of alternative futures, engaging them in experiencing climate risk, and ultimately inspiring them to action. Time Magazine's "Inside the Amazon: The Dying Forest" brings to life the environmentally and socially destructive realities of deforestation through an immersive journey. Meanwhile, the New York Times AR app allows users to visualize air pollution generated by particulate matter and, using location-based sensors, compare local levels with those of the world's most polluted cities.

As part of the growing understanding of the climate problem, it should be noted that significant steps are also being taken at the gaming industry level: the gaming industry, which is worth more than \$200 billion this year, is in fact increasingly embedding the climate crisis within its platforms and products. Activists and governments are convinced that they can stimulate behavioral change in gamers on the one hand through rewards, whereby points are awarded for environmental protection in consumer games, and on the other by devising explicitly educational games and interactive content. In fact, some of the world's largest developers are launching climate games and activations. *Pac-Man* had a reforestation theme, while *Pokémon GO* allowed players to dress their characters in "Earth Day"-themed outfits. Other notable titles include *June's Journey*, in which in the game players can purchase tree decorations against the developer's commitment to plant trees in the real world. In the puzzle game *Monument Valley 2*, the goal is to let players learn about the importance of trees by encouraging them to support a forest conservation petition called Play4Forests. Ubisoft, another major gaming company, has organized a climate march within the game *Riders Republic* where a virtual forest fire is simulated to demonstrate the devastating real-world effects of such disasters.

Finally, there are a growing number of commercial game titles produced by mainstream studios, covering the most diverse aspects of the climate challenge; here are some of the most interesting examples in my view:

- Floodland is a city-building game from 2022. It was released on November 15, 2022 for Microsoft Windows and macOS. In the game, users are part of a group of people trying to survive in a world devastated and flooded due to climate change. The player can choose from four different types of "clans," all of which have unique advantages and perspectives on life. The settlers the player possesses can be tasked with constructing buildings, gathering resources and carrying out expeditions to obtain supplies. As the player progresses, he or she may encounter other clans that have a different worldview and priorities than his or her own people. The player must then introduce laws, to ensure friendly relations between clans and prevent hostility that can cause crime and unrest. Food and water supplies must be managed by the player as he researches new technologies and builds relationships among the clans. Let me say: isn't it interesting to think about governance?

- "GreenSpace" is a social media game that promotes environmentalism and sustainability through waste management. The situation is as follows: for the past 300 years, humans have been sending their waste into the galaxy, unintentionally littering the surrounding planets. SpaceJanitors from the GreenSpace Corps, who are in charge of eliminating the waste, are sent into space to clean up the planets and make them habitable again. Players progress through the game via the social network to earn rocket fuel, credits, energy and experience points. These items are used by players to travel to new quadrants, build and repair structures, and complete missions. GreenSpace encourages players to interact with their Facebook friends in the game as part of a collaborative effort toward positive environmental action and impact. Rocket Owl and WeForest have implemented a tree planting campaign, Play2Plant: when players reach certain milestones, RocketOwl will match their efforts by planting a tree in real life.
- "Working with Water" is a turn-based strategy web game that helps students develop and maintain a sustainable water supply system. The game takes place on Australia's Central Coast, where the need for drinking water increases as the community grows, and the player is responsible for building new infrastructure to meet the increased demand. The game will be a teaching resource for science and geography teachers teaching students 12-18.
- "Fate of the World" is a strategy game that simulates the global effects of climate change and other environmental challenges. The game allows players to take on the role of a global leader and make decisions about energy production, economic development and international cooperation to try to avoid catastrophic climate change.
- "Water Life" is an online game that teaches players about water conservation and sustainability. Players must manage a virtual ecosystem and make decisions that impact the environment and the survival of the species.
- "Tree Story" is an online game that teaches players the importance of biodiversity and conservation. Players must cultivate and manage a virtual forest and make decisions that impact the environment and the survival of the species.
- "Foldit" is an online puzzle game in which players help solve complex scientific problems, including those related to climate change and environmental research. Players must fold proteins and make predictions about their behavior to help researchers make advances in medicine, energy and other fields.
- "The Sims 4 Eco-lifestyle": from wind turbines to off-grid living to recycled clothing, this *Sims 4* expansion pack, released in 2020, allows simulated characters living in polluted neighborhoods to try living a sustainable life.
- "Fate of the world": this 2011-dated strategy game focuses on climate change, with players balancing the need to protect the planet from climate change with the need to feed an ever-growing population. Ten "master plans" allow players to play for different environmental goals, or opt for the Lifeboat strategy, in which they save only themselves.

- JouleBug is a mobile application that allows players to compete to see who is the most sustainable and to share green actions with friends. Each time a player performs an eco-friendly action, such as using a reusable bottle or buying local food, they "Buzz." The app uses gamification elements such as unlockable levels and a leaderboard, as well as social elements such as the ability to share photos and comments to provide feedback. Players can also join local communities to learn about and discover recent activities and ideas happening nearby.
- "Save the Park" is a game that aims to inspire players to volunteer and make a difference in the National Park Service's 400 national parks, monuments and historic sites across the U.S. states. Launched as part of the National Park Service's 2016 Centennial Celebration Campaign, Save the Park seeks to inspire and encourage a new generation of park lovers to take an active role in helping to preserve these important natural and historic resources for future generations. To allocate additional resources to the cause, the American Express Foundation has donated to the National Park Foundation for every Save the Park download; the donation supports NPF's conservation and park management work.
- Finally, another very interesting case is the one developed by the nonprofit organization "Games for Sustainability": "Gamepedia" is a free library of games where anyone can find, among the more than 100 games and simulations organized according to the Sustainable Development Goals, the perfect game for their educational and engagement needs.

These are some of the many instances that show the growing interest in gaming and gamification by stakeholders in the "green ecosystem," but climate change gaming is also being pushed by companies especially in the educational and collaborative spheres, which we will discuss very shortly.

To try to summarize a final view of how gaming is being leveraged by the green ecosystem today, we can say that the huge number of initiatives are clearly demonstrating that games should be and are an important tool for addressing climate change. However, we are still far from seeing experiences with the critical mass and distribution or model that could really have an impact at scale. Only a few of the games we have seen, for example, give concrete rewards to consumers, the reach is mostly limited, and the production effort, though sometimes shared with studio productions, is likely to be high relative to user metrics. Building successful games is not necessarily easy and requires skills, capacity, and scale. This is especially true when we think about MMOGs, seen in the first chapter of the book, where there is community building, internal economies, game currencies, and creation tools (user-produced games). In other words, the "green ecosystem" expresses many game-related activities, but more with a tactical vision than a long-term strategic platform vision.

Most of these games also rely basically only on the intrinsic motivation of the users. Remember: intrinsic motivation is defined as the internal desire to do things for

pleasure or love, while extrinsic motivation is to do things only for their outcome; both intrinsic motivations are necessary to achieve a sustainable gamification effect. In our case we see many examples that rely only on the intrinsic motivation of helping the climate, while most of the games we mentioned lack ways to push extrinsic motivation such as leaderboards, prizes, and other rewards. This means that the potential applications of game mechanics and games to climate change content are still far from being exploited. However, the variety of game formats and creative treatment of specific climate change issues is already impressive and growing daily in both quality and quantity; we could argue that the main problem is distribution and reach. Although we did not find clear numbers on the audiences of the games I mentioned, it is clear that these games are not yet mainstream, are not connected to each other, and, in other words, do not represent anything like a "system" with shared goals and common infrastructure. It also goes without saying that the potential data and information that emerge from these games are mostly in silos, are not shared and, I think I can safely say, are not adequately exploited. On these issues we see very interesting early forms of collaboration and proactive approaches, supported by relevant and significant stakeholders, not just institutions but the gaming industry, that could contribute significantly to pushing a structured approach to gaming even further. Technical gaming design skills and expertise are indeed needed to find the right balance and storytelling in any game, data and analytics skills are equally critical to track and maintain engagement with users—all skills and resources that are in high demand in the marketplace and typically very expensive. This is one reason why forms of collaboration, such as Arsht-Rock's, with game companies, industry veterans, developers, game design experts, some of the largest game companies, and educational institutions are critical. We need to scale this approach more and more.

Let me give one example, among many, to better visualize when I say we need to scale up more. In 2020, the United Nations launched the global "Act now" campaign; as part of the initiative, the "Aworld" mobile application was developed, which some of you have probably already tested and tried to use. The app asks twelve different questions to users to calculate their individual carbon footprint, then the user can learn from tutorials and news about sustainable and positive actions to reduce impact. There are levels, points, stories, and journeys to take, as well as an invitation to create teams and involve friends. The global campaign also has local initiatives that collaborate with brands in a joint effort to push communication. While we do not have statistics and while the app is very well designed, it is easy to point out areas for improvement: there is no extrinsic reward or motivation, which, in my opinion, impacts both long-term engagement and attractiveness to new users; the data collected is limited; user actions are in the app's silos (to say that the app does not track external behaviors as the user profile is tied only to that touchpoint) also content and stories are in silos and do not aggregate external sources to enrich experiences. In other words, what we see with "Aworld" is a lack of a virtuous circle to improve user engagement, we see another silos, a weak or limited view of data collection, in general a lack of critical mass and a closed environment. Again, mine is the user perspective, which is not based on any

data or insight, I have downloaded the app and tried to use it, frankly it is not fun or engaging, unless you are already a fanatic or climate change enthusiast. The global impact, stated in the app, at the time of writing, is over 11 million positive climate actions, measured within the app; let me say that we should be able to multiply these numbers very significantly with stronger engagement mechanics and a different approach. It is also true that "Aworld" could not have been anything other than what it is, since it does not belong to any platform and probably does not have the scale to implement any platform approach; it is a good project, it is a global activation campaign, but it does not take advantage of the opportunities we have discussed so far on gaming or digital platforms. This is true, with some natural distinctions, for all the climate gaming experiences we have mentioned.

## 2.1.2 BLOCKCHAIN

In the first part of the book, we discussed blockchain with a focus on DAOs, cryptocurrencies, and tokenization mechanisms and earn-to-play mechanics. Here we will focus on the importance, in general terms, of blockchain for climate change, as this technology enables several potential benefits that were not there before.

This is not breaking news, blockchain is an issue that different stakeholders are addressing and discussing from different perspectives: legal, regulatory, infrastructure, supply chains, etc. Basically, here we want to see how institutions and policymakers are behaving and what kind of attitude there is about it within the ecosystem. In addition, we will share some examples of blockchain startups and applications that could be a reference for future models on a larger scale.

As a first starting point, let's say that one topic about blockchain that has been widely discussed is the carbon neutrality of the blockchain itself as it would require a large amount of energy to operate. From this point of view, eco-sustainability is not the first thing that comes to mind: bitcoin, the first application of blockchain, is widely known as an environmental polluter, consuming huge amounts of energy and emitting large amounts of CO<sub>2</sub> to validate transactions and support the network. At a closer look, this criticism is often aimed specifically at the Bitcoin blockchain or, more generally, at the consensus proof-of-work mechanism that, without delving into technical details, encourages specific participants ("miners") to continuously deploy resources to increase their chances of winning the race to validate the next block in the chain. To counter this, we begin by saying that by using consensus mechanisms other than PoW (proof of work), energy consumption can be greatly reduced and furthermore, any comparison should consider the degree of energy efficiency of traditional centralized systems. To give a significant example of how this criticism could be addressed: the European banking industry recently took a major step forward with the launch of a revolutionary new blockchain platform for digital bonds. The platform, called "so|bond," is a joint project of Skandinaviska Enskilda Banken (SEB) and Credit Agricole Bank of Sweden and France, respectively. It enables institutional clients to issue, trade and settle bonds digitally, offering a more efficient and secure process than traditional methods. The platform uses a validation protocol, "Proof of Climate awaReness," which aims to minimize the environmental footprint of blockchain networks. This protocol enables energy consumption comparable to non-blockchain systems and incentivizes participating nodes to improve the environmental footprint of their infrastructure. What I want to emphasize is that any balance between possible benefits and carbon footprint should be carefully considered before taking a final position on this topic. The benefits of using blockchain are potentially very large and relevant to all ecosystems and realistically balancing emissions with the positive impact generated.

These topics have already been widely discussed. For example, the 2018 G20 report "Roadmap to Infrastructure as an Asset Class" focuses on ways to improve the overall infrastructure investment environment (G20, 2018). This work, combined with that of the OECD (Organization for Economic Co-operation and

Development) on infrastructure, data and performance measurement, and finance, suggests several key points, related to the infrastructure ecosystem of the green economy, that are also important to consider in the context of blockchain and in general for our discussion:

- Create greater infrastructure standardization throughout the value chain, including contractual and financial standardization. Greater standardization of contracts and documentation in the bidding and procurement phases of the infrastructure project lifecycle is key to reducing their cost and complexity, as well as facilitating comparability. Greater financial standardization would reduce investment costs and facilitate institutional investors' allocations in infrastructure investments.
- Emphasize the importance of data to support well-informed infrastructure investment decisions. New technologies can be leveraged to support increased data availability and quality, particularly when considering the possibilities offered by IoT, AI, geospatial (satellite), and blockchain in infrastructure systems.
- Solutions to manage risks in infrastructure investments through improved transparency, identification, or measurement of risks, along with effective mitigation strategies. In particular, the management of political or currency risks associated with infrastructure could be improved through increased transparency, accountability, regulatory oversight, and frameworks. Even a small reduction in these risks could have a real impact on infrastructure investment levels, especially in developing countries.
- Translating efficiency gains, risk identification and reduction into lower cost of capital and more efficient risk rates for infrastructure assets. Tools such as IoT sensors could provide input for more accurate modeling of financial and credit risk using real-time data on asset performance.

We can then begin to understand what the impact of blockchain on the circular economy is, which includes all supply chain applications for any industry sector at the infrastructure level. As is well known, the circular economy offers the opportunity to solve problems related to climate change, biodiversity loss and pollution. It is a fundamental "system change" that breaks the link between economic activity and the process of drawing from the finite bank of the earth's resources, making systems more resilient and regenerative. The circular economy is based on three principles: eliminating waste and pollution, circulating products and materials at their highest value, and regenerating nature, all through design. Blockchain is ideally suited to contribute to this circulation task by identifying and tracking materials and components throughout the supply chain so that they can be reused, remanufactured or, when no longer possible, recycled or composted. Because blockchain has a high degree of data integrity, this technology is very useful in bringing transparency to supply chains, since at each stage of the supply chain information about a product can be recorded on a blockchain, this allows all participants in the supply chain to retrieve information about the product at any time, ensuring transparency of the entire process. This is particularly useful for

products whose source is important to verify, such as renewable energy: companies and individuals who use energy and want to be certain that it actually comes from a renewable source.

Some good examples of companies pursuing this mission include the following. One of the first is "FlexiDAO," based in Spain, which is leveraging the blockchain technology revolution to improve transparency. With the intermittency of renewable sources, what we think of as "green" energy may come from fossil fuels while the wind doesn't blow or the sun doesn't shine, and it is devilishly difficult to find out if this is really the case, and the current system of tracking energy sources is based on certificates that do not reflect the physical reality of the grid hour by hour. FlexiDAO therefore uses blockchain to address this problem. Their solution compares business consumption with renewable energy production statistics to determine whether supposedly "green" energy can be called such. The certification is thus transparent, granular and works in real time. The innovation has been welcomed and FlexiDAO has already partnered with giants such as Microsoft and Vodafone. Another interesting reality is "Circularise," which, on the other hand, tracks various materials and production raw materials across supply chains on a blockchain. As an example, Porsche uses Circularise to learn about its supply chain and track its carbon footprint. Both platforms, FlexiDao and Circularise, thus provide customers with evidence and transparency on supply chains while enabling manufacturers to build trust and credibility.

We do not go into the circular economy, which of course is a key issue because it is closely related to the supply chains of different industries that have very different frameworks and logics, but we note that examples of solutions are many, and we also observe that more or less all industries are trying to move in this direction.

If we want to take a closer look at the potential impact areas of blockchain technology beyond the circular economy or supply chains, we need to emphasize that the role of blockchain in the context of sustainable infrastructure goes far beyond enabling efficient data collection, monitoring, reporting and management services. In fact, blockchain technology offers potential in building collaborative platforms and network systems, which can help achieve the country's investment goals, including for the low-carbon transition phase. These are of course general benefits that imply widespread use of blockchain as a platform, which could lead to a shared ecosystem that today is still highly fragmented, non-standardized, and with often unclear governance. It is worth noting that there is a general lack of expertise and knowledge of the principles of blockchain application operation and development, as we mentioned earlier.

At a high level, the features that blockchain offers to support sustainability efforts are decentralized finance, emission certificate trading systems, blockchain-based infrastructure, contract management system, blockchain applications for governance, and consumer mobilization on mitigation and adaptation. Let us now quickly describe the impact and potential use cases of each, according to the OECD report, with some examples that might clarify practical applications.

- Decentralized financing infrastructures are critical to climate mitigation and adaptation because they can provide the funds needed to implement projects quickly and efficiently. By funding these projects through blockchain, a decentralized network of funders can be created that could significantly help support climate mitigation and adaptation efforts. This decentralized network would offer several benefits, including reduced transaction costs, increased transparency, and enhanced security. In addition, by using blockchain to finance climate-related projects, we could ensure that funds are used effectively and efficiently to support larger investments.

Use Case 1: Similar to current crowd-investment platforms, assets such as renewable energy facilities, bicycle paths, efficient agricultural facilities (e.g., aquaponics and hydroponics), and many others can be financed by the direct participation of small and medium-sized enterprises, institutional investors, public and private sponsors. Due to the advantages of blockchain technology in terms of process efficiency, transparency and speed of settlement, micro-financing can also become feasible by lowering transaction operating costs and enabling the participation of a broader spectrum of investors.

Use case 2: Companies and public institutions that choose to offset their carbon footprint could easily invest a desired amount in a decentralized infrastructure project platform. By reducing transaction costs and strengthening the verifiability of their commitment, organizations would have the opportunity to invest more resources than in the past. A blockchain-based solution implemented globally, operating on a not-for-profit basis, could minimize transaction costs and eliminate the risk of monopolistic behavior observed in traditional digital markets.

Two practical examples in the marketplace in this area are ClimateTrade and Climate Impact X, both of which provide a marketplace for carbon offsets. In their marketplaces, companies can choose a wide range of green projects to invest in. As their investments accelerate sustainable efforts such as reforestation, these companies are also able to offset their carbon emissions.

- Emission certificate trading systems would be an important step forward for system efficiency, allowing companies and individuals to trade emission credits and creating incentives to reduce emissions. In fact, an emissions certificate trading system on blockchain could be beneficial to both consumers and suppliers: suppliers would benefit from an easily accessible marketplace to sell their energy; consumers, on the other hand, would benefit from a wider choice among suppliers and a guarantee of greater transparency about the source of their energy.

Use Case 1: Trading greenhouse gas emission certificates. Using blockchain, it is possible to implement globally a decentralized, highly automated and self-managed ledger that accepts, stores, tracks and destroys unique certificates for

real-world emissions. This would represent a new infrastructural layer compared to currently implemented carbon certificate systems. With blockchain, therefore, it is possible to create a much more flexible and globally shared marketplace. Quota rules and certificate circulation could be controlled by rules defined in smart contracts, which would enforce certificate transactions in an automated way. On the other hand, climate-mitigating investments (e.g., forests and wetlands) could be sources of carbon credits, which could then be monetized by creating, tracking, and trading the new credits generated using blockchain technology.

Use case 2: Virtual carbon content accounting. Energy Trading Systems, or ETSs, account for a company's emissions and monitor appropriate offsetting through the trading of emission certificates within a specific geographic market, but do not account for emissions generated by the same companies outside the jurisdiction of the trading system. To accurately allocate all emissions caused globally by a single company, it is necessary to identify and track the carbon content of products and services throughout the value chain. The carbon content of products, unprocessed products, or intermediate inputs could be recorded on a blockchain-based system allowing regulators to enforce action more broadly against climate change.

Use Case 3: Certificates of Origin for Green Energy. By uniquely identifying and tracking energy from renewable sources throughout the value chain (generation, distribution, storage, consumption), several use cases could be enabled. For example, emissions caused by power generation used by electric vehicles could be uniquely identified and assigned to each charging process. A decentralized open-source application (dApp) developed by the Energy Web Foundation has already been tested on several sites. The application offers granular data on energy ownership, location, time of day, and marginal CO<sub>2</sub> emissions avoided per kWh, while enabling direct and automated exchange of certificates of origin between renewable energy generators and buyers of any size (EWF, 2018). This allows consumers to have a greater ability to identify and purchase from renewable energy facilities with greater potential for marginal avoided emissions. Blockchain-based solutions therefore modernize the technological tools available for renewable energy tracking, trading, and reporting systems, disintermediating the process and reducing administrative and transaction costs in certificate of origin markets.

- Screening of agricultural and natural lands. By combining remote sensing, image processing and blockchain technology, verifiable screening of forests and agricultural lands can be established. Natural carbon sinks could be accounted for in near real time, and payments related to their growth or reduction could be automatically and securely settled on a blockchain platform. For example, the platform could enable timely monitoring for the achievement of mitigation commitments at the farm or national level. As we have seen, blockchain technology enables peer-to-peer exchange of all kinds of "tokenized" assets,

such as securities, real estate, or commodities like gold and silver; energy is just another example of an asset that can be tokenized and traded digitally. Two cases of companies already in the marketplace that are moving in this direction: PowerLedger, for example, is accelerating the transition to a decentralized energy grid. It is doing so with a blockchain-based marketplace where consumers and suppliers can easily exchange renewable energy. Another example is WePower, which solves a similar problem: It uses blockchain to directly connect companies with local green energy producers, reducing transactional costs. In these two examples we see how blockchain can be applied to create efficient and more liquid markets for renewable energy, of course these markets then need volume and critical mass to make a significant impact, but we are still quite far along here.

- Blockchain-based infrastructure contract management system. A blockchain-based infrastructure contract management system would be a decentralized platform that would enable the construction, management and enforcement of contracts among infrastructure stakeholders. The system would use smart contracts to automate the process of contract formation and execution, while providing a secure and transparent way to record and track the progress of each contract. The system could handle different types of contracts, such as construction contracts, energy contracts, environmental contracts, etc. Smart contracts would, for example, enable local governments to automate the process with a secure and transparent way to store data.

Use Case 1: A contract management system that verifies and tracks valid and legally binding versions of contracts could greatly improve the transparency of existing multi-party agreements. The parties involved should they adopt such systems could benefit from the certainty of knowing which version of the contract is valid and review its terms at any time, leading to more streamlined and automated processes. This solution would work in tandem with existing IT environments, such as document management systems, enabling a high level of security for sensitive documents while providing a single, reliable version of multi-party contracts.

- Blockchain-based infrastructure optimization: by creating an efficient transaction platform, the capacity of current infrastructure can be better utilized. Based on time-based monitoring of infrastructure utilization rates, all key sectors, from power grids to public and private transportation assets or agricultural land, could benefit. Especially in the areas of urban mobility services and power grids, many emerging start-ups and other players have already proposed extremely interesting use cases where blockchain enables micro-interactions among a large group of participants in an efficient and secure way.

Use case 1: Traffic management platforms. By securely and selectively sharing mobility data across an ecosystem of stakeholders, such as automobile manufacturers, municipal authorities, and map and routing service providers,

specialized analytical software could evaluate the data and dynamically set incentives to prefer or avoid certain roads at certain times. In relation to current discussions about restricting combustion vehicles in urban centers or implementing special tolls, the integration of sensor data e.g., pollution measuring stations, monitoring of virtual tolling areas, etc., could be used to create a system that would allow local authorities to monitor the traffic flow of cars. Each local government could design a suitable traffic control system and implement it as a real-time application. Monetary incentives (or fines) could be transferred directly between wallets held by (shared) mobility assets, their owners, or users.

Use case 2: Energy sharing economy (P2P trading). So-called "prosumers" can use "homemade" energy (e.g., through solar, wind, or cogeneration plants) while selling excess energy on a highly automated decentralized platform. Selling excess energy would increase the efficiency and resilience of the power plant portfolio and incentivize the private sector to invest in renewable power plants. Local grid operators and integrated utilities could benefit from more efficient grid operation and decreased demand for conventional generation plants and power transmission infrastructure. However, the move to a decentralized grid also represents a huge discontinuity of traditional energy and utility business models (as well as the power grids themselves, which were designed to distribute energy from generation to consumer, not from consumer to consumer).

In summary, on the topic of infrastructure, there are many initiatives and ideas underway on the implementation of blockchain technology to support a sustainable infrastructure system. The level of complexity and resources required for implementation vary significantly from case to case.

- Blockchain applications for governance: blockchain applications for governance can powerfully impact the fight against climate change in many ways: for example, a decentralized application could help track and monitor carbon emissions, ensuring that companies and individuals are held accountable for their pollution. We will discuss this issue extensively in the last part of the book.

Use case 1: A blockchain layer could enable the creation of decentralized applications by any organization to support governance, alignment, and monitoring of various infrastructure standards. Decision makers, including investors, need access to authentic, standardized, and up-to-date information on infrastructure assets, and this could be based on blockchain, including data on financial performance, but also ESG criteria or climate-related information. As existing data is fragmented and can be misaligned with climate goals, a blockchain-enabled platform would provide the digital backbone needed to support data transparency for sustainable infrastructure development while enabling automated compliance checks, standardization, and integration with other digital technologies such as deep analytics (artificial intelligence) and remote sensors (internet of things).

- Consumer mobilization on mitigation and adaptation: in addition to industrial behavior contributing to carbon emissions, end consumers are equally an important lever for building inclusive infrastructure systems. To mobilize consumers, it is important to raise awareness, reward sustainable behavior, provide adequate infrastructure to reduce consumer burdens, and accelerate individual adoption levels. In this regard, blockchain can provide the IT backbone for transparent information on emissions and consumer choice. On this I would like to emphasize that this is a key topic, in my view, very much related to gaming and education as well.

Use case 1: Marketplaces of greenhouse gas reduction rewards. A cryptocurrency and marketplace could be created that rewards consumers and organizations that make decisions with a positive environmental impact. For example, a U.K. start-up has introduced a platform that rewards activity and walking. By walking, the user earns cryptocurrency that he or she can then use in a decentralized marketplace of merchants who in turn offer services ranging from graphic designers to local food retailers to NGOs that receive donations.

Use case 2: Food provenance for consumer visibility. A blockchain-based solution for tracking food supply chains could provide consumers with transparency on the origin of production. By introducing a label on products indicating their provenance and including a link to an open database, consumers could see if their food was sustainably sourced.

- Efficient recycling systems to support a circular economy approach. Participation in recycling programs, while contributing greatly to a sustainable future, currently has few incentives. Using blockchain technology as we have seen, it is possible to create reward systems. As an example, one start-up has built an efficient plastic recycling system for developing countries: individuals can collect and bring plastic waste to established recycling centers that, in return, repay the collectors in the form of digital tokens. The tokens received can be used to purchase goods such as food, water or phone credits.

At the institutional level, all these issues and application cases are on the table for discussion: indeed, numerous consortia and alliances have already been formed among industries and competitors to jointly define basic technology standards, establish global rules, support timely alignment with regulators and policy makers, and clarify financial and sustainability parameters.

Among others, the European Union is undertaking several actions to support blockchain adoption, such as technical assistance and investment programs, blockchain solutions that establish a network between providers and consumers, support for sustainable finance initiatives, and the development of partnerships with strategic partners. Among the institutions that are most exploring the topic are the United Nations, the World Bank, the European Investment Bank and the European Bank for Reconstruction and Development.

But, in my opinion, the two most interesting initiatives underway are the following. The OECD (Organization for Economic Cooperation and Development) project that, in the report already mentioned, already draws a roadmap toward implementing the different blockchain use cases mentioned above to build a shared and common platform that can aggregate the different stakeholders. Second, the "Blockchain for Climate Foundation" has created a platform to enable the issuance and exchange of "Blockchain Internationally Transferred Mitigation Outcomes," called BITMO. In this case, the idea is to embed the entire Paris Agreement, in which each country sets its own unique and differentiated "Nationally Determined Contribution" (NDC), in the blockchain, indicating specific ways to combat climate change. The BITMO platform should be able to play a critical infrastructure role, enabling corresponding adjustments and the immediate settlement of international carbon trade. The adoption of the BITMO platform is ultimately up to each country signatory to the Paris Agreement, and a working group of representatives from different nations is being convened to contribute to the vision and creation of this functional blockchain tool to operationalize Article 6 of the Paris Agreement.

However, there are many initiatives that seek to build infrastructure approaches. Another example is the establishment of the Energy Web Foundation (EWF) as a global consortium of energy producers, integrated utilities, and related companies such as research institutes, IT service providers and start-ups. In addition to developing a new open-source technology platform specifically built for the energy sector, the EWF has established several specialized working groups and knowledge exchange forums to enable "affiliates" to accelerate the development of blockchain-based applications, especially around certificates of origin for green energy, electric vehicle networks and other application areas.

Also of particular note are Yale's open-source Open Climate shared protocol platform, the Ethereum-based Blockchain for Climate Foundation, the Climate Ledger Initiative, which examines concrete use cases of digital innovation to promote climate action, and, finally, the World Bank-supported Climate Warehouse, which attempts to link carbon credit accounting systems.

Finally, to understand the potential impact of blockchain in the climate change ecosystem, it is worth commenting briefly on what is happening in the world of start-ups and investments with a focus on this technology. From this perspective, several particularly interesting start-ups and companies are emerging that are demonstrating new business models and new solutions to problems. Among those that have captured my interest the most during this research are the following:

- "Alchemy" wants to do for blockchain and web3.0 what AWS (Amazon Web Services) did for the Internet. It is a platform for developers to build scalable and reliable decentralized applications. In February, Alchemy announced that it had closed \$200 million in a Series C1 equity round led by existing backer Lightspeed Venture Partners and new investor Silver Lake. With this, the company's valuation reaches \$10.2 billion.
- Another is "Single.Earth," whose mission is to help preserve existing systems by making conservation profitable for landowners of all sizes. Single Earth is thus working to make saving forests as profitable as cutting them down. On the

platform, landowners receive a token for the equivalent of 100 kg of CO<sub>2</sub> captured from their forests, wetlands or other natural resources, based on the ecological value of their land. The company is based in Tallinn, Estonia, and was launched in 2019. Founder and CEO, Merit Valdsalu, spoke at this year's EU-Startups Summit and shared some insights on how to enhance the environment and create a sustainable economy. This is an interesting initiative for the concept of land remuneration and profitability.

- "Justcarbon is working to bring blockchain to carbon credit markets. It has developed a marketplace for trading carbon credits that helps reduce costs and eliminate middlemen. Users can purchase JustCarbon tokens, called JustCarbon Removal Units (JCR). 1 JCR = 1 ton of carbon sequestered certified under the platform's governance rules, which are managed by JustCarbon's DAO. JustCarbon Governance token holders control the DAO.
- "Senken" is a marketplace where anyone can compare, buy, trade and retire carbon credits. The platform makes voluntary carbon offsetting as simple and easy as possible by making the marketplace accessible. Senken's mission is to solve the problem of reliability and transparency of the voluntary carbon market since their tokens are stored in a distributed, decentralized and immutable database. The platform also provides detailed information about each climate project in the marketplace to help users make an informed decision.
- "Coorest" is another marketplace that offers institutional and individual investors the opportunity to offset their carbon footprint. The goal is to bridge the gap between the real and digital worlds. Coorest sells NFT, which it calls NFTrees, a project that involves planting real-world trees to offset excess CO<sub>2</sub>. When the tree is planted, the NFTree owner collects tokens equivalent to the amount of CO<sub>2</sub> sequestered, and the tokens can be used or sold as carbon offsets. Coorest supports agriculture by purchasing previously unused land and employing local farmers to work on the land. The Estonian startup was founded in 2021.
- "Toucan" is building web3 infrastructure for a regenerative economy. It has created a globally accessible and liquid marketplace for voluntary carbon credits. Through their platform, carbon credits can be used in a variety of use cases, including NFT, digital assets and collateral.
- Brazil's "Moss Earth" has streamlined the carbon offset process by ensuring traceability and transparency of carbon certificates. Moss tokenized the governance and economic rights of small forest areas into NFTs: individuals and companies can then purchase an Amazon NFT through Moss and protect a piece of forest. Moss has incorporated carbon credits into the MCO<sub>2</sub> token, which is listed on some of the world's largest exchanges such as Coinbase, Gemini, and Uniswap.
- The Ocean Protocol Foundation has created a decentralized data marketplace. Imagine an artificial intelligence developer who needs data to build predictive models, while a large corporation is sitting on a huge pile of data that is not being used. The Ocean Protocol bridges the gap between these two players by enabling the exchange of data for a fee. In this way, the Ocean Protocol unlocks

data stored in silos and allows data providers to securely allow others to use their data without having to grant access. This is because it is only the artificial intelligence algorithm that handles the data and only the end result is transmitted to the data consumer. The OCEAN token is used as a means of exchange and remuneration between data provider and user.

- The idea of Switzerland-based Frigg.eco is that investing in climate change mitigation infrastructure in emerging markets can be difficult because investors perceive projects as risky, financing structures are underdeveloped, progress can be difficult to measure, and returns remain uncertain. Most investors see these obstacles as particularly significant. What if we could break down large investments into a series of much smaller, and therefore easily accessible investments for all types of investors? Frigg's solution is to tokenize projects, thus splitting large investments into smaller investments, whose tokens are then sold in Frigg's marketplace. The tokens can be based on either equity or debt financing structures and can be bought or redeemed in most currencies.

In conclusion, blockchain could be a "game changer" in the climate challenge and that its impact could be significant on several levels of the ecosystem; from the perspective of infrastructure, both technical and market; for the emergence of new business models; and for the enablement of different ways of engaging the user and stakeholder community.

The private sector, public institutions, and all of us are important levers in the transition to a sustainable future: if it is essential to build global awareness of environmental issues and increase the willingness and ability of individuals to contribute: then blockchain can serve as a transaction-enabling infrastructure for new market models. Using tokens or models based on cryptocurrencies and gamification approaches, it would be possible to build and then scale efficient markets for carbon offset activities. This approach requires business models and applications that are easy for users to understand, and use: so, education and knowledge of blockchain-based applications are critical to successful implementation. On the climate challenge in general, we know that many people are critical, and many argue that the current plans, set by countries to meet the goals of the Paris Climate Agreement, are not sufficient to meet the ambitious investment targets set by governments: therefore, to support current and future efforts, it is essential to strengthen the collaboration and technology framework. Achieving these goals requires a re-setting of the vision for climate infrastructure systems and services, starting from consumer interaction to operations, financing, construction, procurement, and planning. Innovative approaches are needed to envision how to achieve this transition, cheaply and equitably. However, several policy actions are still needed to facilitate the development of shared blockchain-based solutions. The application of new technologies, especially in untested markets, carries risks that must be weighed against the benefits. Policymakers are indeed taking initial steps to address legal and regulatory issues related to the use of blockchain technology, but because many of these issues are cross-border, strong international coordination is also needed. But this is a topic, governance, that we will discuss later.

### 2.1.3 EDUCATION

Education has an extremely important role in guiding the transition to a sustainable future. By increasing the quality and accessibility of education and developing people's knowledge, attitudes and behaviors toward climate change, the world will witness more effective and faster change. In 2020, Global Education Monitoring (GEM) reported that funding education in low- and middle-income countries could reduce global emissions by 51.48 gigatons (a gigaton is a billion tons) by 2050. Research (such as that conducted in 2019 by North Carolina State University) shows that education dedicated to climate change and the environment can help change a population's environmentally harmful behaviors. Moreover, a well-educated workforce is a vital part of the industrial revolution needed to address the necessary transition phase generated by climate change. The international community widely recognizes the importance of education and training in addressing climate change: the United Nations Framework Convention on Climate Change, the Paris Agreement and the associated Action for Climate Empowerment (ACE) agenda call on governments to "educate, empower and engage" all stakeholders and key groups on climate change policies and actions. The Convention has provided two main strategies for addressing global warming: mitigation and adaptation. Both require education. But when trying to bring education to climate many focus too narrowly on explaining the concept of climate change or greening infrastructure: the power of education for climate action is much broader than this.

Education is indeed a key tool for achieving mitigation and adaptation goals. Education can help raise awareness about the causes, impacts and potential solutions of climate change. By providing the scientific information behind climate change, students and the public can better understand the problem and its implications for their lives. Education can also foster behavior change by encouraging individuals to adopt more sustainable lifestyles, such as reducing carbon footprint and conserving resources, promoting energy efficiency, sustainable transportation, waste reduction and other measures. Another key aspect is that education can build the skills and capabilities needed to design, implement, and evaluate climate change mitigation strategies. For example, students can build skills on renewable energy technologies, sustainable agricultural practices, and green infrastructure. Education can encourage advocacy, action and collaboration, empowering individuals to participate in climate change policymaking and community-based initiatives. By providing opportunities for engagement, education can help create a sense of collective responsibility and encourage individuals to take action on climate change. Finally, education fosters innovation and creativity, which are key to developing new technologies, policies, and strategies to mitigate and adapt to climate change. We can say that harnessing all these opportunities can have a transformative impact that, if managed properly, could create millions of new jobs in sustainable economies. This is clear to most institutions, governments, associations and stakeholders at any level. When we think about climate change education, in fact, we are not only discussing educating

the entire world population to impact individual and collective behaviors, but we are also thinking about the workforce, teachers, policy makers, and so on: this is a huge effort that is already underway by many stakeholders and by the green ecosystem in general.

- The World Bank, which is the main funder of education in developing countries, responds to requests from national governments and has several education- and climate-related projects underway.
- UNICEF works on climate change and disaster risk reduction in many of the more than 190 countries where it works. In East Asia and the Pacific it is working to build the resilience of education systems and improve the sector's contribution to climate change reduction. UNICEF also chairs the Global Alliance for Disaster Risk Reduction and Resilience in Education (GADRRRES), which has updated the Global Framework for School Safety. This will help governments and education stakeholders to soothe students and practitioners from anticipated risks related to climate change and other hazards.
- UNESCO's Climate Change Education for Sustainable Development program (CCESD) aims to help people understand climate change by expanding CCE activities in non-formal education through media, networking and partnerships. With the help of organizations and individuals, UNESCO was able to host the World Conference on Higher Education (in Barcelona 2022). The program was based on the holistic approach of Education for Sustainable Development (ESD), which incorporated key sustainable development issues such as climate change, disaster risk reduction and others into education in order to address the interdependence of environmental sustainability, economic viability and social justice. The program has promoted and fosters participatory teaching and learning methods that motivate and empower students to change their behavior and take action for sustainable development. It seeks to help people understand the impact of global warming today and increase "climate literacy," especially among young people, and aims to make education a more central part of the international response to climate change. In doing so, UNESCO is working with national governments to integrate ECC into national curricula and to develop innovative teaching and learning approaches.
- The Global Partnership for Education (GPE) supports governments in low-income countries in the delivery of education and crisis preparedness and response, including to climate-related disasters. One example of ongoing work is a project in Rwanda, which plans to minimize anticipated risks from climate change by building flood defense mechanisms in schools and training teachers and students in conservation and sustainability. GPE is also developing a new way to support countries in integrating climate change and environmental considerations into education sector plans, budgets and strategies.

- Education Cannot Wait (ECW) is the United Nations Global Fund for Education in Emergencies and Protracted Crises. The Fund has supported countries such as Haiti, Mozambique and Pakistan to support educational projects in response to climate-induced disasters in those nations. In its new strategy, the ECW aims to increase its ambitions in education preparedness, continuity and resilience to climate-induced crises.
- The "Climate Change and Universities Partnership Program," on climate change and universities, coordinated by the Nairobi Work Program (NWP), is an opportunity for graduate students to work closely with local, national and regional partners to undertake a research project as part of the production of their master's thesis. Launched at the United Nations Climate Dialogues 2020, the project is designed to strengthen collaboration between the UNFCCC, the United Nations, and academic and research institutions. Universities around the world are increasingly recognizing their responsibility to prepare students and society to actively contribute to combating climate change. This role sees universities adopting and promoting carbon-neutral goals and practices, developing curricula and pedagogical approaches to educate students and, by extension, society.

Indeed, universities and research centers are key players in promoting both education and innovation and technologies, a very interesting example is as follows. Under a NASA grant, Mathematical and Geospatial Pathways to Climate Change Education, students at California State University, Northridge (CSUN) have integrated geographic information systems (GIS), remote sensing and satellite data technologies into the study of global climate change. ESRI's ArcGIS and ERDAS Imagine mapping, spatial analysis, and image processing software were used to explore NASA satellite data to examine Earth's atmosphere, hydrosphere, and biosphere in areas that are affected by or influence climate change. These technological tools have been incorporated into the Geography Department's climate change and remote sensing courses to enhance students' knowledge and understanding of climate change through the practical application of image processing techniques to NASA data.

We have to say that most of these programs are developed with traditional methodologies and processes; we did not find a great deal of innovation in the most widespread initiatives. This is not surprising: like most industries, the education industry is undergoing a profound transformation and chasing after new technologies, as we saw in the previous chapter of the book. In general terms, the contribution of ITC industry and technologies to the education industry has been enormous in recent years, for example, with e-learning platforms or massive online courses; that was yesterday, but now, as we have seen, the acceleration provided by technology is impressive and the scope for improvement in educational impact enabled by new technologies is therefore enormous. However, real-world applications of innovative models for teaching and learning are not yet so widespread. Various climate change-focused e-learning platforms and resources include:

- "Climate Interactive" is a nonprofit organization that offers a series of interactive tools and online simulations designed to help people understand the complex dynamics of climate change.
- "Climate Literacy and Energy Awareness Network" (CLEAN): is a free online resource that provides educators with peer-reviewed educational materials on climate and energy issues.
- "The Climate Reality Project" offers a free online course on climate change that provides an overview of the science behind climate change and explores potential solutions to the problem.
- "Yale Climate Connections" is an online platform that provides news and information on climate change, as well as a variety of educational resources and online courses.
- "The Climate Change Course" is a free online course offered by FutureLearn that explores the science of climate change and its impact on the world.
- "The Climate Web" is an online resource that provides users with a range of resources and tools to help them understand climate change, including e-learning courses and interactive tools.

In all of this we can say that gaming and serious gaming is the tool that the green ecosystem is considering the most among all those mentioned: just as we also found interesting cases of collaborative initiatives that could be useful to use as examples or best practices for all.

Seeking innovative approaches to raise awareness of climate change among digital natives, online games and serious games are emerging as new platforms for communication, education, and social change. Through their interactivity and engaging storytelling, games could convey to young people the issues they will face in the future, allowing them to experience them directly through play. In addition, online games can offer the possibility of being implemented in educational settings as a teaching tool for teachers. As we have seen, the intersection of gaming and learning is often very light, as one of the success factors is to entertain and learn at the same time, within the gaming environment. Here are just a few of the many examples along these lines:

- "The Climate Adaptation Game" was developed by the Swedish National Center for Climate Change Knowledge and Adaptation, based at the Swedish Meteorological and Hydrological Institute (SMHI), together with researchers from Linköping University and high school teachers. The center's mission is to provide tools and information to help society cope with climate change. The goal of developing the game was to provide a tool suitable for sustainable development education in high schools, as well as for municipal officials and policy makers who are beginning to work on climate adaptation. The main motivation behind the development of the game was the governmental operational mission of SMHI's Swedish National Knowledge Center for Climate Adaptation, which is to raise awareness of the need for and possibilities for climate adaptation.

- "Sustainability Games" is a team-focused educational environment filled with mini-games, educational pathways and impactful challenges. It offers companies and organizations ready-made or customized game experiences to engage, educate, activate and assess any workforce. Sustainability Games help client workforces excel in circular thinking and application. As an added impact factor, each player can give back to nature: for every 10,000 Re-coins rewarded, a tree will be planted. The Sustainability Games are designed as a platform to drive organizational transformation in the company with collective learning.
- In the "Green Business Lab," participants take on the role of a company's executive team. They are charged by the board of directors to lead the company while minimizing environmental impact and increasing business and social value. They must then manage the company with accountability, transparency and respect for employees and other stakeholders. Participants must then develop their own personal model of corporate sustainability and put it into practice.
- The "Games4Sustainability" platform, which we have already mentioned, is a guide to making sustainability messages more compelling and accessible using games and social simulations. Sustainability professionals, academics, and organizations from around the world have applied games and social simulations in their business areas. The G4S platform is managed by the Centre for Systems Solutions, an NGO with 12 years of experience in developing and applying systems tools such as social simulations and computer modeling. Games4Sustainability is a non-profit project, currently 100% self-funded. Money from donations is used for the creation of additional articles and entries on Gamepedia, where more than 100 games are featured, and for technical development and maintenance of the platform.
- "Climate Quest" is an educational game with retro 8-bit graphics made by the University of Washington's Earth Games studio. Students must choose which tools to use to solve a seemingly endless series of environmental disasters in the continental United States.
- In "A Green New Election," also from Earth Games, users play the role of a politician who hopes to be elected and implement a workable new green deal.
- "Beyond the blue" offers users the chance to step into the shoes of scientist Mirai, exploring the ocean in eight stunning and immersive dives. Discover volcanic vents, coral reefs, chasms and more, and learn about issues such as acidification and plastic pollution.
- "Echo": In this educational game, players work side by side to build a civilization advanced enough to save the planet from an impending meteor attack without destroying its fragile ecosystems.
- In the game "Keep Cool," each player tries to balance conflicting demands, achieving their country's goals while wrestling with the demands of the oil industry and environmental groups. Decisions, selfish or altruistic, may or may not determine whether or not droughts, floods or pandemics occur or the world's climate collapses; in other words, everyone loses.

- "Cool School: Where Peace Rules" is an online game developed by the United Nations Environment Program (UNEP) that teaches children about climate change and encourages them to take action to address it.
- "Global Warming Adventure"-an interactive game designed for elementary school children that teaches them about climate change and how they can help reduce it.
- "The Climate Kids"-a website developed by NASA that provides educational games and activities for children to learn about climate change and its impact on Earth.
- "Climate Quest"-a mobile application that challenges players to complete quests and learn about climate change in a fun and engaging way.
- "Climate Cops"-a game developed by the British government that challenges players to reduce their carbon footprint by making green choices in their daily lives.
- "Earth Day Quiz Game"-an online quiz game that tests players' knowledge of environmental issues, including climate change.
- "Carbon Cycle"-a game developed by the University of California, Berkeley, that teaches players about the carbon cycle and its relationship to climate change.
- Last, but very interesting: Roblox and Technovation collaborated to support Technovation alumni from around the world in developing a game in Roblox Studio to raise awareness for climate action. Participants worked in small groups, each supported by mentors from the Roblox team, to brainstorm and explore what a climate-focused game might look like. The result was "Planet Roblox," a game that teaches girls around the world how to combat climate change and inspires them to learn how to solve problems in their communities, all while having fun. Players struggle to save Planet Roblox by making small changes in their daily lives to reduce their carbon footprint.
- To conclude this long and non-exhaustive list, I think it is also worth mentioning "The Games for Change (G4C) Student Challenge," the leading U.S. national gaming contest program that combines students' passion for games with digital learning and civic engagement. The G4C Student Challenge culminates in a national game design contest through which middle and high school students (ages 5 to 12) can submit their original social impact games for a chance to win prizes and awards. Age groups include "Junior" (5-8 years old) and "Senior" (9-12 years old). Regional winners can then compete against each other for the title of national champion. Last year, more than 4,800 original games were submitted.

AR and VR have also been used in climate education and are another key technology to be leveraged to make education more effective through the immersive experience of virtual word contexts and different scenarios. Here are some examples of VR and AR applications:

- "Climate Visualization" is an AR application that allows users to visualize the impact of climate change on Earth's ecosystems. The app overlays climate data onto real environments, allowing users to see how rising temperatures, sea levels and other climate-related factors are affecting the natural world.

- "Earth School" is a VR application that provides students with immersive learning experiences on environmental topics such as climate change, biodiversity and conservation. The platform uses VR technology to simulate real environments and allows students to interact with virtual objects and learn about different ecosystems.
- "Our Changing Climate" is a VR experience that takes users on a virtual tour of the impacts of climate change on Earth. The experience allows users to explore different environments and see how climate change is affecting the planet, from rising sea levels to more frequent natural disasters.
- "Project Drawdown VR" is a VR experience that explores different solutions to mitigate climate change. The experience allows users to learn about different strategies such as renewable energy, regenerative agriculture, and forest restoration.

What we have seen so far is certainly a very positive trend, yet all these experiences are not really using technologies to their full potential, certainly not at scale. There are many reasons why this is happening: the first is the fact that although many actors are pursuing initiatives in the right direction, they lack the technical expertise and capacity to develop coherent digital projects. Indeed, we are at the intersection of education and technology, and we need to emphasize that to make a breakthrough in terms of both scale and models, we not only need to educate citizens in general, but also a new ruling class, capable of dealing with the innovation of climate change. Technology and digital education, particularly in fields related to Web 3.0 and blockchain, gaming, and other emerging technologies, is crucial if we are to use these levers for climate change. Technology education can lead to the development of innovative solutions that reduce the carbon footprint of sectors such as gaming, entertainment, and e-commerce, can improve the efficiency of existing systems by introducing new technologies that reduce energy consumption, emissions, and waste, and better manage the transition. Finally, technical education can promote collaboration among stakeholders from different sectors and industries, which as we have seen is essential.

We note that the environmental and climate education sector is lagging in addressing these innovation issues and technologies, which is not surprising, and is true for many other sectors as well. Schools, universities and institutions are still mostly traditional, and only with Covid has there been a strong acceleration of "digital learning." Personalized learning, interactive or immersive learning practices, and collaborative learning are not yet common practice in the education sector, much less for climate change issues. It is certainly very difficult to imagine that a single school or institution, even with the best possible effort, would be able to develop and exploit technology at scale. Collaboration and the sharing of educational best practices, whether it is a technology or a piece of content, such as a course module, is probably the only way to accelerate the innovation process needed to make a greater impact. As we have seen, there is already a tremendous amount of collaboration at the institutional level on sharing content related to ESG

goals; we probably need the same effort and commitment to train decision makers and educators to leverage technology.

#### 2.1.4 ARTIFICIAL INTELLIGENCE, DATA AND COLLABORATION

So far, we have described how the green economy ecosystem is addressing blockchain, gaming, and education. These are the main innovation streams that are influencing, in my view, the climate change challenge from a digital perspective. Of course, artificial intelligence, as we mentioned in the previous chapter, is a very important discontinuity factor that we need to consider. There are two aspects that I think need to be outlined: the first element is that applications of artificial intelligence are definitely prevalent in all the different technological and application fields that we have seen, we can actually find different use cases in almost all aspects of climate-related digital solutions; the second element is related to the availability of data needed to train AI, which is mainly related to the data sharing experiences that we will see later. As far as vertical applications of AI are concerned, here are just a few examples that are useful in explaining how wide the range of use cases is around climate issues:

- Climate modeling- AI used to improve climate models by incorporating large amounts of data and reducing uncertainties in climate projections.
- Energy efficiency- IA used to improve the energy efficiency of buildings and industrial processes by predicting energy use and optimizing energy consumption.
- Carbon capture and storage - AI used to develop more efficient and effective carbon capture and storage technologies to reduce greenhouse gas emissions.
- Climate risk assessment- AI used to assess the risks and impacts of climate change, including extreme weather events, sea level rise and other climate-related hazards.
- Precision agriculture- AI used to improve agricultural practices by predicting weather patterns, optimizing irrigation and predicting crop yields.
- Climate Adaptation - AI used to support climate adaptation efforts by predicting the impact of climate change on ecosystems, wildlife and human populations.
- Natural language processing-AI used to analyze large volumes of textual data to identify climate-related trends, sentiments and public opinions.
- Climate finance- IA used to improve the efficiency and effectiveness of climate finance by analyzing investment risks and opportunities in the context of climate change.
- Sustainable Transportation - AI used to optimize transportation systems and reduce greenhouse gas emissions by predicting traffic patterns, optimizing routes, and promoting the use of electric vehicles.
- Forest Monitoring- IA used to monitor forests and detect deforestation, illegal logging, and other changes in forest cover to support conservation and climate mitigation efforts.
- Water management- AI used to improve water management by predicting water availability, optimizing water use, and identifying water-related risks and opportunities.

- Smart Grids - AI used to optimize electricity grids by forecasting demand, managing renewable energy sources, and improving energy storage.
- Climate Communication- AI used to improve climate communication by analyzing social media and other data sources to identify climate-related beliefs and attitudes and to develop more effective communication and outreach strategies.
- Climate Action Planning - IA used to support climate action planning by analyzing data and providing insights into emission reduction strategies, policy options, and implementation pathways.
- Disaster Response- AI used to support disaster response efforts by predicting the impact of extreme weather events, identifying vulnerable populations, and optimizing response strategies.
- Ocean Monitoring- AI used to monitor and analyze data from the oceans to improve understanding of their health, including changes in temperature, acidity, and sea level rise.
- Climate Education- AI used to support climate education efforts by developing interactive educational tools and resources and analyzing student performance data to identify effective teaching strategies.

That said, today we see applications of AI on very vertical issues, mostly implemented by start-ups and innovators, while more traditional and institutional stakeholders are, according to my research, lagging. This is a key issue that needs to be addressed at any level: how might we, as humanity, use AI for climate "management"? If we look at the scenario, we need the entire ecosystem to move as quickly and efficiently as possible, and this could only be achieved with a global level of collaboration that can share best practices, technologies, content and resources among key stakeholders. It is nearly impossible. Today, thinking about impactful initiatives on a global scale without a collaborative environment. Following this path in our research, we discovered interesting experiences in this direction, some of which could form a significant backbone for future developments.

Driven by the urgency to intensify climate action, various institutional stakeholders have committed to facilitate the achievement of the Paris Agreement. The "Global Climate Action portal " " is an online platform where actors from around the world-countries, regions, cities, companies, investors, and other organizations-can showcase their commitments to action on climate change. These actors are recognized here for their various commitments to climate action, such as defining their commitment, participating in cooperative initiatives, adopting climate action plans, and taking specific mitigation, adaptation, or financing actions. The set of individual actors' goals provides an indication of the global efforts being made to mitigate climate change and ensure a resilient future to the challenges it poses. Launched by the United Nations for Climate Change, Peru and France in 2014, the portal was born out of the realization that addressing climate change requires ambitious and far-reaching actions by all segments of society, public and private. In particular, it helped build momentum toward the adoption of the 2015 Paris

Climate Agreement. With the formal inclusion of the portal in the decision text of the Agreement, countries welcomed the efforts of all actors to increase their climate actions and encouraged them to record these actions through the Global Climate Action portal. The monitoring captures the progress made by individual actors and registered cooperative initiatives, including initiatives launched at the UN Secretary-General's 2019 Climate Action Summit and COP25. The work to define the components and metrics to reflect the progress of nonpartisan stakeholders' voluntary actions was done in collaboration with several organizations. Regarding work on international cooperation initiatives, the Global Climate Action Portal worked closely with the German Institute for Development and Sustainability (IDOS), the Global Center on Adaptation, and the UNEP DTU Climate Initiatives Platform (CIP), which provided input and support to the work. These collaborations enabled the alignment of data collected by cooperative initiatives, with the aim of reducing the reporting burden on the part of lead organizations.

The Climate Knowledge Innovation Centre" (KIC) is a community platform working to accelerate the transition to a zero-carbon, climate-resilient society. Supported by the European Institute of Innovation and Technology (EIT), it identifies and supports innovation that helps society mitigate and adapt to climate change. The community brings together partners from business, academia, the public and nonprofits to create networks of expertise through which innovative products, services and systems can be developed, brought to market, and scaled. The goal is to bring about systemic change. The goal is to catalyze and nurture innovation, regardless of its origin: from large corporations, research institutes and government agencies to start-ups and individual entrepreneurs. The KIC thus encourages new thinking beyond the mainstream through initiatives such as the Climathon, a 24-hour hackathon, or the Climate Launchpad cleantech ideas platform. The KIC also runs several inspiring training programs across Europe and online, for students, graduates and professionals. Finally, the incubation program, provides seed funding, structure and assistance to start-ups and SMEs. I think this is definitely a very interesting case.

Important examples of collaboration are also there in the education world we have seen before, we mention here only the "Climate Change Learning Partnership" (UN CC:Learn) is a joint initiative of more than 30 multilateral organizations that help countries achieve climate change action through both general climate literacy and applied skills development. UN CC:Learn provides strategic advice and quality learning resources to help people, governments, and businesses understand, adapt to, and build resilience to climate change. UN CC:Learn is supported by the Swiss Agency for Development and Cooperation (SDC). The UN CC:Learn knowledge sharing platform provides a "one-stop shop" for accessing climate change learning resources and services offered by the UN system.

One area where collaboration is key is in data, which is the basis of any artificial intelligence project and where there is a need for both quantity or scale and quality. We have discussed the importance of data before; it is important to note that many

stakeholders already have an awareness of the strategic relevance of data sharing activities. These are some of the existing platforms but, let me tell you, this should only be the beginning, with only some of the potentially useful data that could be leveraged for climate.

- Global Climate Observing System (GCOS)-a platform that provides climate data and information to governments, organizations, and the public to support the development of climate policies and strategies.
- Climate Data Initiative (CDI)-a U.S. government initiative that provides open data on climate change to support climate research, policy development, and adaptation efforts.
- The Climate Data Center (CDC)-a platform developed by the German Meteorological Service (DWD) that provides climate data and information to researchers, policy makers and the public.
- The World Climate Research Program (WCRP)-an international organization that coordinates climate science research and provides data and information to support climate policy and decision-making.
- The European Climate Data and Information System (ECDIS)-a platform developed by the European Centre for Medium-Range Weather Forecasting (ECMWF) that provides access to climate data and information for Europe and other regions.
- The Global Land Data Assimilation System (GLDAS)-a platform that provides data on land surface conditions, such as soil moisture, temperature, and vegetation cover, to support climate research and modeling.
- The Intergovernmental Panel on Climate Change (IPCC) Data Distribution Center-a platform that provides access to data used in IPCC assessments, including climate models, observational data and scenarios.
- The Climate Prediction Center (CPC)-a platform developed by the U.S. National Oceanic and Atmospheric Administration (NOAA) that provides climate data and information for the United States and other regions.
- The Copernicus Climate Change Service (C3S)-a platform developed by the European Union that provides access to climate data and information for Europe and other regions.
- Climate and Environmental Data Services (CEDS)-a platform developed by the University of Illinois that provides access to data on greenhouse gas emissions and other environmental indicators.
- Earth System Grid Federation (ESGF) - The ESGF is a global network of data centers that provides access to climate data, including models, simulations and observations.
- Global Carbon Project - The Global Carbon Project provides data and analysis on global carbon emissions, including trends, sources and sinks.
- Integrated Carbon Observation System (ICOS) - ICOS is a European research infrastructure that provides long-term measurements of greenhouse gases and other climate-related variables.
- OpenAQ - OpenAQ is a platform that provides access to air quality data from around the world, including real-time measurements and historical data.

- World Climate Research Program (WCRP) - The WCRP is a global research program that coordinates climate research and provides access to data, models and tools for climate analysis.
- European Climate Assessment and Dataset (ECA&D) - ECA&D provides access to climate data from across Europe, including observations, reanalysis data and climate projections.
- Climatic Research Unit (CRU) - The CRU is a research unit at the University of East Anglia that provides access to climate data and develops climate datasets, including the CRU TS dataset.

All these data-sharing initiatives are about, for example, scientific data, which are obviously critical. But when we talk about data and climate challenge, we need to understand that there are many useful data sets, potentially any data set could be useful: consumer habits, industrial supply chains and productions, learning pathways, mobility, social interactions are just some of the possible dimensions. In addition, data should have a high granularity, especially, but not only, for AI implementations, taking into account their consistency, e.g. at the national, regional, local level or for different clusters of targets and consumers. This is to say that current collaborations on climate data are functional for scientific uses, but not so for the other goals related to the climate challenge, such as engaging individuals, behavior change, education, and so on. It may not be considered a morally optimal practice, but the way big tech and digital platforms are using data in marketing and advertising may give an idea of how much more needs to be done. Let's take again the example of "Aworld" that we used for gamification. The data collection strategy in the app is quite basic: this is understandable since there is a trade-off between the quantity and quality of data collected and user engagement-the more data we ask for, the less users will stay on the platform. What is clear is that more data would enable personalized experiences in the app, a lot of data could be retrieved from partners, some requested data could be useful for other institutional campaigns, user behaviors in the app could be used to build better clusters for communication and marketing, and we could continue the list. This leads to another aspect to consider when we talk about data, which is accessibility: the idea that, for example, a start-up could have access to relevant data to further its business, from this point of view we see many barriers today: standardization of data, absence of a market, fragmentation of sources, availability, cost.

I believe and hope that the current initiatives are just the beginning. In fact, collaboration and data sharing are critical both in terms of vertical problems to be solved and getting different sectors to work together horizontally to achieve better results. Following our reasoning, we should have people with technology skills collaborating with educators, game designers, blockchain and AI experts, we should have institutions collaborating with the private sector, citizens and individuals with local governments or NGOs. Indeed, it is this hyper-connection that enables the speed of technology adoption and thus the opportunity to have a greater impact on climate change issues. We need large-scale collaboration to enable our collective intelligence to contribute

## 2.1.5 BIG TECH AND CLIMATE

We know that most companies and institutions are committed to achieving the carbon neutrality targets set by individual governments and reported in the ESG perspective. Our goal here is not to verify the actual commitment of these companies to achieve 100 percent carbon neutrality in their supply chain, but to understand what concrete initiatives the major big techs are implementing beyond their "internal targets," which of course are welcome and due. I think an overview on this is significant because these players, like it or not, are more than just big companies in the context of our discussion: they are the "owners" of data, technologies, know-how, infrastructure, and so on. Their role in this ecosystem could be crucial and their help, in my view, is somewhat necessary beyond the carbon neutrality of their supply chains. This discussion is also preliminary to the next chapter of the book, in which we will try to imagine a hypothesis to put the pieces of the puzzle together. I will focus only on the big names, so to speak, but a broader look at the possible contribution of large platforms would be very helpful, for example by also considering the gaming industry. For the moment we focus on Microsoft, Amazon, Apple, Meta, Alphabet, and Tencent as obvious references. Of course, these companies are all advocates of climate action and have urged governments and businesses to take more aggressive measures to address climate change: fine, but what are they sharing? Are they actively collaborating in the ecosystem? Here is a summary that I think is relevant to anticipate the themes of the next chapter of the book. Let's start by saying that everyone is doing data-sharing activities and developing tools focused on climate issues.

Microsoft's main interesting activities in this direction are:

- Open Data Campaign: In 2020, Microsoft launched the Open Data Campaign, which aims to promote data sharing for climate resilience and sustainable development. The campaign encourages governments, companies and organizations to make their data openly available for use in climate research and solutions.
- AI for Earth: Microsoft's AI for Earth program provides funding, tools and resources to researchers, organizations and individuals working on environmental solutions. The program uses artificial intelligence to analyze and interpret environmental data, including satellite imagery and sensor data, to develop solutions for climate change and other environmental challenges.
- Environmental Sustainability Dashboard: Microsoft's Environmental Sustainability Dashboard provides a platform for companies to monitor and manage their environmental impact, including carbon emissions, water use and waste management. The dashboard includes tools for analyzing data and creating reports, which can help companies identify areas for improvement and track progress over time.
- Shared innovation: Microsoft is collaborating with other companies, organizations, and governments to share technologies and expertise for climate

change solutions. For example, the company has partnered with The Nature Conservancy to develop tools to track and analyze carbon storage in forests.

Apple has a couple of interesting initiatives such as:

- Apple's Climate Data website provides access to climate change data, including temperature and precipitation data, sea level rise projections, and other information. The site is intended to help researchers and policymakers better understand the impact of climate change on the planet.
- Apple's Carbon Calculator allows people to calculate the carbon footprint of their daily activities, such as transportation and energy consumption. The tool aims to increase awareness of the impact of individual actions on the environment and encourage people to make more sustainable choices.

Then Alphabet/Google:

- Google's flood prediction initiative. Google has partnered with the Indian government to develop a flood forecasting system that uses machine learning and cloud computing to predict floods and issue early warnings.
- Google's Environmental Insights Explorer is an online tool that provides data on the emissions and renewable energy potential of cities around the world.
- Climate Change Explorer, which provides access to data on the impacts of climate change, including temperature changes, sea level rise and ecosystem changes. The tool aims to help researchers and policymakers better understand the impacts of climate change on the planet.

Amazon:

- Amazon Sustainability Data Initiative: Amazon has launched the Amazon Sustainability Data Initiative, which aims to make large-scale sustainability datasets available to researchers and innovators. The initiative provides access to data on climate change, deforestation, and other sustainability issues, with the goal of enabling new research and solutions.
- Amazon Climate Pledge Fund: Amazon has established the Climate Pledge Fund, which invests in companies and technologies working to reduce carbon emissions and promote sustainability. The fund has pledged to invest \$2 billion in companies working in sustainable transportation, energy storage, and other areas related to climate change.

And finally, we see what Meta is doing:

- Climate Information Center: Facebook's Climate Science Information Center provides users with accurate and up-to-date information on climate change from leading scientific organizations and institutions. The center includes a range of resources, including data, facts, and news related to climate change,

as well as tips for taking action to reduce emissions and mitigate the impacts of climate change.

- Open Compute Project. Facebook's Open Compute Project is an initiative focused on developing and sharing open-source hardware designs for data centers. The project aims to improve the efficiency and sustainability of data center operations by sharing best practices and technologies.
- Facebook's Data for Good program gives researchers, nonprofits and governments access to data and tools to support social and environmental causes, including climate change. The program includes a range of tools and datasets for mapping, disaster response, and environmental monitoring, among other applications.

This is a good start. In the end, we might think that the awareness of large technology companies on climate change issues is increasing and that this goes even beyond achieving carbon neutrality in 2030. Interestingly, many other large companies are implementing similar or even more relevant measures. In particular Tencent, the Chinese big tech, is really pushing new technologies and innovative approaches in the direction we have talked about so far. Here it is what Tencent is doing:

- Tencent Earth: Tencent Earth is a platform that provides real-time data on air quality, water quality, and weather conditions in China. The platform uses Tencent's data analysis capabilities to monitor environmental conditions and provide insights to policy makers, researchers and the public.
- Green energy: Tencent has invested in several renewable energy projects, including wind and solar power, to support the transition to a low-carbon economy. The company has also implemented energy efficiency measures in its data centers and offices to reduce its carbon footprint.
- Climate change research: Tencent has partnered with leading Chinese research institutions to support climate change research and develop innovative solutions to reduce emissions and mitigate the impact of climate change. The company has also launched a series of conferences and public forums to raise awareness of climate change issues.
- Carbon trading platform: Tencent has developed a carbon trading platform that enables companies to trade carbon credits and reduce their emissions. The platform uses blockchain technology to ensure transparency and security of carbon trading transactions.

In general, large technology companies are contributing to the climate change challenge by reducing their carbon footprint using renewable energy sources, developing and promoting sustainable technologies through energy-efficient investments and appliances, and encouraging sustainable habits among suppliers and customers. Of course, they can also use their platforms to raise awareness of climate change and promote sustainable practices by providing information on energy use, carbon footprint, and other environmental impacts. This information

could help consumers make more sustainable choices. In a sense that is what they are doing today, which is already something we should appreciate.

However, the potential impact these companies could have could be much greater, in my opinion. While Apple or Amazon are closed systems, Google or Meta, for example, seem more inclined to make some of their technologies available in open source. Google's commitment to open standards spans more than two decades of OSS contributions such as TensorFlow, JAX, TFX, MLIR, KubeFlow and Kubernetes, as well as sponsorship of critical data science OSS initiatives such as Project Jupyter and NumFOCUS. Last year, prior to the launch of ChatGPT, Meta released the largest language model OPT-66B, following OPT models from 125 million to 30 billion parameters, which Meta said was the largest open-source AI language model accessible without restriction.

Perhaps, considering the importance of the climate challenge we face, this attitude toward open access could be strengthened more. As we have said, big tech has not only the data and technologies, but also the know-how, the infrastructure, and could leverage their scale and critical mass to do much more. While it is true that developed nations need to take the lead in addressing the climate challenge, it may be true that big tech companies should take the lead in driving technology and innovation in the interest of the planet. To do so, they certainly need a different, open, proactive, collaborative, and transparent approach. The climate challenge should not be a competition, but a playing field for collaboration: either we all win, or we all lose.

## 2.2 CONSIDERATIONS

So let us summarize what the main evidence of this high-level view on the "technological" state of the art of the green economy ecosystem are.

We started by looking at what is happening in terms of gaming mechanics and applications for the climate challenge. Interestingly, the number and variety of activities carried out by different stakeholders is very high, indicating that gaming is considered by many green economy actors to be a strategic tool for achieving results. In our analysis, however, we did not see experiences in which the full potential of gaming is expressed as described in the first chapter of this book. Although we did not look at the individual audiences and metrics of the various games, we generally see a lack of scale and critical mass for consumer-oriented games; in fact, most of these games are "just" games, with volumes that are not sufficient to build a "self-growing" community or a more expansive digital environment as functionality and logic. Because of their small size, typically local or very specific (with few exceptions), these games are unable to generate adequate rewards and incentives for users: in some cases, there are game currencies or some form of extrinsic motivation beyond the game, but certainly not with the volumes and mass to be "platforms." Being able to give and recognize rewards in a more advanced way is a key accelerator for growth. Many of the games we observed also replicate the same mechanics with each other (e.g., being in the shoes of politicians) and are basically based on basic structure and storytelling, a sign of a market in its "early stage" of growth. To partly balance this lack of expertise, we have noticed a few, but very interesting, initiatives by institutions and foundations to work closely with the gaming industry, as well as a couple of projects involving leading game titles such as Roblox, this is something positive that should be pushed much more: the interdisciplinary approach is indeed a key success factor.

We also note that the main objective of the games in this context is to raise awareness of climate change and to simulate or incentivize virtuous behaviors, while only a few of the games seen are focused on real or virtual problem solving, which is another key aspect of the game. In fact, through appropriate game structures, users could contribute creative and unconventional solutions to real problems, collaborate, aggregate working groups, define their own goals and create real actions on the ground: let me say that the value of this contribution could be very high, and this is, today, little expressed.

To achieve goals like those that gaming could provide, we need to work at scale: games need to become platforms, which to date is far from being the case for the climate challenge. We have seen significant but local examples where game mechanics have generated real effects and practical actions to solve specific problems; my question is, what if we could do this on a larger scale? Game experiences related to climate change are very fragmented, with little sharing of best practices, among different stakeholders; gaming is not yet perceived as a common, collective area to invest in, even though it is widely recognized as an effective tool for both awareness raising and education. In some of the games we

have seen, there are interesting assets such as simulators or models that could be leveraged much more if shared or distributed across platforms amortizing investments. The same observations and issues apply to serious gaming in educational applications: remembering that the overlap between gaming and education is surely something to work on more and more.

Of course, the adoption of gamification and games is not an easy task. Although gamification can be an effective way to engage users and encourage behavior change, we know that it can be difficult to design a game that is engaging enough to maintain interest over time. Development cost and scope are two elements to consider when it comes to developing a high-quality, technically sound game that can handle large numbers of users. This can be expensive and therefore not in the hands of smaller organizations, as the investment in the game is often not justified by the limited potential reach in terms of the individual player's audience.

The second theme we addressed is blockchain: here we observe not only a wide and distributed number of application domains, covered by both institutions and companies and start-ups, but also a growing focus on infrastructure approaches such as the one promoted by the OECD. As we have seen, vertical use cases of blockchain technologies are potentially disrupting old processes, generating new business models and new products or services: the space for growth and increased adoption is impressive. The tokenization framework could, for example, enable user rewards or, if we think about games or even physical assets, decentralized infrastructure could address both financial and governance models; transparent and trusted marketplaces could enable new markets and revenue opportunities for stakeholders.

However, from an ecosystem perspective, there are still significant steps to be taken and opportunities to be seized. Blockchain technology is still relatively young, and we need to understand the challenges ahead. For example, we need to consider the lack of standardization in the industry, which can make it difficult to ensure interoperability between different systems and ensure that data is consistent across platforms. In addition, many blockchain networks are limited in their scalability, which can make it difficult to process large volumes of data in a timely manner. Another challenge is related to the process of validating transactions on blockchain networks, which may require a significant amount of energy; on this although many concrete actions have been taken to reduce the impact of carbon emissions, public perception is still not so positive. Blockchain technology, which has been gaining ground in recent years, is not yet widely adopted in many sectors, which can make it difficult to implement specific projects related to climate change. One reason for this relatively limited penetration is related to the regulatory landscape, which is also rapidly changing, creating uncertainty with the consequence of making it difficult for organizations to navigate the legal and regulatory requirements of using blockchain in general and specifically in climate change-related projects. Adoption is also affected by the fact that the costs of implementing blockchain technology can be high, which can be a barrier to adoption, especially for smaller or resource-constrained organizations. Last, but not least as a challenge, is the lack of technical

expertise: due to market growth, there is a chronic shortage of experts with the skills and knowledge needed to implement and maintain blockchain networks-this is one of the critical bottlenecks.

Education is the third key pillar for all institutions and stakeholders in addressing climate change: citizens, decision makers, policy makers, teachers, students, children, activists, and, in essence, everyone on the planet is a recipient of climate education. Most institutional education programs are developed with traditional methodologies and processes; in general, we did not find much innovation in the most popular programs. Indeed, the education industry, and not only for functions related to climate change issues, is undergoing profound transformation. As we saw in the previous chapter of the book, innovative new best practices are not yet so common: think, for example, of personal training, AR-VR immersive learning, collaborative learning, personalized learning paths, and interactive learning. The role of information technology in education is crucial: the distribution and adoption of e-learning platforms, massive online courses, and distance learning are some of the pillars for enabling a global "distribution" of climate-related educational content. In this context, technological innovation and collaboration are key accelerators. Regarding collaboration, we can say that significant efforts have been made by leading institutions to build and share best practices, such as in the case of the United Nations Climate Change Learning Partnership; but when it comes to technological innovation in education, best practices are far from being leveraged. Education is mostly the responsibility of institutions, foundations, NGOs, and school systems that, with a few exceptions, mostly concentrated in universities, are unfortunately not great innovators. So, the examples of innovation we have seen are very interesting and useful, but not at scale: and the same happens in the dimension of serious gaming and educational formats, which could be much more distributed. We have to say that in the production of educational content and formats there is indeed a wide variety of initiatives going on, which are indeed interesting and engaging, but again limited by the same barriers mentioned for gaming: cost, scope, skills, size.

Finally, we discussed artificial intelligence, data, and collaboration, which are indeed the pillars for any future development and innovation in almost all application areas related to climate change. Collaboration and data sharing initiatives are numerous, reflecting the strategic relevance of these issues among stakeholders. However, there are many challenges here as well. First, standardization: data are often collected by different organizations and can be difficult to standardize and integrate, making analysis and interpretation difficult. Second, limited data availability: some regions, for example, may lack the data needed to effectively model climate change impacts, especially in developing countries. Third, the cost of collecting and analyzing big data can be high, especially for smaller organizations or those in developing countries. To all these issues we need to add other significant problems that we have seen in the other "growth tools" as well, such as: limited skills, skilled resources and capabilities, technical challenges, privacy and security. I believe we are only at the beginning of the

journey toward using data at scale for climate. The actors that are playing with data at scale are only the big technology platforms, and the untapped potential of data at scale for the impact of climate change strategies is huge. I also have this position because when we talk about data in the context of the climate challenge, we mostly refer to the data needed to perform climate modeling, whereas the possible types of useful data could be many more. Moreover, data formats are not yet standardized, merged and enriched and are mostly managed in silos, which clearly limits the potential value of the ecosystem. Data availability, as we have said, is the cornerstone for AI formation, and having structured, reliable, and valuable data at scale is a prerequisite for implementing effective, ethical and innovative AI-based solutions for the market. Models such as "The Ocean Protocol Foundation," which enables the creation of decentralized data marketplaces to train AI, are not yet widely present, but they are beginning to grow for very specific and vertical goals- this element could be a very impactful driver of growth. This strategic direction seems to be shared by several institutions and data providers, who are beginning to give third parties access to data. A good sign for the future, and a path to follow even further.

In conclusion, the green economy ecosystem is complex and highly articulated: we can assume that all actors are doing their best to innovate and improve outcomes with respect to their specific missions. But the green eco-system still needs to leverage technology and innovation at scale: actors are proceeding at their own pace and with their own resources, which, more often than not, means limiting opportunities for growth and the critical mass needed to truly have best practices. This may be a first conclusion. All the technologies we have seen require different conditions to scale, while the structure of the ecosystem itself has its own challenges: the questions we are asking are "what is required to breakthrough?" and "how can we create the conditions to accelerate the innovation process?" These are fundamental questions, in my opinion, because we know that it is the key to facing a challenge where time is the real unavailable resource in our hands. The more we can use technology as an ally in the climate challenge, the more likely we are to save the planet and preserve our way of life. I think there are no questions. What then are the structural issues we need to solve beyond the specifics of technology and education? In my opinion they are the following:

- Governance and governance of innovation. One of the biggest challenges is clearly governance: because our societies are deeply interconnected, but divided between developed and underdeveloped countries, the effort cannot be the same for all; this is widely accepted, and we have seen how developed countries have taken the lead on the climate challenge. It is widely believed that this is the only way forward, with richer, developed countries setting ESG standards, building the carbon credit market, promoting global education projects, and so on. With the rise of new technologies and platforms that, in addition to "general governance," are unevenly distributed and accessible, we face the same problem. Access to innovation is indeed a matter of skills and resources, critical mass of data, infrastructure, collaboration, training, intellectual property management,

and of course investment and capital. We cannot expect, beyond regulation, that technological innovation will be driven by traditional institutions or associations, which themselves are trying to implement a digital transformation process internally. Technology, which is spread across all stakeholders, is an issue where no one is really taking the lead: private sector leadership is therefore critical to driving innovation and investment. But what does innovation governance mean in our context? What do we want to achieve? The keyword, in my view, is access. We need all possible actors to be able to obtain and properly use all the new tools available: to do that, we need to lower the barriers to adoption, which could be done through collaborative mechanisms, shared resources, marketplaces, and incentives: all of these should be across disciplines or application areas, across nations and, of course, regulated and transparent. In other words: we need to build a global framework to govern technology, efficiently and at scale, if we really want to harness the most important tool we have to save the planet: technology itself.

- Marketplace and collaboration. Collaboration is a nice word, but to make it really work, several issues need to be addressed. In this chapter we have mentioned many forms and initiatives of collaboration and sharing, some related to data, some to educational programs, some to sharing best practices, and so on. Two things need to be emphasized: the first is that all these experiences are very vertical, with their own "environment and rules," in silos; the second, is that all of the initiatives are based on a spontaneous interest or motivation, to say that there is no coordinated strategy by stakeholders in the ecosystem to incentivize and push collaboration at scale. It seems that the key tool is left in the hands and goodwill of everyone, from the bottom up, but I think it is not enough. As a system, we need to establish clear and transparent rules, manage Intellectual properties properly, build a framework for both incentives and infrastructure collaboration platforms. We already have tons of assets, ranging from data to learning materials to games to blockchain implementations, all these assets could be available in a shared, collaborative marketplace that would help scale, reuse, efficiently deploy assets, best practices, and technologies. In two words, this would mean time plus potential exponential growth.
- Awareness, investments and incentives. Most efforts to date by global institutions, the scientific community, opinion leaders, and NGOs are in the direction of raising awareness about climate change to achieve more sustainable behaviors. Awareness about climate change is never enough; it must literally reach every individual on the planet. Today our actions and initiatives are mostly based on the goodwill and sense of responsibility of the individual, as well as on a kind of social "control" that stigmatizes bad behavior: this is yielding significant results, especially in developed countries and in large consumer industries. The truth is that we want everyone to be more engaged, everywhere and as soon as possible: to do this, we need to increase individual motivation, not only to behave correctly, but potentially to be an active part of the challenge. So far, we have seen that there are many tools to use for this goal (gamification,

tokenization, game rewards, social rewards, etc.), but, again, there is no coordinated plan to push individual engagement. While ESG criteria and carbon credits are the avenue for corporate and government rewards, tax policies or investments, we do not have anything similar for consumers-this is left to individual stakeholder initiatives and goes back to the topic of innovation governance.

- Financing and orchestration of financing. The volume of investment in the green economy is significant and likely growing as the impact of government fiscal policies is incentivizing the transition. The number of funds and institutions investing in climate change-related technologies is growing, as is the number of start-ups in the sector. However, most of these investments are not infrastructure-relevant or coordinated for the entire ecosystem and are, more often than not, very specific and limited in scale. Imagine, for example, a very innovative start-up, XYZ, in the Netherlands, that may not be able to raise as much funding as the same U.S.-based company, or scale the business globally, etc. Trying to find more efficient ways for investors and innovative startups to scale quickly, giving access to investment to a wider audience of investors, improving crowdsourcing, building transparent investment accountability, and funding a climate change infrastructure technology platform are some of the areas to work on soon.

I believe that if we can solve or significantly improve our performance on these issues, we could achieve an exponential positive effect, or network effect, on the climate change challenge. Being more efficient and coordinated means shorter time to technology adoption, it means better resource allocation, greater results, and an increase in achievable impact. It is certain that the complexity to be addressed to achieve such an ambitious goal is enormous, as it challenges the status quo and its stakeholders: as in any transformation journey, resistance to change is high: however, this time it is really a matter of survival.

### 3. A VISION FOR THE FUTURE

Now is the time to imagine how we might try to leverage more what we have seen so far, but before we do that it is important to quickly go back to the beginning of our discussion.

In the next ten to twenty years humanity will define its own future and perhaps shape a new world order; this is inevitable. On the one hand we have the increasingly pervasive and symbiotic relationship between the individual and technology, which has had, with the topic of AI, an incredible acceleration in recent months, raising existential questions, concerns, and worldwide discussions about the ethics behind it. This is a turning point; the anthropological journey that humans have taken together with technology and the connection we are building with it is nothing new: but today we are asking whether we will be dominated or whether we will be able to manage, as a society, what we have created. We saw in the book's introduction how many philosophers and thinkers have addressed this issue, both with optimistic and pessimistic or dystopian visions of our future.

Over the past three decades, after the Internet and connectivity became part of our lives, technological acceleration has been impressive and exponential: this has brought significant changes that are before everyone's eyes both from an anthropological perspective and from the perspective of markets and businesses. From the birth of the World Wide Web onward, technology-driven changes have had an increasingly profound impact on society, and the process will be much more rapid now than we are used to seeing. The urgency of regulating and managing the transition, risks and evolution, so to speak, driven by technology is a key priority for all of us, and this sentiment is not just mine, but a central topic in today's media. We have recently seen how the discussion about OpenAI has raised unprecedented ethical debates and polarized positions: up to the point where Elon Musk and thousands of other influential people signed the open letter to stop the development of AI. It seems that we are not ready, as a society or as humanity, to manage technological evolution. We have said that it is critical for the future but the time to decide is now, today.

Besides technology, climate change is the other big question mark we have: we still do not know what kind of world we will live in any time soon, since, as humanity, we have put our very survival on this planet at risk. Over the past decades we have managed our planet and resources without planning, with short-term goals, mostly driven by capitalist logic of unsustainable and unequal growth: we have not invested in preserving our home. Now we have finally figured it out, and we are way behind; we need to hurry, and we don't have enough time to catch up. Before us we have the same barriers as before, conflicts of interest among nations, sustainable culture and behavior to build, unequal distribution of both investments and the practical consequences of climate change. We are nonetheless making our collective effort to change, trying to affect more and faster, awareness is rising, and an incredible number of activities and initiatives are already in place: yet apparently it is not enough. The sense of urgency is growing along with the slow pace of concrete results: this is a sentiment shared by many leaders and institutions.

These two issues, technology and climate change, are linked. Many scientists and leaders rely on the hope that technology can give humanity green energy over time, and this would obviously be a great and fundamental achievement. But energy is only one piece of the puzzle: we are discussing the governance of the commons, our technological lifestyles, inequality on the one hand, and more vertical issues or topics such as plastics, mobility, food, water, etc. on the other. Humanity's challenge is to harness technology to improve both the health of the planet and our lifestyles; we are discussing a new model of society and, if you will, a new human being, similar or not to the one envisioned by Yuval Harari in *Homo Deus*, just to name one among many thinkers' visions. The transition of climate change and the discontinuity imposed by technology are at the same time creating and killing economies and jobs: again, in a very unequal way both socially and geographically. If we start from the assumption that technology is a fundamental tool that humanity has to improve and evolve, we need to figure out as soon as possible how to manage, regulate and control this asset, beyond traditional market logic and in the interest of the whole community, this is of course not only related to climate change: but I believe that climate change, which is the first and most urgent priority we have, could be the most important area where to focus all the possible innovation effort that humanity could express. If we can achieve this very ambitious and perhaps utopian goal, we may be able to design new and positive ways to evolve our relationship with technology and the planet at the same time. Climate change could then be a first common theme on which to challenge all of us to build a different future: indeed, we do not only want to save the planet, but we want a better future for our children, a more sustainable and equitable society, better health, and so on. Our goal is therefore not just to survive. We want to avoid the dystopian futures generated by climate disasters or the domination of technology over individuals and society, as imagined in most science fiction movies. These scenarios are not far from describing the risks we are facing in the long run: but now, today, is the time when we are setting the stage for our future: the tipping point is here, right now, it is only a matter of a few years. If we can agree on that, we should try to imagine how we could do more as a system and society, how we could remove existing barriers and harness technology more and in the right direction, specifically to solve the climate challenge.

In the first chapter we outlined what are some of the critical factors for building successful projects in the technology field, we talked about scale, critical mass, availability of technical resources, culture and management: elements needed to efficiently harness the power of technologies. It is a fact that the last few years of digital progress have decreed the success of the so-called "platform model" and economy, i.e., the business model typical of large technology companies. If we look at the digital market from a Darwinian perspective, we might agree that the winning species so far is platform. Platforms can exploit the network effect, enabled by data, algorithms and mass customization, which allows them to grow progressively and exponentially. We can realistically say that platforms have a kind of gravitational effect that increases their attraction incrementally over time.

Platforms are centralized, privately owned, and profit-driven: this is another fact. But as a green ecosystem we should be able to achieve the same benefits that a platform offers so that we can scale the technology for the planet and achieve similar network effects. In other words, we should try to replicate on a global scale, applied to climate change, some of the characteristics of platforms, particularly a network effect based on technology and data; on facilitated exchange of goods, services and social currency; on better matching of supply and demand; and on a collaborative community and space. In my view, this would generate exponential improvement in addressing climate change. If we agree on this, we are suddenly faced with the biggest hurdle to solve: governance and ownership.

No private sector could be the potential owner of such a shared platform, and institutions or governments alone could not take the lead: it is not their mission, nor is it their skill or expertise. We have said that the private sector should take the lead in driving innovation and technology, but again, we have a problem: it is not the mission of the private sector to build an infrastructure and shared platform, especially if it is not something that can be driven only by profit. I think the way forward is to find robust forms of systemic collaboration between institutions, the private sector and other stakeholders. We will try later to imagine how this can happen: today as a society we simply do not yet have such a project on the table.

The governance challenge is for each stakeholder to act beyond its traditional perimeter, engaging and participating in building the conditions for scaling technology as an infrastructural asset of the green ecosystem, and not "just" focusing on its usual territory. From this perspective, the challenge is not technological, but ethical or political: simply human. We need to establish new rules of the game to enforce collaboration, we need to have a transparent platform that can generate value for all, accelerate positive impacts, and we need to make sure that this platform is a public asset of humanity and a load-bearing infrastructure for the future: in the state of the art, it is we humans, with our habitual comfort zones and our peculiar interests, who are the real limitation for new governance. Tackling climate change is in everyone's interest and is, unfortunately, a game in which we must play all our possible cards: we might hear, this time, the real need for more cooperation and better models of governance. This is the greatest innovation we could achieve.

When we think about innovative governance models, we clearly open a discussion about the characteristics these models should have. We might assume, although it is not so true, that trust and transparency are a "taken for granted" condition of any future model: then we need a "horizontal" level that can deal with transnational issues, interdisciplinary decision-making, holistic or 360-degree planning and priorities. Whatever model we can imagine, it is simply unworkable and inefficient without technology. Democracy was invented 3,000 years ago, and we still rely on the same basic principles, at least in Western countries, and it is only in recent years that we have begun to discuss extensively the role of technology in politics. I don't want to dwell too much on this issue, but whatever the governance model of the future is, it must be designed "together" with technology. The models of the future are decentralized, based on consensus, direct participation and transparent, shared rules, no matter whether we are talking about a company, a government or a

platform: technology will still be the enabling agent. From this perspective, we discussed how blockchain technology can offer a disruptive level of governance. Blockchain technology has its specific limitations and challenges, as we have seen, but it is nonetheless something that enables new governance frameworks that, in my view, we should seek to apply widely in the case of climate change governance. In the first chapter, we described DAOs and how they work; this is something that was fundamentally unavailable until a few years ago. Like any technology, blockchain is not good or bad: the design of the governance model of a potential climate platform, it is up to the stakeholders to agree on the rules, in other words, the definition of different governance, is not up to the technology but up to us as a society and community. We should build a vision for it with the help of philosophers, technologists, climate experts, decision makers and policy makers: blockchain would then only be the enabling and guaranteeing operational platform. Thinking about this logic is a project and a commitment that could push blockchain technology itself to improve its scalability and performance, which could be beneficial for all players in the ecosystem.

I would like to say that regardless of the governance model, the ambition to think within the framework of a platform is necessary for two other fundamental reasons: collaboration and efficiency of scale. In some ways, both issues are related to the "operating system" of the current green economy structure. Although there are many collaborative initiatives, there is no common framework or shared logic. I would like to exemplify this by saying that it is as if the synapses in our brains today are using only a few thousand instead of the billions possible. There is a tremendous opportunity to improve the green ecosystem by building a shared level of collaboration: this is true at any level or from any perspective we look at the climate challenge: it is critical for data, for new solutions, for investment strategies, for education, for interdisciplinary issues, for regulation, and for governance, just to name a few. Collaboration, however, is not something that can be achieved from above, it is not something that can be rigidly structured, it is not something that can be imposed. But even so, the actions we could take to foster collaboration are many and potentially powerful. Let us begin by saying that the availability of a reliable and transparent environment is critical, and that collaboration without technology is neither efficient nor scalable. The experiences we listed in the previous chapter are limited, individual, vertical, and unconnected. In my view, if we can provide a regulated collaboration environment, which by the way is one of the key components of many existing platforms, we should be able to create a network effect of skills, solutions, and ideas to meet the challenge. In other words, using the brain metaphor, we could create a much more useful number of synapses for the future.

This topic has never been more relevant than it is today, after AI has become part of our lives, a collaborative environment, just think of data and expertise, is indeed one, if not the best way, to manage and control AI-based solutions. I would not necessarily say that this aspect is crucial, but it is certainly desirable. Collaboration also means inclusion and access, two key factors in enabling young and talented start-ups, for example, to grow faster or the individual talented scientist to find an opportunity to work on a remote project, share data and resources, leverage

intellectual property, etc. Finally, collaboration is the key to unlocking collective intelligence: the idea that we, all together, are better at defining and solving problems, anyone can contribute based on their skills, abilities, actions or behaviors. To be bold once again: we need to scale collaboration.

After collaboration, the second element to consider is efficiency of scale. Scale is a key concept in any technology enterprise; we could certainly say that it is a notion embedded in any transformational technology since the industrial revolution. Without considering for a moment the "financial" view, where scale is basically represented by capitalization and investment capabilities, in the platform framework, scale basically means data/assets, critical mass, and infrastructure-three dimensions that can have a great impact on ecosystem efficiency.

Let's start by considering data and assets first: both have similar reasoning. While we have already discussed data extensively, we have not explicitly talked about assets. By assets we mean any piece of content, research, game, source code, trained model, or anything that is in any way related to the topic of climate change. Both data and assets need standards, both need to be reliable and trustworthy for obvious scientific reasons, both need to have a global and local dimension or a vertical and general view, both need scale to work best. For data, this logic is obvious, but I would like to give some examples for assets. The cost of development, understood as effort in terms of financial and skilled resources, for an educational program or game carried out by a single school, for example, limits the scale of the project, whereas the same program could be developed simultaneously in another country or context: as a system, or platform if we wanted to, we could have produced the same effort only once. This is not new, digital enables reuse, customization, and sharing, but today we do not have a single place where this can happen at scale, whether for climate change data or assets. Again, in the logic of the platform, this represents a missed opportunity, not only to achieve scale, but also to create economic value for data and asset producers.

It may be easy to write all these things down, but it is certainly a bit more complex to put them into practice. So what is needed to facilitate this path? Basically, three things: one a marketplace, two a way to manage IPs, three the critical mass.

The marketplace: why is it essential? Because it is a regulated, interdisciplinary and efficient place where demand can meet supply, where every actor can offer input, where transactions are certified and transparent like any marketplace. But in our case, the marketplace would be owned by everyone, a kind of "global public service." Again, blockchain comes back as a strategic tool in this direction, as based on smart contracts, crypto currency and tokens it is also a perfect way to protect and monetize intellectual property.

Critical mass is another key element, we discussed in the first chapter because it is different from scale, let's say there is a minimum level of users or participants below which the network effect does not occur. Critical mass is the condition that someone I am least concerned about in the specific case of climate change: the people, the

stakeholders, the companies, the governments are all already active, they just lack a common place to meet, they are many and, in many places, sometimes isolated and sometimes alone in their mission, but certainly they are not a few stakeholders, we are all. I believe that more than the critical mass itself, which is necessary to start and turn the wheel of growth, the strategy of progressive inclusion of stakeholders that should be generated by and generate the gravitational effect of the platform is more important.

Finally, in terms of efficiency of scale, the infrastructure layer is easy to explain, as it is just a matter of cost and investment. Even large companies are increasingly turning to cloud services, which allow them to have flexibility and cost efficiency: in the logic of a platform, this is a kind of "must have" to lower the barriers to all stakeholders and manage accordingly, or "properly," all the data and services on the platform. It is very difficult at this time to predict who might oversee or possibly work and take the lead on a common infrastructure. All these issues are critical if we believe that the platform concept can be a relevant accelerator for systemic innovation. This especially impacts the work of institutions, companies, start-ups, associations, and governments.

The other fundamental issue, as we have extensively discussed, is awareness and change toward more sustainable behaviors by individuals. Here the challenge is very high because it involves not only education and changing consumer habits in developed countries, which often means less convenience and an effort to adapt, but also building sustainable lifestyles and growth in less developed countries, where even basic and essential services are lacking. Therefore, awareness is only a first step; we need to engage and potentially turn every individual into an active agent of change. The social pressure, which all climate change campaigns and initiatives have built up, is strong, but we are relying mostly on the goodwill of individuals, and we are doing so mainly only in developed countries. The process of changing consumer behavior is long and complex from a user perspective, as media coverage of climate change often offers confusing messages, contradictory positions, green washing stories, superficial and instrumental messages from different sources. We have seen how, to give just one example, the Carbon Almanac Initiative is trying to build a clearer and simpler view of climate change by covering different topics and viewpoints, but most importantly by providing reliable sources of information, correct data, and resources to delve deeper into individual topics. This is a good example of a serious effort to give consumers an organic view of climate-related issues. The concept behind all these activities is that each of us is part of the problem but also part of the solution: everyone is called upon to actively contribute. So how can we improve and carry this strategy forward? The topic is complex.

Let's start by saying that a first step should be to work much more on education and visibility of reliable sources of information, on controlling fake news and misleading information. Institutions, governments, NGOs, schools and universities are already doing a lot of work in this direction. We have discussed how distributed educational programs, technologies, and serious games can be fantastic tools for improving the user experience; these resources could be leveraged much more in a

platform framework as described above. What I would like to address here, however, is related to motivation: individual motivation to learn, change habits, participate or proactively contribute to the green ecosystem. The path in this direction encounters gamification strategies, reward mechanisms, and incentive policies. The carbon credit market and ESG/SDG criteria are already applying some kind of "reward" in the business community, but when we get to consumers basically there are no shared tools to push motivation forward. In the examples of climate games we have cited, rewards are limited both because extrinsic motivation, such as being a leader or at a certain level in the game, is limited to the audience of the game; second, because the points or rewards of the game are non-negotiable and have no concrete value outside the scope of the game itself. Moreover, the actions or activists on the ground are not extrinsically rewarded: thousands of green initiatives are led by volunteers and climate enthusiasts who seek to have as much impact as possible—if we pushed the rewards and incentives, this population could grow greatly in both quantity and depth of engagement. Let's be clear, rewards are not necessarily money or tax incentives, but they include visibility in the community, the opportunity to participate and influence decision-making, win a contest, have a badge, and so on. If we are asking individuals to participate, to be engaged and to be proactively involved in climate change, we probably need to think about what we could give back, as a system, to virtuous individuals: we need to recognize effort.

Let me say that this is a key pillar for the coming years. By 2030, BCG's analysis suggests that the climate transition will create between \$13 and \$14 trillion in value, while trillions will likely be destroyed by companies that fail to decarbonize quickly enough and by assets that become obsolete or not included in regulation. If we couple this data, for example, with the impact of AI on labor markets, we understand how managing this transition means finding new jobs and new places to monetize everyone's specific skills. I would say that this, more than an opportunity, is a global transition issue. Building a framework to reward actively engaged people could be a great way to create job opportunities. We see this happening today in the gaming industry, where the volumes of the creator's economy are growing steadily; we see how blockchain is enabling new forms of monetization by users; and finally, we see how, and this goes hand in hand with education, both in terms of technological and green skills, we are unfortunately facing a structural lack of technical resources.

Implementing this logic at scale means different things, again framed within the notion of a platform. Money and incentives could be tied to marketplaces, where individuals could perform the tasks required by companies, institutions, startups; other forms of rewards could instead incentivize both physical and digital behaviors performed by engaged individuals or activists, rewards that will vary in value depending on the size of the community they belong to and the structure of the gamification mechanism. If we want to push this reasoning toward more innovative mechanisms, let us think of blockchain, tokenization, and cryptocurrency, all of which are tools used in blockchain-based virtual worlds. Imagine being able to offer cryptocurrency payments to activists or individuals in exchange for tasks

performed, as is the case in earn-to-play mechanics; we would then be able to generate, through the marketplace, a true parallel labor market, digital and green economy, and incremental value for our mission. Like carbon credit, cryptocurrency and the token mechanism could become the standard for measuring climate impact at the individual level and incentivizing new sustainable behaviors. In recent months, several consumer applications have been launched and are gaining traction that offer the service of tracking one's individual carbon footprint; we have widely cited the United Nations' "Aworld" as one of the examples. What if these apps were also able to distribute rewards? What if these rewards were somehow exchangeable or tied to specific benefits? I think there would be tremendous value creation in this way. The mechanics and business models of Earn to play could have a huge impact, especially in developing countries, where per capita income is very low and where there is a lack of employment opportunities and having an impact from the standpoint of engagement to change behaviors in these countries, as we have already mentioned, is critical. I am aware that it is very complex and perhaps utopian to think of a cryptocurrency for the green economy: currencies have their own market logics and dynamics, and cryptocurrencies are in the crosshairs of regulators after the latest scandals and failures. But this is due to speculation and mismanagement, not the technology itself.

The value of a currency, and specifically a cryptocurrency, is linked to the underlying transaction volumes and the financial guarantees offered by the platform: we might think that, if such a currency ever exists, it would be backed by institutions, foundations, and other stakeholders that can guarantee its stability and value: let's say it would be regulated and controlled appropriately (again a governance issue). The potential effects of a market with its own tradable cryptocurrency are a more efficient and transparent economy that can create wealth, jobs, and streamline trade and investment, and in our case, also real and physical effects on the ground. The value of a cryptocurrency, linked to the green economy and climate change, would depend on several factors, including adoption, usability, and perceived value to users. If the currency were widely adopted and used in green business activities, it could create significant additional value by providing a more efficient and effective means of conducting transactions in the green economy. In addition, if the currency is seen as a valuable tool for promoting environmental sustainability and mitigating climate change, it could attract more investors and users, increasing its value. Another factor that could create additional value is the development of a strong ecosystem of projects and services using the currency in the marketplace. This would create a network effect, whereby the more people and businesses that use the currency, the more value it gains. Such a scenario would reduce transaction costs, encourage investment and financing on "bankable" assets, and, in essence, create a transparent and reliable global environment for green investments. To build a strong ecosystem of projects and services using the currency, it becomes essential to develop partnerships and collaborations with companies and organizations that could include: acceptance by merchants and service providers; the development of a decentralized exchange that would allow users to trade the currency with other cryptocurrencies or FIAT currencies,

increasing its liquidity; and the development of decentralized applications (dApps) that could provide useful services to users, such as carbon offsets; production and distribution of green energy and certification of sustainable products; partnerships with green investment funds and venture capital firms; and education and awareness raising about the benefits of cryptocurrency and its use in the green economy.

A cryptocurrency could also be directly linked to the carbon credit market, which would be a way to incentivize investment in carbon reduction and offset projects. In this case, the platform would use smart contracts to automate the verification and transfer of carbon credits, thereby increasing transparency and reducing transaction costs. One way to link cryptocurrency to the carbon credit market, for example, would be to create a reward system that incentivizes users to invest in green projects that generate carbon credits. Users who invest in these projects could earn carbon credits that are then stored on the blockchain-based platform. These carbon credits could be exchanged for cryptocurrency or other cryptocurrencies on the platform. This could also provide a more efficient and cost-effective means of buying and selling carbon credits, increasing the liquidity of the carbon market. As we have seen on this there are already concrete cases in the market.

Of course, the design of such a currency is very complex and requires in-depth understanding and studies, which are beyond our scope, but we can point out that this would involve several actions. First, the need to invest in strong security measures to prevent hacking and ensure the integrity of the blockchain; second, to develop a stablecoin mechanism that can provide stability to the value of the cryptocurrency; third, to build a scalable infrastructure that can handle a large number of transactions and users; fourth, design an intuitive user interface that makes cryptocurrency easy to use and accessible to a wide range of users; fifth, work to increase cryptocurrency adoption by forming partnerships with green economy companies and organizations; and finally, promote its use through education and outreach efforts. All of these are things that can be implemented if we just wanted to do it.

Now, before closing and making some final remarks on a possible vision of the future: this might seem like a utopian discussion. The main reason for having this feeling is mainly related to "the way it is today": we all know the difficulties, bureaucracies, fragmentation and conflicts of interest, elements that seem impossible to eliminate today.

During the research for this book, I was struck by how the same critical issues emerge when talking about different perspectives of climate change, be it financing or mitigation efforts or investments for loss and damage, as well as when talking about technologies, be it AI, data or cryptocurrencies; these three elements are always three: governance or lack of global/shared governance, education and time.

Although we have discussed governance and education sufficiently, I think it is worthwhile to do a little thinking about time. Time is relevant because technology moves faster than we do. We are always late in understanding the long-term effects, positive or negative, that technology might bring. Time is relevant because the adoption of technology by organizations, institutions and companies takes too long

and encounters too many difficulties. Finally, time is relevant because we should aspire to extract value from technology in the best way, with the most positive effects, and as soon as possible. As we mentioned, the call for urgency has been made by various leaders and institutions to raise awareness among governments and policymakers globally. Regardless of the goodwill or effort that could be made with the current ecosystem, it seems to me very unlikely that the technologies we have been talking about will be implemented at scale any time soon: we do not have the time to wait for the digital transformation of all stakeholders. It would probably be a radical change or even an internal or organizational revolution for current stakeholders to try to implement or even decide to consistently implement one or more of the suggestions given earlier. Green ecosystem decision makers are not techies and technology leaders are not in the business of helping institutions or driving climate change; it is not their mission. Is it therefore possible to find a collective climate solution? Is it possible to demonstrate that technology is our collective asset? I think if we can do that, we could really make a breakthrough for all of humanity.

In the next chapter I will share with you my small utopian vision of how we might be able to achieve this. It would certainly be a singularity in our history: to be able to find a new model of governance, an equitable and distributed access to technology, a collaborative and incentivized environment, a much larger and efficient green economy market, and structure. In other words, a common global platform, a common mission, a common environment in which the relationship between humans and technology can be guided and harnessed positively. It would certainly be an ambitious goal to think about and even more to achieve something like this: so, do not blame me if what follows is a high-level vision. If you prefer, you can approach the next chapter as an intellectual exercise in how concretely we might achieve it and how it might work. The reasons why I undertake this exercise should be clear enough if you have had the patience to read this far.

#### 4. PLANET 3.0

Before we begin the last part of our journey, let me write something about digital transformation processes in companies, just to highlight the scale of the problem and because what follows could be a possible solution. On a large or small scale, any organization facing a digital transformation process has problems to solve, such as different budget allocation by divisions and objectives; silos between different departments or functions; the connection and interrelationship between different technologies that, many times, are again in silos; alignment between management or stakeholder objectives; alignment between different functions; lack of digital culture and technical skills and resources; old organizational and business models, to name a few. This is quite a lot, but any successful transformation process needs to work on all these different components. In addition, if you try to implement such a program, for example in a publicly traded company, you will face enormous problems in raising sufficient funds and investment for a long-term goal, because it is clearly unlikely that the innovation manager will be able to break through all these barriers and achieve significant results in the short term. Let us say that investors and the stock market would not be happy with the quarterly results achieved. Managers with technology skills have the task of making their often skeptical and ignorant bosses aware of the opportunities offered by technology. In fact, for many it is much easier to leave research and development or technology efforts outside the company; an alternative option, so to speak, is to consolidate new business through mergers and acquisitions or through partnerships and open innovation programs; in other words, "buying" innovation outside the company and this is one of the reasons why, in my opinion, the start-up ecosystem plays a key role in the market. Now, if we look at the climate challenge market or the stakeholders in the green economy, we are facing the same problems but on a different and larger scale: here we are talking about an ecosystem, and not a small one, and while it is true that this is much more complex than a company where the internal transformation process can normally take years, to apply the same logics to an entire ecosystem would probably take a generation. I am not kidding, for the transformation process to be complete we need time to replace decision makers, we need time to have a population of tech-savvy leaders, most importantly we need a long-term vision which is not common practice of governments, institutions or financial markets. Innovation, then, must be external to the ecosystem, or rather it must be a new external agent that drives and enables the ecosystem and all its individual participants. The utopian part of the vision is just that: to expect the actual stakeholders to be able to exploit all these technologies beyond their limits with vision and determination. If we are to be assertive, from a Darwinian perspective, it is very likely that the current actors will not be the actors of the future.

But all these institutions and stakeholders, although traditional in DNA, are incredibly valuable and indispensable: they are the ecosystem, not only because of what they have built it so far, but because of their expertise, their organizations, their anchor role, their ability to manage and coordinate global activities, their vertical visions, and above all their specific missions. But in order to achieve or

come as close as possible to the goals of carbon neutrality, which we mentioned in the previous chapter, and which seem unachievable in actuality, we need another level or actor's category, so to speak, that can help the whole community by grafting a discontinuity in the ability to innovate.

Another aspect to remember as essential in any innovation and transformation process is the holistic or horizontal view of the organization, which is necessary when implementing core and functional technologies. In a company, this implies collaboration between departments, fair allocation of budget and results, and shared standards and processes, elements that are far from easy to manage in practice. The green economy ecosystem consists of an incredibly large number of verticals and dimensions, such as geographic, thematic, industry, stakeholder, disciplinary, and so on, which makes it virtually impossible to efficiently implement top-down policies or standards. The only process that could work in this direction should be bottom-up and should be progressive, inclusive, open, and flexible to incrementally implement standards, tools, and whatever else is needed by the ecosystem. To make this happen, there should be a clear value and return that justifies the adoption of any innovation by all horizontal stakeholders: this is a critical success factor in the transformation process of any organization and even more so in our case where the drivers in this direction can be many, as we will see in a moment.

Another determinant related to digital transformation is the choice of the "technology stack," i.e., the integrated set of technologies and platforms of the company, with its functionality, features, cost, performance, etc. This is a decision that usually, within an organization, involves both IT and business: IT deals with legacy software, compliance, integrations with other technologies, security, service levels to be delivered; business determines requirements, user experience needs, etc. Let me say that this decision is often contentious and painful. In our case, I think the one point to emphasize is the importance of a shared, horizontal, functional technology approach across the ecosystem. Although we have talked a lot about blockchain by the way, my point of view is agnostic: I am not an advocate of blockchain "per se," but I just think that some applications of blockchain are fundamental; this is to say that different technologies cover complementary functionalities and can address different needs and goals. Certainly, except for a few relevant cues that we have already seen, horizontal collaboration architecture or infrastructure is something that current stakeholders are not yet implementing.

These are the reasons why PLANET 3.0 (it's a code name, I'm not a creative guy) is the vision of a new market player, which must move at the speed of technology, efficiently and in the interest of the ecosystem, which must be attractive enough to be adopted broadly, which must be able to enable all stakeholders to collaborate in accordance with its mission, and which must be transparent and trustworthy. Let's see what I'm talking about.

## 4.1 WHAT IS PLANET 3.0

PLANET 3.0's mission is to harness technology, with critical mass and scale, in the interest of humanity and the climate change ecosystem. The mission is made explicit in practice by providing a technology backbone, a shared platform for innovation, an environment for collaboration, and a reliable and transparent economic system in which all stakeholders can participate.

So, PLANET 3.0 is basically composed of:

- 1) A decentralized global platform with a defined and relevant role for humanity:
  - Global: because it addresses climate change and provides planetary access.
  - Decentralized because it is managed by a DAO, there is no owner, but all stakeholders are co-owners. We have already talked about the DAO framework, and we will go into this more when we talk about the governance and roadmap of the platform.
  - Role defined: is the ecosystem enabler to accelerate and drive challenges, improve outcomes, foster collaboration, and enhance market transparency.
  - Relevant to humanity: wants to be the benchmark for everything related to the climate challenge.
  
- 2) A global community of stakeholders working together and committed to the same goals, the stakeholders as we can easily imagine are:
  - Citizens: everyone can contribute and know that by performing activities in the platform they get rewards.
  - Communities: they can issue challenges, aggregate users on tasks, develop content, communicate their actions.
  - Companies: bring data, tools, challenges and activate open innovation mechanisms and programs.
  - Institutions and NGOs: share challenges, data, tools and maintain their institutional function of certification, trust, regulation, etc.
  - Financial institutions could provide funds and invest in activities and companies within the platform.
  - Big tech: they have a key role, which we will see later, in providing data, technology, infrastructure tools and user attraction.
  
- 3) A digital and virtual environment in which community and user engagement generate rewards.
  - Challenges and goals: the platform have the overall goal or mission mentioned earlier, which is composed of various sub-goals, projects, activities, problems or tasks to be solved. Challenges and goals can be uploaded by stakeholders into the platform.

- Gamification: is the key mechanic for managing engagement and rewards for each challenge or goal achieved, which includes all possible types of rewards (from monetary to status rewards, from levels to access).
- A marketplace where all stakeholders can exchange services, goods, skills, time or other. A place where investors can also find interesting companies or activities for their participatory portfolio.

4) An infrastructure for sharing tools and resources to be leveraged for individual and collective intelligence. The components of the "backbone" are basically:

- Ecosystem: goals, tasks and challenges, as well as rewards, can be pursued either by individuals or by teams mixing different skills, attitudes and contributions. Flexibility and the ability of users to interact within the platform will be critical.
- Libraries and tools: the platform will make available all assets generated by or within the platform, or those provided in the form of contributions from stakeholders. Access to these libraries and tools will be subject to both gamification logic and specific skills or hierarchies. Some of these assets could be free and some could be paid for.
- Data: are a key asset of the platform, any data generated within the platform will be available according to a specific regulatory framework that must prevent misuse and value recognition for users or communities that by performing certain activities have generated valuable data.
- Intellectual property and royalties: challenges will also be solved through the creativity and ideation or development of users and communities, thanks to the tools available in the platform. Each new IP, tool or solution developed by community users will grant rewards to creators over time.

5) A cryptocurrency and a token system:

- We have already discussed in the previous chapter the potential benefits of a cryptocurrency to regulate and give more value to the market, as well as the fact that it could generate new business opportunities and monetization models. We can only mention and highlight the fact that it is possible to have both currency and tokens, monetary and non-monetary rewards.

In short, and after all our discussion, it should be no surprise if we are imagining:

- An open, distributed, gamified global platform that potentially belongs to "everyone" interested in the future of the planet.
- An open and distributed global collaboration platform where all the necessary tools are available, as well as content, education and training.
- A community-built immersive virtual space that is a shared global place in the interest of the world and beyond isolated economies, cultures and governments.
- A cryptocurrency is a market in which the underlying value is the positive behavior and scale of all stakeholders.
- A global "call to action" where everyone can contribute, where everyone has a challenge at hand, inclusive, rewarded and transparently regulated.

Let us try to better describe the components of this platform and how it might work in practice, considering that we are not designing the entire structure, but only highlighting how the process of engaging different stakeholders might unfold.

Conceptually in the platform we will have a list of problems, goals and challenges that will be uploaded into Planet 3.0 by any stakeholder, user, institution, NGO or company. Each challenge brings with it a reward opportunity, and to solve a challenge anyone will be able to use data, tools and whatever else on the platform, within the marketplace, either for free or for a fee with cryptocurrency. Of course, different challenges involve different tasks that can be done with different levels or skills, and the rewards move accordingly. For example, one challenge might require artificial intelligence modeling and thus need skilled developers to complete; while another challenge might be very local and involve general users with only "non-monetary" or status rewards, depending on the game mechanics decided upon. Challenges could also be solved by an "ad hoc" virtual team built within the platform; these teams will realistically be based on the skills or reputation of individuals, as there will be ratings, past action ratings, track records, etc. Since our goal is to engage all stakeholders, we will address later what their benefits and trade-offs for their involvement might be, which is obviously a key topic to address if the goal is to achieve critical mass, scale, and network effect. Being reasonably sure that there is sufficient impact and critical mass to begin with is critical to having a significant volume or proposal from day one. A key concept then is to systematize what already exists: we saw in the previous chapter that there are already significant experiences in each technology or trend, these are all assets that should be integrated within Planet 3.0 for sharing, collaboration, etc. that would allow for critical mass quickly.

Therefore, the question is: How can such a vision be implemented in practice?

## 4.2 IMPLEMENTATION: A FRAMEWORK

While the vision, utopian or not, should be very clear now, we begin to confront reality. Let's imagine that we want Planet 3.0 to be real: could it really happen? My answer is yes, it is very unlikely, and we will discuss it, but the answer might be positive. We do not focus now on the financial aspect of the project, which we will discuss later, but only on the logic or methodologies of implementation. Let us imagine structuring the start-up process of Planet 3.0 into the following phases: ideation/conceptual, set-up, launch, growth.

### Ideation/conceptual phase

The conceptual phase is necessary to properly design each element of Planet 3.0 and has as its key output the so-called "Manifesto," which we discussed when discussing blockchain and DAOs. Writing a shared "Manifesto" and delving into all the components of such a project is very challenging. The requirements to achieve it are essentially two: first, clear leadership and vision, and second, an interdisciplinary task force.

The first point is closely related to who takes the initiative. In my opinion three components are needed at the working table: the big technology companies, leading institutions and association, a few leading financial institutions. I personally envision a group of no more than 20 to 30 actors, or even less, participating in this table where the key aspect is the representation, the level of the different categories and expertise, the credibility of the super parts role, the project reliability, and the scale represented by the project.

These "founding stakeholders" have the responsibility and goal of building the platform's plan and model, of making sure they put within the platform all the resources necessary, or possible, to build sufficient initial critical mass and of "wisely" guiding the governance and development of the platform from the beginning. They are the ones who take the leadership of the early stages of the project; we will see later why they should do so.

To write the "Manifesto," the best way, or perhaps the only possible way, might be to create a team of experts and interdisciplinary leaders that includes technologists for platform design, climate scientists, corporate and business decision makers, investors, philosophers and politicians for future governance. The "manifesto," in my view, should be seen as the plan to broaden the stakeholder base as much as possible. To do this, the working table will need to consider all possible disciplines, perspectives, and viewpoints. In fact, if the platform's mission is to be the world point of reference, the Manifesto will need to contain not only a new model of governance at regime, possibly useful even beyond climate change, but also a transition pathway from the initial phase to the "at regime phase" such that it will ensure the best possible operational implementation.

A key aspect of the Manifesto would therefore be, from the outset, to include the logic of the handover executed by the founding stakeholders over time for the benefit of the community. As in the manifestos used for virtual worlds in the metaverse, the cryptocurrencies issued, as well as the structure of the tokens in terms of voting rights or otherwise, are transparently defined and shared ex ante.

The founding members, of our scheme, would progressively leave the helm for increasingly distributed governance. The options for managing this process are really many, and I think I am not the one who can give a solution but let me propose a couple of possible scenarios. For example: when fully deployed, large technology companies could have voting rights only on certain topics regarding marketplace, platform, or data management while they might have no voting rights at all on issues such as privacy or ethics regulation that could be influenced solely by institutions; at the same time, citizens with certain tokens and rights could participate directly in decisions at the local level, representative or otherwise. The same voting rights could have different weights depending on the various decisions, e.g., the same party, or set of parties in a Dao, could weight ten percent for decisions on platform issues and thirty percent on marketplace management issues. The design elements are therefore multiple. What I envision is a collaborative place where, while respecting the role of each actor, decisions are made cooperatively, especially together with the last and most important stakeholder who are the citizens who, as we said, in Planet 3.0 can actively participate in decisions on the climate challenge. Involving citizens would also be a significant and positive change and a disruptive message, while for large technology companies to take the initiative at this stage would, in my opinion, be a great opportunity to re-establish a more sustainable relationship with consumers and governments.

The participation of institutions would ensure alignment between the general regulatory environment and the internal rules of the platform, described in the manifesto, through their input and guidance. This initial set of internal rules is clearly critical as it represents not only the functional and operational model for running the platform, but the set of balances and interests that through the rules are formalized. We note that there are several possible types of rules:

- Governance rules could differentiate decisions and voting rights by topic, for example on technology decisions or ethical decisions, where different categories of stakeholders would be able to best exercise their expertise. In addition, governance rules could be different for different levels within the platform, decisions on individual activities or projects could be voted on by subcategories of stakeholders, for example, a local decision could be voted on only by local stakeholders. Personally, I imagine that the weight in decision-making on specific topics will be in favor of the most knowledgeable category of stakeholders, e.g., in a decision on cryptocurrency the views and input of institutions and investors should be more important, or in a technical decision the opinion of tech-savvy stakeholders such as big tech will be more relevant.
- Community rules are needed to define community expectations, participant behavior, privacy, access, specific voting rights, ethics, etc. These should also include general rules for banning or excluding players who have engaged in misconduct.
- The rules of entry of new actors within Planet 3.0 are also important, as they in fact represent the platform's growth model, which must progressively and incrementally include all possible stakeholders over time. The inclusion of new actors has two different elements to consider. The first is to regulate contribution "in kind": a stakeholder could enter the platform by contributing an asset, of

which IP and ownership, useful to the platform and the marketplace, at the same time, this stakeholder will have access to the platform's resources under established conditions. The second element to consider for the entry rules is that these should give the new entrant the ability to define the conditions for the use, sharing, sale, and reuse of the assets by other actors: the manifesto should therefore make explicit what the rules and conditions are for the proper use of the asset, for example in case we do not want everyone, but only some, to have access to certain content.

- The financial and economic or management rules are, on the one hand, how the income statement of the platform is maintained, and, on the other hand, they define the criteria by which investments are made-this is very much related to the platform development roadmap, which is also something to be included in the manifesto.
- In the rules of the marketplace, we can include firstly, the proper regulation of the marketplace related to transparency, transaction management, monetization of intellectual property rights and identity; and secondly, the regulation of the logic of collaboration, which also includes the previous points.
- Finally, the engagement rules concern the use of tokens, cryptocurrencies, and other distributed rewards. Let me elaborate on this: the platform should allow stakeholders to use tokens or rewards to "gamify" their initiatives, which means that not everyone is allowed to issue tokens or rewards, whether in the case of monetary or nonmonetary rewards. Monetary rewards are somewhat easier to manage, since the actor promoting them would recognize the payment with currency; while the issuance of nonmonetary rewards, or rewards that release rights in some way, would have to be managed on the one hand to keep the perceived value of the reward high, and on the other hand to manage the forms of participation.

As we said, this set of rules is critical to push progressive adoption of the platform in the different phases of the planned roadmap. The entry of new players, in fact, needs to be handled incrementally but quickly, more than anything else it is necessary that in the setup and launch phase the platform has an initial critical mass that depends, of course, on the first players to join and their contribution. From this point of view, we know that potentially there are already a significant number of assets that could be brought into the platform by institutions and other stakeholders; these assets should be selected and incorporated from the beginning with a defined model, to facilitate the critical mass and acceleration process. This model would then define future inputs since the platform should be open to continuous integration of best practices.

As mentioned, in the "manifesto" the platform roadmap is another element to be described in detail. The complexity is high both in terms of services and volumes to be potentially served, and it is unrealistic to expect to have all the features and layers on day one. The roadmap is therefore necessary to make explicit the long-term vision and the steps and investments to implement it. Again, there is a degree of complexity because the platform will necessarily leverage different technologies for different domains, and from this perspective, the release of functionality will

need to be coordinated with the planned adoption plan. It is therefore realistic and reasonable to assume that the development of the platform will be divided into several subprojects and development streams.

To summarize on the conceptual phase: we have a small but representative number of "founding stakeholders" who, with the help of a dedicated interdisciplinary task force, draft the "Manifesto" of Planet 3.0, with its rules, its vision of being, as well as the funding and requirements needed to implement the project. This is implemented in the form of a DAO, which we can now call "Central Dao," where all the founding stakeholders are present.

Let's use an example of how the "Central Dao" might be composed and how it might evolve in later stages.

We could assume at this stage: to have 33 percent of the voting rights expressed by large tech companies and/or tech players functional to the platform, 33 percent as an expression of institutions; 33 percent expressed by investors, associations, schools, and the scientific community. Again, as an example, let us assume that we have, at this stage, 20 stakeholders. A last note: we do not consider now the financial/financial topic, which we will discuss later.

#### Set up phase

Thus, the "Manifesto" is the tool to generate incremental entry of new players and to progressively involve all other stakeholders, so far nothing concrete has been developed from a technological and product perspective: the purpose of the set-up phase is to begin the development of the so-called minimum viable product, bones the first working version of the platform with its essential and basic functions, and after a period of testing and experimentation, at the end of the set-up phase, release the beta version of the platform.

Founding stakeholders will run a kind of roadshow to broaden participation to a selection of targeted and functional actors or stakeholders for the fine-tuning and testing phase. The actors that are selected for the road show reflect the same principles and logic as in the conceptual phase, i.e., critical mass and functionality, but with more significant numbers. If in the conceptual phase we envisioned about 20, now we must think in the hundreds or at least such a number to ensure critical mass, trust, visibility and "gravitational pull." It is likely that with these numbers, the effect of the targeted roadshow, we are already covering a significant/relevant portion of the ecosystem, which is key.

In fact, the key objective is the positioning of Planet 3.0: having involved global technology players, globally recognized climate change institutions, associations, and leading investors, all aligned with the "Manifesto," the platform would already be operating in a manner consistent with the mission of serving all stakeholders for the interest of all. We can probably divide this phase into two milestones: the first is the MVP, minimum viable product of the platform, which could be open to stakeholders present at this stage to test, fine-tune and debug; the second is the public launch of the beta version, which is when the real public launch phase of Planet 3.0 begins. It is important to say that during the private beta test, stakeholders will probably also work to refine the "Manifesto" possibly adjusting governance

issues and what is prescribed in the "central DAO" project governance models and rules: just to say that the process could be continuous and dynamic. This process is managed by the central Dao but at this stage, also to facilitate implementation, some specific DAOs could be formed, as we have already recounted. However, let us say that the main challenge here is mainly technical execution, since all the rules of the project have already been defined in the "manifesto" during the ideation phase.

Following the example we used for the conceptual phase, let's say we now find ourselves with this composition: 25 percent (-5 percent from the previous phase) of the voting right by large tech companies and/or tech players functional to the platform; 40 percent (+7.7 percent from the previous phase) by institutions; 35 percent (+2.7 percent from the previous phase) for investors, associations, schools, scientific community.

So at the end of this phase: we have a beta platform ready to be opened to the public, the platform is already populated with significant assets provided by the initial stakeholders, there is a reliable and transparent environment and governance (tested in the small group), many of the features needed to create network effects are developed, the governance and Dao model has been refined and is beginning to take its trending shape.

#### Launch phase

In the launch phase Planet 3.0 will be open to the public, which basically means two things: one, citizens and potential mass adoption; two, market and B2C functionality. The overall goal of this phase is to move from beta to platform's version one with all the features and components required and envisioned in the Manifesto.

Whereas in the set-up phase the focus was on developing the first version of the platform and building the critical mass of available actors and assets, in this phase we are beginning to manage an environment where supply meets demand at different levels: funding, job opportunities, data sharing, models and IP, etc. The platform, which is now open to new entrants from any stakeholder category, is tasked with pushing new entrants to participate in activities and incentivizing all actors based on their category and status. Thus, the launch also includes public cryptocurrency, with coin issuance, token mechanisms and gamification tools of the platform to engage individuals and activists.

As stated in the "Manifesto," new entrants may get voting rights, and this will significantly change the original governance structure for two reasons. The first is that a significant portion of the voting rights must go to individuals and the public if we are to have a final framework in which citizens can have significant weight in decision-making. The second is that we can expect the number of associations and private stakeholders to be more significant than in the conception or establishment stages.

Therefore, following our usual example, we could end the launch phase with a voting composition like the following: 10% (-15% compared to the previous phase) of the voting right from large technology companies or technology actors functional to the platform, 35% (-5% compared to the previous phase) from institutions, 20% (-15% compared to the previous phase) from investors, associations, schools,

scientific community, and finally a 45% intended for contributors and citizens. The number of participants is now a question mark; we could expect hundreds or a few thousand new stakeholders (institutions, private companies, associations) and millions of citizens worldwide. As we have seen, the governance structure has changed and the handover of Planet 3.0 from the founding stakeholders, toward the full-scale model, is taking place as originally envisioned in the manifesto.

#### Growth phase

Let's say the growth phase is when the platform is fully functioning and has already achieved or is consolidating its role for the ecosystem: adoption will continue progressively; climate change challenges will continue to populate the platform; the market is now significant in terms of volume and transactions; cryptocurrency has its market value; etc. The governance model has now stabilized on the final framework, Dao hierarchies and articulated voting rights. The most important thing that the growth phase must ensure is constant innovation and efficient use of resources and technologies; this is its main value. A picture of the final voting pie could be as follows: 5 percent (-5 percent compared to the previous phase) of the voting rights from large technology companies or technology players functional to the platform, 35 percent from institutions, 20 percent from investors, associations, schools, scientific community, and finally a 50 percent from contributors and citizens. As we can see the dilution over time is not proportional for the different categories: this is just one of the possible logics to be applied and described in the manifesto. To get a final definitive picture we cannot rely on the number of stakeholders who will join, we have to define ex-ante how much voting power we want each category to have at the end of the path and, to put it in other words, do a kind of reverse engineering of this picture step by step. This last sentence brings us to the very challenging and sensitive issue of governance.

### 4.3 GOVERNANCE

The governance model is by far the most important success factor, to begin with I would just like to quickly remind you of the DAO model and the principles that the platform should adopt in my opinion. These are three basic elements: decentralization, transparency and automation, and consensus. As we know, these principles underlie the concept of DAOs. The size and ambition of Planet 3.0 calls for neutrality, a body of "super parts," and an ironclad transparent governance without the dominance of commercial actors. All this is desired by the participants for a common and global goal and in the interest of the citizens of this planet.

To try to address the issues of governance and the proper influence of different stakeholder categories, we need to understand how this complexity can be articulated in terms of rules and structures. We could imagine that, to address and align all the specific interests of different stakeholder categories, Planet 3.0 would provide specific DAOs, with differentiated voting rights at different levels. In my view, these are some examples of levels of governance that need to be addressed:

- Central DAO, we have already discussed some of the tasks it performs as the mission of the platform. In the example we gave earlier, we were referring to the voting rules of the "Central Dao," which is the place where the overall mission, role and principles of the platform are ensured, as well as the normative consistency of activities within the platform and externally. This is obviously the most politically important and critical and representative Dao. Sub-DAOs, which we could define as specific decision-making tables composed by expertise or interest, should also participate in the central Dao. This strategy would allow Planet 3.0 to have several levels of decision-making, each involving the most relevant and useful stakeholders for the specific topic or task that the sub-Dao is to carry out. Here is a non-exhaustive list of possible Daos:
- Sub DAO of Monetary Policy and Incentives: would manage the cryptocurrency's monetary strategy and set rules, e.g., on IP, incentives, platform funding.
- Sub DAO Execution and operational management: to follow the technology and platform development. This is the operational structure of the platform, teams, leadership, and basically all "business" functions such as marketing, IT, administration, legal, etc. Indeed, the team must have decision-making power at least on how the platform is to be managed.
- Sub DAO Marketplace, community, and collaboration. These are shared and collaborative environments where participants should be able to influence decisions, which also need governance related to how these environments are managed in terms of rules, transparency, rewards, standards, transactions, etc.
- Specific sub-Dao on vertical sectors. Sub-Dao could also be used to make decisions on specific topics and challenges. Just a couple of examples might be: a sub-Dao for plastic pollution or one for reforestation strategies or another for water issues, etc.

The hierarchy of Sub-Dao is mostly flexible and allows for progressive involvement of actors, each with specific and defined voting power. Each Sub-Dao will then have its own voting power, with defined weights, e.g., in the central Dao or other Sub-Dao, depending on the participants, relevance, and topic. A model such as the one proposed would allow for great flexibility but, at the same time, stakeholder representation and a way to coordinate expertise according to the objective. Of course, the creation of Sub-DAOs would have to be regulated. We can imagine that only certain entities would be allowed to create certain DAOs, or that we could think of an approval process, or that there would be selection criteria for voting DAOs. The final form of this framework should not be defined in detail, since it will be the community, partly bottom-up and partly top-down, that will create the DAOs needed to respond to specific problems, challenges, or projects. In other words, it is the platform itself, with its community and environment, that should generate these levels of governance. As we said, different DAOs could also have very different goals, those of some might be measurable while those of others are not; some might be business-oriented (imagine a DAO of investors, for example) others might be nonprofit and provide incentives in exchange for citizen engagement or activities, and so on. Personally, I find it fascinating to imagine the possible forms such an environment might create.

The Daos we mentioned earlier are thus only some of the possible bodies where decisions are made, but they are the ones who centrally and horizontally manage the platform keeping it in line with its mission.

Another aspect to consider when talking about governance are citizens and contributors, who should weigh heavily in the overall governance framework. Let's start by saying that contributors should have rights, as they are active individuals who use their skills and time to contribute either to specific topics or to the improvement of the platform itself, building shared services or otherwise: while "citizens" are the public, interested in the topic and subscribed to some of the platform services available to Planet 3.0 consumers, e.g., a course, event, etc. While contributors might have voting rights in a specific Dao, citizens should have some right to vote on the overall direction of the platform, even if it is also moderated and regulated by institutions and stakeholders already somewhat representative of their interests. In other words, we envision a balanced governance that should enable decision-making based on expertise, consensus, and transparency, with different levels of stakeholder representation.

The idea of dividing voting rights from profit goals within different Dao is a key element that allows different stakeholders to exercise their specific missions within the ecosystem. Let me clarify this point further. In the traditional governance system, the two things, voting rights and profit, are usually aligned: shareholders receive pro-rata dividends and have pro-rata weight in decisions, easy. What happens in our case is radically different, as each Dao will have its own goal, mission, model, and voting rights. While the platform's mission is not to become another big tech giant with huge market capitalization, but to innovate the entire green ecosystem in the interest of all: it is equally clear that the platform must generate value, "economics," and returns. The value generated is therefore

concentrated in the spread and adoption of cryptocurrency and its valuation in the market. The "central Dao," from this point of view, aims to fuel internal economies, increase transaction, and project volumes, and enable efficient exchange between supply and demand; the other Daos will aim for profit, have turnover, and returns in cryptocurrencies generated by their own activity within Planet 3.0. The more companies and stakeholders can benefit from the marketplace, the more cryptocurrency transacts, the more value the platform will have.

The vision of a governance model such as the one described and based on blockchain is likely to be a new laboratory of public governance, where different interests and positions could coexist under the same umbrella of Planet 3.0 that ensures trust, transparency, enabling technology, clear and fair rules of stakeholder involvement in decision-making.

A key aspect, which we have not talked about so far, is the investment needed to implement and manage all the complexity we have seen so far. So let us address the issue of money and funding or financial perspective, remembering that one cannot think of involving, for example, large technology companies without prospecting for returns.

#### 4.4 A FINANCIAL VIEW

The financial one is clearly a very delicate aspect of the project, we are in fact launching a global platform and a cryptocurrency, which, after all, almost means imagining a new market, with its own economy, governance, and citizens. Moreover, the goal of Planet 3.0 is not profit, this could generate great doubts for many. Of course, we need to consider the path we have described to arrive at this final vision: it is based on an initial pool of founding stakeholders and progressive adoption that fuels the growth of the ecosystem, while the founding stakeholders become less relevant over time, up to a defined point. From a financial perspective, the framework we have described could be complicated and unattractive for founders.

Investments in the platform and its currency must therefore give economic returns, which means we are creating an economy and value and not just helping the planet: this is also a key concept of sustainability. Planet 3.0 must produce value and be self-sustaining, activities and ideas must generate returns, as must every single virtuous behavior enacted by citizens; moreover, if we want this platform to have true mass adoption to fuel collective intelligence and so on, we cannot fail to address this point.

So let us try to imagine how financing and returns might work. To do so, we must first emphasize three notions: one, not all stakeholders are directly interested in the economic value generated, this means that the "returns" are potentially different depending on the category of stakeholder; two, the financial value of the platform will be the value of the cryptocurrency in the market; and three, we must consider this topic in relation to the overall investment picture of the green ecosystem: a complex topic that we have not yet touched on, but will highlight shortly.

Let's start by understanding how funding the conceptual phase might work, which essentially consists of investing in the conception and production of the "Manifesto." Operationally, this means establishing the first "Central Dao" of founding stakeholders, as well as establishing and paying the interdisciplinary task force to draft the manifesto. The financial effort should not be particularly significant, relative to the scope of the mission, and may not necessarily be reflected in voting rights or promises of expected returns: at the end of the day, it is a matter of defining the vision you want to have, building a blueprint, a plan, and a service infrastructure design. Even if the complexity is incredibly high, this process could be managed in an agile framework, and it should not take a particularly long time; one could probably give oneself the goal of a year's work where there is no product development or anything implementation yet.

Investments begin to be significant, beyond quantification, in the set-up phase in two respects. The first is the funding strategy required to implement the platform and its functionality; the second is the financial mechanism that remains behind the adoption and that should also ensure adequate returns to the founders. Regarding the first point, the development of the platform, it is clear that investments can be significant here: how much is needed and to do what has been defined by the task

force in the Manifesto, but we are talking about a global infrastructure, with a significant critical mass from the beginning, even if at this stage not yet at scale. In this scenario, we expect mainly institutional investors to be involved, considering that the composition of the stakeholders would already include some of the large technology companies, institutions, etc., are the stakeholders that should ensure the successful implementation of the project. At this stage, therefore, an initial private issuance of cryptocurrencies reserved for founding stakeholders and incoming stakeholders could be made, remembering that this does not necessarily mean voting rights.

Let's come to the second point: the financial mechanism that remains behind for adoption and returns. To address this topic, we might start by saying again that we want the platform to have the critical mass needed from the start: this means that we must already have a great deal of value to offer the market for further adoption. The platform should then be populated with data, assets, courses, tools, collaborative models, and whatnot; these contributions are made by the founding stakeholders and not necessarily for free; their contribution should therefore be rewarded with the first private issuance of cryptocurrencies. The idea is to have a first public issuance of the coin only in the launch phase; only then will the coin have its market price and volume, realistically based on the value of the company and its assets. While pre-launch private issuance would offer early contributors or stakeholders a return for their efforts, such a mechanism could also probably be run as a discount on the price of the first issuance. I am unable to elaborate on this topic with sufficient expertise, but I believe that the first public issuance should be reserved primarily for institutional investors with long-term investment objectives to ensure greater stability in the short term. The financing plan could also include public contributions from governments or institutions/foundations as another source of capital not directly tied to currency, and over time it could also obtain contributions from donors or foundations. The effects of this structure are increased benefits and value for crypto coin owners and nonprofit stakeholders participating in the platform.

After the launch phase, according to the development roadmap, there will be several successive coin issues to ensure growth and adoption, up to the limits and timelines defined in the "Manifesto" to make the currency progressively more and more used and traded.

Another significant element from a financial point of view, which we must again keep in mind is that the platform does not work for profit, is that Planet 3.0 must be successful, financially sustainable, and have the resources to push innovation itself. Operating costs should be covered by public funds, transaction fees from platform services, value-added services, payments, and donations. A partially different approach could be used for research and development where, like any other stakeholder, the platform team could ask the market to actively contribute and, in this case, funding could also come from crowdsourcing within the platform.

Finally, another aspect to mention in terms of adoption and financial attractiveness is the fact that the platform could replace the research and development and technology efforts made by individual/vertical stakeholders, especially those dedicated to innovation and transformation plans. This peculiar element is one of

the benefits that the platform should be able to return to participants, allowing them to focus on their core mission while infrastructure innovation is managed collectively and "centrally." Indeed, the platform would provide "managed services" efficiently for the entire community, and cost savings could be another key driver for adoption.

So far, we have discussed what the platform wants to be with its mission and role for humanity, we have had some thoughts on the possible governance model, and we have had an overview of the financial aspects of the idea-it is now time to address some aspects of implementation that might be interesting.

#### 4.5 IMPLEMENTATION AND OTHER ELEMENTS.

First, we have to say that the executive team is managed by a DAO and is composed of high-level leaders in different functions, also supported by the founding technology stakeholders. The DAO allows the team to have a fair compensation package relative to the market and to participate in central decision making—we need a team that is motivated to the max.

The second aspect to consider is the technological approach. Although I have emphasized the opportunities related to blockchain, I personally do not see it as a blockchain-only platform—I envision a hybrid environment that can leverage the best possible technology and approach in the specific individual space. While blockchain could handle all governance and currency, collaboration could take place on another infrastructure, the key aspects are scalability, transparency and "seamless integration." This last point is vital, as one of the capabilities of the execution team should be maximum reuse of the work already done by stakeholders today. We have seen in the previous chapters the vast amount of assets and initiatives in blockchain, education, gaming, collaboration, and AI/data: we should have the goal of engaging best practices from the beginning and scaling existing experiences. In other words, collaborate as an ecosystem from day one. So, we can say that, from an executive perspective, the mission is to systematize, within a platform, many of the existing initiatives and assets whenever possible.

However, there are necessarily infrastructure components that should be designed and implemented independently: the governance blockchain is one, the gamification framework is another, the cryptocurrency and collaboration infrastructure are others. Potentially, the platform should have its own cloud where all data and services can be stored and managed—these are topics for the "Manifesto." It is also useful to mention vertical applications that Planet 3.0 might implement: these are not part of the central roadmap and are projects that start at the sub-Dao level, but once released become part of the platform. These cases would have to be managed collaboratively by the "Central team/dao" and the "vertical team/dao," potentially funded by the sub-Dao: therefore, processes and rules are needed to properly manage these situations. It is a given that another mission of the "Central Dao" is to enable, as much as possible, an open and accessible environment for development, as well as clear rules of engagement for central and distributed efforts.

Like anything nowadays, communication plays a relevant and indispensable role, and in our case, it is a key success factor as we aim for mass adoption of the platform, and this is crucial from the very beginning of the process. The founding stakeholder group and the manifesto task force are also part of the communication strategy: we need leading institutions and large technology companies on board. A stated joint effort and an undertaking where the initiators are Alphabet, Amazon, Microsoft, etc. all or some of them contributing assets and know-how to the project, along with leading institutions such as the UN, Unicef, OECD, Unesco, for example, would already be a "game-changing" message. The quality and size of new stakeholders gradually joining the platform is the key element for positioning,

trust, and transparency. In this perspective, a key element from the beginning of the project is the task force of experts, which, among other things, being the author of the original "Manifesto," could continue to play its role in overseeing activities as the platform evolves. The composition of the task force, which we have already discussed, should have prominent personalities who can serve as ambassadors in the different communities and give some coherence to the mission and message. From my point of view, there are other elements beyond those mentioned that have considerable strength in terms of communication and positioning of the project. One concept could be called "technology for good": the idea that for the first time public and private interests are aligned in leveraging technology for a global scale issue together, with new governance at least in the digital space. This is an important concept; communication should be able to describe the process to the end, as the potential perception of a dominant role of technology companies should be avoided. The open and inclusive approach to enable innovation and collaboration across silos is a message of concrete action and change; it is itself a challenge. The platform does not replace the mission and activities of either institutions or NGOs, it is not a scientific organization or a profit-oriented company: it is a new digital tool for all. Another strong concept is the participation of citizens and all stakeholders through voting rights: this could be a very strong call to action with potentially surprising returns, in my opinion. But beyond these topics, I think the most important thing we should be able to convey as a message is the impact the platform wants to have. It may not be easy to adequately explain the role of technology and market facilitator, a cryptocurrency, gamification, etc., especially in such a fragmented and culturally and economically uneven context. By giving explicit messages about the project's impact area, we could better engage different target audiences. Here are some examples:

- Institutions: the platform could reduce research and development efforts, make available resources and engaging technologies and tools/premiums for end users that can improve the outcomes of your initiatives.
- Investors: access to a transparent marketplace where innovators and start-ups develop solutions in partnership, etc. More bankable projects and greater scalability of invested companies. Returns on green investments.
- Companies and start-ups: access to data, technologies, assets and resources both in the marketplace and through the collaborative environment. Business opportunities and partnerships. Return on investment in research and development.
- Collaborators, scientific community, and developers: job and income opportunities, training, resources, and access to rewards and professional growth within the community.
- Governments: a platform of trusted partners that could help achieve national and local goals more efficiently, access resources, training, best cases, etc. A trusted and influential partner to address ethical and governance issues of technology.
- Educational system: access to content, technologies, assets and resources both in the marketplace and through the collaborative environment, engaging tools/premiums for end users and teachers.

- Citizens: commitment and reward for their virtuous behaviors and active participation. Reliable source of information, access to educational materials and courses, job opportunities, entertainment/games, privacy.

Ultimately, growing the green economy and managing the transition are probably the two main impacts the platform can have. These two topics are broadly inclusive of most of the specific beneficial contributions or goals that Planet 3.0 could have: research and knowledge sharing, access to technology and investment, efficient governance, awareness and behavioral change on climate adaptation and mitigation, ethical use of technology and data, reliable context and sources, market efficiency, and return on green investments or education. I think we have now addressed all the significant points of this vision.

## 4.5 A CHALLENGE WITHIN A CHALLENGE

We have seen how climate change is the greatest challenge humanity has faced so far: our very survival is at risk, and the sense of urgency to meet the 2030 and 2050 targets is growing. We said it many times before during this journey together: time is the critical factor we must address. The time element is linked to technology and innovation, which are the tools at our disposal to improve our efficiency, our decision making, our supply chains, our mobility, and ultimately our way of life. Technology and innovation are bringing a wide range of solutions to most, if not all, of the issues and problems that need to be solved in relation to climate change. These initiatives, projects, and applications arise from the efforts of many players in the ecosystem who are doing their best to keep up with the impressive evolution that technologies have had in recent times.

The complexity of the market is increasing, and often the transformation effort that many players are making has no clear horizon to look to: not only do we not have the time to build the culture of innovation, the resources, the skills through traditional tools, but we also do not have the vision of the destination to which we might go. The only option we have to manage the process is to use the technology collectively as a whole ecosystem.

What we have just described, Planet 3.0, is one of the possible options or hypotheses, and it is certain that if I say possible, I do not mean it will be at all easy. It would be a huge responsibility for the founding stakeholders and their task force to be able to pull off such a project. The path is very politically complex, both in conception and execution, probably more than I can imagine, and it would only make sense if we were all convinced that all these technologies could have a huge positive impact on climate change, and for us. I personally think so, but I don't think most of the decision makers in the green ecosystem clearly understand the technological context. I'm not blaming them. But I think it is the responsibility of the technology ecosystem to take the lead, with a different and new approach, not based on the same old rules of finance and profit, and in favor of the green ecosystem. This is an issue of political and existential relevance. Institutions, politicians, NGOs, and governments are driven by politics: being able to build something that is not owned by anyone is a real challenge to the way we, human beings, usually behave. We will discuss this in the conclusion of this book, for now let's just say that this is a discontinuity that humanity should address on many other issues. Here, I would like to focus more on the challenges of conceiving and executing Planet 3.0.

We have seen what the "Manifesto" should contain and the complexity of the complete design of the project with its evolution over time. What is important to understand is that the "manifesto," particularly regarding the governance model, is basically setting the ground rules; the concrete development of the structure will be done by the community, this is the effect of the progressive active participation of stakeholders and concerns governance but also services, interconnections between enterprises etc. Thus, ideational complexity is about creating the conditions for a

flexible but "safe" environment in which new connections, new ideas, new services, which cannot be fully foreseen or planned, can be born and grow.

Again, the conception must consider the rules for managing continuous innovation, as we can be sure that the technology talk, which we have been doing so far, will be outdated soon: we need to think of a system that can constantly reinvent itself while guaranteeing impartiality, equality, trust, transparency and so on to the market, and in doing so it must maintain absolute alignment with the mission.

The framework we have seen on the topic of governance is certainly the most critical level: we need to "drive centrally" to make things happen at the operational level and at the general decision-making or ethical level but, at the same time, we look to an active community that participates heavily in shaping this environment. Ideation means finding new models, but also defining limits, requirements, and regulations.

From this point of view, we know that the starting model will be modified, and will have to be modified, in the process and from the bottom up, with the definition of boundaries and rules. From a certain point of view, in our case, the "manifesto" is more than a "simple" project plan: it is a kind of real "constitution of the new environment." The different layers of DAOs we imagined earlier are "de facto" policy makers within their specific theme or function: we should therefore imagine from the beginning, if we want to give order to the platform ecosystem, to have defined models of DAOs, let's say, already structured or pre-designed with specific governance rules, with all the necessary smart contracts available and ready, which could be activated only by certain categories of stakeholders, with or without certain voting rights. The critical element of design is precisely to define how much should be centrally governed by the platform and how much freedom to leave to the different levels of governance. Excess in one direction or the other would kill the project. This is one reason why governance should be "released" in progressive stages, as we have envisioned, starting with more central control but also with the goal of progressively distributing decision-making power to the stakeholders of the DAO platform. In making this delicate argument, we cannot split off or forget the executive process altogether; the main reason is that anything we might design in the ideational or conceptual phase is strictly dependent on the technologies that enable the mechanisms. Whatever form of governance philosophers might think of for the future, and for the present in our case, it is inherently defined by the technology that underpins it. In our journey we have been clear in talking about blockchain and DAO, some might argue that this is not the only possible path, and I am sure there might be several technical issues to be addressed specifically about what might or might not be enabled by specific layers of technology. Also, in choosing a technology, for example blockchain, we face challenges in several areas, such as scalability, performance, security, etc., that impact what we might or might not do for governance: again, these constraints shift over time, defining the possible evolution of the governance layer. These interrelationships are many and not all predictable. What I want to emphasize is that these issues need to be addressed simultaneously with different perspectives, which I think we are not used to doing. These are perhaps the objections that would be made by presenting Planet 3.0 and

the platform that I think are all legitimate. In my opinion this is where we need to take a significant step forward: in the ability to collaborate and be aligned for the same mission beyond vertical interests. Finding solutions together. I'm not concerned about technological limitations or developments or the complexity of the platform, if we want to, we can certainly implement what I've described or even more, any technological problem can be managed and solved over time if we just wanted to.

Unfortunately, we cannot say the same for human beings and organizations. Here we face the real and enduring challenge of humanity. From this point of view, the only real challenge, in our ideal process, is departure, and that is why the idea is to involve key stakeholders progressively, but with a limited number of them at the beginning. We must build consensus progressively and dynamically. This is not only a rational process, but consensus is also influenced by various human emotions and mechanisms that are difficult to predict, often if not always, dependent on the attitude of a single decision maker who can influence the direction of an entire organization; fear, interests, culture, intuition, or myopia are just some of the variables to consider.

Having been working for more than thirty years in the field of digital innovation, I understand very well how difficult it is to explain innovative projects to people or decision makers within organizations, who usually lack a digital culture, are risk-averse, and, regardless of the fact that the project would bring incredible results, the decision-making process is often irrational. Losing control or letting someone else be in charge for most decision makers is tremendously difficult, because it means recognizing the other person's value and one's own weakness or incompetence; in a traditional business dynamic this means risk and potential loss of power. Very often the right choice for the system is not aligned with individual benefits, and all these aspects are implicitly but significantly underlying any decision-making process. If this is true for individuals, it is even more so for governments and nations, which must legitimately pursue the consensus of their citizens often as opposed to investment and support for international initiatives that might divert resources from domestic issues. This is nothing new, but it is a problem we must solve pragmatically if a project like this is to succeed. The effort and commitment of the founding partners is probably the challenge within the challenge we have. It is not the investment money, as more than 140 trillion will be invested in the green economy in the next few years, it is not the technology that, although complex, is always improving and evolving, it is not the model or the activities that in many cases have already been implemented, it is not the collaboration because, although without a shared platform to support it, it is something that all stakeholders are looking for. The challenge is being able to bring together the right leaders, companies and institutions that can build consensus on a global issue like this. It is the human challenge, to behave differently than in the past, to embrace technology and, more than anything else, to understand that only through different governance will we be able to best accelerate the climate challenge and technology together.

As humanity, we have shown with the COVID pandemic emergency that we are able to push much more innovation and research, through global collaboration, toward a single mission, in that case finding the vaccine: we were compelled to do

so by the compelling urgency that anyone felt by being confined at home or seeing parents and friends die. We were able to move quickly, to invest well in research, to engage billions of people to be vaccinated globally. That was a short-term urgency: we must be aware that for climate change the urgency is the same, but the problems will not be solved in the short term. That is why we must manage an infrastructural and continuous emergency in the years to come. The urgency is the new "normal" speed required. To use a metaphor: COVID was like running the hundred meters in the Olympics, a great effort of short duration: here we have five to ten years to run at the same speed as the hundred meters. That's why I believe the solution must be infrastructural, with a long-term vision and with committed and stable stakeholders. We need to find a new deal and a new balance between us, the technology, and the planet. But even more, today, we need a new story, a new dream for ourselves and for the possible future of humanity. No one can do it alone. No one can do it without technology.

Let me finally close this idea of Planet 3.0 with a couple of personal opinions that were important in the writing of this path and this book, before moving on to the final conclusions.

A first point is why I have not covered anything related to risks; the reason is that, in my view, the biggest risk of all is not doing enough. Complexity and innovations bring with them risks, and it is equally clear that climate change is "the risk" for all of us. In other words, this vision or project is a potentially powerful tool precisely for mitigating risks at different levels. By sharing technologies and assets in an efficient market and pushing innovation in the ecosystem we are reducing the risk of weather, by creating a governance framework we are reducing, in my view significantly, the risk of bad and uncoordinated decisions or activities: in conclusion we are reducing the risk of not being able to evolve and improve the way we live on this planet. I am fully aware that many specific "risks" might arise in the journey of building the platform, in the search for governance, in addressing ethical issues, in managing transparency and trust, and so on, but in my view, these are not real risks, but rather work to be done collectively. In recent months, for example, the discussion of AI risk has raised the attention of the world's media and governments; if we imagined that we already had our vision and platform, it would be an incredible and valuable environment in which AI, as with climate change applications, could be harnessed but also collectively controlled and trained in a trusted, profit-free, shared environment with ethical oversight. Wouldn't that be reassuring? Wouldn't it be something somehow necessary? My personal answer is yes. Overall, Planet 3.0 would reduce global risk on many aspects of the climate change ecosystem, at least from my perspective: it reduces investor risk, new business risk, unequal access risk, research and development risk, and even governance risk. Therefore, we come back to the notion that the biggest risk is not acting and not trying.

Here is my second point: if we want to act collectively, we must look for a solution that has to be a singularity, a disruptive approach, a new model, a new challenge

for us. This has been my attempt to describe Planet 3.0. We cannot rely on small incremental advances; we need something that can be a game changer. It is very realistic to predict that Planet 3.0, or whatever it is called, will never come to life: yet the dramatic problems and issues that humanity is facing have, today, in my view, no truly coordinated global interdisciplinary table where to set the long-term vision for both technology and climate change.

I am quite sure that one or perhaps more singularities will occur in the vertical technological application of climate and energy research, such as with hydrogen, nuclear fission, or other green energy sources. I might even think that in the long run the cost of green energy might tend to zero: if we are optimistic and if we align with the thinking of many scientists, this scenario might be possible. However, in my opinion, this would not solve problems such as the equitable distribution of resources, access to infrastructure investment, the issue of education, and so on. Most importantly, it would not give us the new governance models we need for our future. It is not enough for us to have green energy for a fee, we need to design the world and society in which we will live in the future, our lifestyles, our new patterns, our ambition and evolution as a species.

For me, from this perspective, the exercise done in thinking about this platform was fascinating and interesting. I thought it was worth sharing an insight that could perhaps help some thinking by people more relevant and influential than me. I just hope I have transferred my thinking correctly.

## 5. CONCLUSIONS

There has always existed a symbiotic link between man, technology, the environment, and the nature. These three elements have always gone together. In the late 19th century, when electricity became a mass-distributed technology, we began to change our behaviors, our lifestyles, and our pattern of society. Electricity enabled industries to work 24/7, employees began to track and manage continuous production, the daily routine of breakfast, lunch, and dinner shifted accordingly, streets, restaurants, and clubs expanded their offerings for now-lit nighttime activities, and even homes began to have more electricity-enabled services. We changed our lifestyles as economic rules about supply chains and efficient production cycles, thanks to technology, were setting new standards for companies that wanted to compete in the marketplace. Along with this revolution came new social tensions, and we reacted by trying to find trade-offs, as in the case of the regulation that came about between industries, new labor organizations, and governments on workers' contracts and rights. Electricity also created a divide between nations and economies and was one element that reshaped the world order of the century. This is just one example of the continuing evolution of the relationship between habits, social structure, and technology. The path that humanity has taken because of this link, especially in the last seventy years when we have experienced an unprecedented period of peace, is certainly a positive one. If we look at all the parameters normally used to describe the health of a nation, such as average age, new births and deaths, average income, average access to food, water, or education we have made impressive strides everywhere in the world. As a society, too, we have evolved, dealing with human rights that were unimaginable only in the last century, discussing inequalities, creating international bodies for governance, adjusting and evolving our financial infrastructure, and, if you will, finding a balance to manage the fear of atomic technology in the interest of all. Although, along this path, the gap between developed and undeveloped countries has widened further, this progress of humanity is a steady trend, interrupted only by major factors such as world wars, which is also incredibly accelerating in the last two centuries since new disruptive technologies are entering the market more and more frequently and with faster adoption. Some of the technologies we have used to improve humanity are vaccines, communication, mobility, agricultural techniques, efficient industrial production, progressive price reduction, and fossil energy. Fossil energy has fueled economic growth since the middle of the last century and enabled our current way of life, while creating a "debt" on our part to the environment that we unfortunately know we now face. From another point of view, fossil energy underpins the economic and financial markets of this century: it is around this issue that most geopolitical strategies are based, as we have observed recently with the Ukrainian war, the latest of many global-local struggles and wars where control of resources weights. The goals, structures and governing priorities of nations today are based on this pattern: for a nation, access to cheap energy means domestic growth, wealth and, ultimately, consensus for leaders and governments.

Yet, no one bears ultimate ethical responsibility for the debt we have generated to the environment.

In this relationship between humans, technology, and nature, we have had another major discontinuity with the advent of the Internet: the last thirty years have been one of incredible change with incredible speed. We all know what has happened: globalization of communication markets and infrastructure; disrupted industries, new entrances, new business models, the rise and consolidation of large technology companies; job losses and new hyper-demanding professions; an incredible wave of creativity enabled by technology; a radical change in our behaviors and social interactions; the growing relevance of technology as a new geopolitical territory; I think we could add more topics to the list. We have been overburdened by the changes and probably were not ready to absorb them so quickly; in fact, access to and understanding of technology is at the top of the daily agenda of every organization and individual, unless you are a digital business or a digital native. The challenges that these years have brought are very important for individuals, markets, societies, and humanity in general, where the discriminating element is access, skills, and understanding of technology. The digital literacy of individuals, companies, and societies was not ready and, to some extent, still is not. Some examples: individuals providing their data without real understanding; companies being disintermediated; companies failing to regulate and address issues in a timely manner. The combined effect of this evolutionary latency and the structure of our governance, both political and financial, has shaped the market as it is today, dominated by big tech, and has consequently also raised a great deal of existential questions about our relationship with technology, made even more urgent now with the recent discontinuity brought by artificial intelligence.

These past three decades have also been the years of awareness of another existential threat: climate. This awareness stems from humanity's journey, step by step and with very different starting points in different regions, toward greater ethical responsibility in the use and distribution of resources. We have seen how developed countries have taken the lead in driving climate change globally-this is a clear and positive sign of this awareness. The urgency of climate change has also prompted nations, governments, and associations to find forms of global collaboration to address adaptation and mitigation issues, another significant element in underscoring the growing need to find ways to collectively manage this problem: in my view we are having a good degree of success. At least in western countries, most of our habits have already changed and are still improving toward a more sustainable world; companies have plans to achieve zero emissions; several initiatives have been taken both on the ground and at the regulatory level. Yet, as we have seen, according to the most credible sources, we will not be able to achieve the goals we have set for 2030 and 2050; there is no global agreement with nations that have different positions; there is nothing like a clear vision of the environment in which we will live soon: we know that many things will change for sure, too late to prevent it, but we ignore the potential effects of our inability to achieve the goals we have set, which by the way should be considered minimum

goals. The existential question thus remains our future as humanity. We know that what we do today will shape our destiny to come.

Our journey started from the assumption that both existential questions, "us and technology" and "us on the planet," could have the same answer. We tried to connect the dots, to put it this way, starting from experiences and what we all have, or should have, learned from these last few years of technological and digital evolution, and possibly giving a vision for the future.

We have learned, for example, that technologies have side effects. Just as the nuclear bomb had long-lasting effects after its explosion, we are just now processing the impacts of the digital revolution of recent years. Beyond the specific application of a technology, we now understand how this hyper-connectedness is changing our entire way of life, but it is also generating wider gaps between generations, countries and technological literacy, something that has a dramatic impact on society. We may or may not be happy with the shape that the Internet has given to society to date, and as we said in the book's introduction, many thought leaders are simply frustrated by a picture of the digital marketplace that is honestly far from initial expectations and visions. There is nothing we can do about this, no more. We can only look to the future to improve this scenario.

We have learned about the power of technology ecosystems and platforms. Indeed, the Darwinian evolution of recent years has enshrined the success of scale and critical mass as key drivers of economics and business models; technology wants to be fueled by massive amounts of data and interactions; marketplaces must match supply and demand as leaders if they are not to shut down; and the typical gravitational effects of platforms, which we have talked about, are now a survival element to be considered for any technology start-up. I think we have understood how the barriers that platforms have been able to build in their respective segments are so high that it is hard to imagine a different shape of the market today and in the short term. We have seen how these platforms have become so pervasive and how they are fundamentally the operating system of the world of today, not only in terms of their size and influence, which is individually comparable to that of a nation, but in fact for every tool we use in our social or work lives. The role of large technology companies is now so significant that it is difficult to consider them as just ordinary companies; they are a new category of actors, a new specie, that has arisen in the last two or three decades. When we are concerned about technology, we are mostly not concerned about the technology itself, but about how it is managed and who will use it: on this today we basically rely on these platforms and their ethical and privacy statements.

As a result, we have, or should have, learned about the limits of our governance model, which is no longer adequate to the challenges that technology imposes. In these days and weeks, we talk about Artificial Intelligence and how to limit the risks it might pose, and well I am not happy to say that it is already late: whatever, whoever and wherever a decision is made for the global interest, someone else will not follow it, will not limit their technological superpowers. We should have learned that this model no longer works, it is not enough, and that if we do not find alternatives our future will be forever conflicted and polarized.

We should have learned, and replicate more and more, that the power of collaboration and cooperation enabled by technology is an extraordinary tool and way to achieve results for global issues. What we achieved from this perspective as humanity during the COVID pandemic should not be underestimated, both in terms of what was done in collaborative research for the vaccine and the overall cooperative behavior of citizens. During that time, we tested and proved to ourselves, companies, and society that we could work and collaborate remotely, that we could learn remotely, that we could also socialize remotely, that lifestyles and jobs other than nine-to-five office work are now available and sought after. We must thank technology and digital infrastructure and penetration if Covid has not stopped the world much longer.

In recent years we should also have learned the power of distributed creativity and innovation. Not only are technologies helping each other to achieve new things—think, for example, of all the developments in artificial intelligence that have been made possible by graphics processing technologies originally only functional to the gaming industry: but technologies are also enabling us to execute, create, and innovate. Innovation is more accessible than ever before, and the speed of adoption has been pushed to near real-time. Small groups or even individuals with the right skills are now able to use technology to innovate or create new activities, new tools or solutions, to attract audiences and directly monetize their work. We cannot ignore that this is a value and perhaps one of the most important pillars on which we can build our evolution as a society, collective intelligence.

Finally, we should have learned that we need continuous learning and education in any field, as individuals and as professionals, and on both technology and climate. Only with continuous learning will we be able to cope with the speed that technology imposes on us; only with education will we be able to help undeveloped countries participate; only with education will we be able to lay the cultural foundation for the coming decades. Whatever an individual's role in the future, education will be his or her most important asset. That said, looking at the marketplace with a digital perspective, education and technology culture is a sore point: our generation of leaders, policy makers, decision makers, managers, teachers, and parents is not prepared for what is coming from an anthropological, strategic, operational, and cultural perspective. I know this is a bold statement: but let me say that I am not prepared myself, even though I have been working in digital since 1995, have always tried to keep up to date, have read everything I can, even though I write books and have an open and curious attitude. It is a challenge for everyone to be as prepared as possible. Motivation and mass involvement, as we have seen, are not easy to achieve. If these are the most important lessons of the digital age, so to speak, we need to build our future vision on these lessons constructively and consistently. We need to be bold and smart enough to transform these lessons into the governance model and plans to capitalize on the incredible opportunities that technology is offering us: we need technology to do that.

We can't stop the exponential progress of technology, and we can't stop in a day the damage we have done to the planet: two perfect storms are bearing down on

us at the same time: it's inevitable, and it's coming now; all we can do is surf the waves as best we can and hope for the best. In the meantime, we are using the same old methods of governance, the usual market and investment logic and tools, the traditional educational approach, and so on.

Regarding climate, we have seen how new instruments, such as ESG criteria, are encountering major challenges; we have problems financing undeveloped countries for both uncertain or low returns and long-term infrastructure projects; we have fragmented and limited impact of current initiatives. It could not be otherwise; we might reasonably think. I think we should look at what we could do differently and better.

In our journey together we looked at gaming, blockchain, education, and artificial intelligence first as stand-alone technologies with their own specific characteristics and impacts; then we looked at the actual applications of these technologies to the climate challenge, where initiatives and experiments are many, most of them interesting, creative, and proactive. We considered the limitations of these applications and what the opportunities are to leverage these technologies more, but over the course of this journey it became increasingly clear that whatever the project, governance is the most difficult of challenges. The hopefully stimulating temptation to envision a project like Planet 3.0 goes precisely in this direction. As we have seen Planet 3.0 is a new entity, proposing a new environment, with a different model of governance and a new balance among different stakeholders: it is a singularity from today's reality. More than anything else, it is a call to action for technology leaders, large companies, and institutions, since, in my limited view, I have not seen anyone proactively trying to propose the disruptive approach needed to address both technology and climate governance. Regarding governance, several philosophers and thought leaders, as we mentioned in the introduction on technology, are giving ideas on possible requirements, but this is anything but practical; we cannot change the global order and move, as a society and humanity, toward a more efficient and equitable form of governance, in the short or long term, unless we start from a different perspective. While the role of institutions and regulators is obvious, an extra step should be taken, in my opinion, by technology companies: they really have to take the responsibility and the burden, rewarded, of driving technology and innovation for the common goal: they certainly work for profit, consistent with shareholder objectives, yet the positive impact they could make, in general and specifically on climate change or in a project like Planet 3.0, would be immense and would contribute enormously to rebalancing our relationship with technology and climate as well. Large technology companies, as we have said, have a larger role, willy-nilly, than just being profitable; they are mastering and managing most of our future through their know-how, data, algorithms, services, and infrastructure: in my opinion, if they were also partly social entities, much more than they are now, we should not be so concerned about their influence and the ethical use of the power they have. They would have an opportunity to change the paradigm: a project like Planet 3.0 would not jeopardize the revenues of the big techs; in fact, it would potentially provide them with an opportunity to have a "political" voice

on climate and to exploit, like others, the platform to monetize their services or their data. Recall that the addressable market for the green economy is simply enormous.

Imagining and applying a new governance model for a new entity, even if it were real and at scale, would still be an experiment: for it is clear that something like Planet 3.0 could not be, in the short term, "the model" or "the platform" where regulations happen, except internally; but it could be a place where regulations could be tested, discussed, and deployed; it could be a place where all stakeholders have a voice and a right to vote, but for platform rules and not for politics; it could be a place where trust, transparency, and direct involvement of citizens and businesses could make a difference. Planet 3.0 in summary is a proposal for an anthropological experiment on our technological evolution applied to the biggest problem we have, climate; it would also be a social experiment because of the different forms of governance that could arise from below through the Dao mechanism. But this experiment would take place in a coordinated, collaborative, regulated, trusted, transparent and defined environment that is surely much better, in my opinion, than a disjointed, fragmented, unbalanced and mostly traditional environment. Collective and interdisciplinary intelligence is the resource we can really try to activate through something like Planet 3.0. The question is: Are we smart enough? Are we capable of understanding? Or should we think that humanity is so foolish and stupid as to let the world burn without using what is available? Are we stupid enough to let it happen? The Netflix movie "Don't look up" comes to mind: yes, most likely the answer is yes, we can just let it happen and that's how it will be if we don't interrupt, if we don't innovate, if we don't evolve: it will just happen. I'm not crazy enough to think that such a project could save us all, but I think the contribution to the climate challenge ecosystem would be significant and would help us grow as a society.

Before I put an end to this journey, let me share a couple of personal reflections that came to mind as I wrote over the past few weeks.

I realize that my view of technology has a positive connotation that might seem enthusiastic at times, but it is not. Perhaps, my 30 years of exposure and involvement in the digital business has generated an overload and a consequent sort of revulsion for an always-on lifestyle, social media "streams," in general the experience that the Internet offers me as a user today; however, my history and attitude are toward innovation, which is the virtual space where technology meets anthropology, society, creativity, and business. Most of the time, innovating means doing the same things as before but in a different way: from this perspective, looking at all the climate experiences we have described, I have seen or sensed the presence of many innovators, but with lack of tools and within organizations that are not quite ready, as we have said too many times. Whatever the innovation, it needs a proper ecosystem to grow and bear fruit: this is one reason why in our case the way to accelerate is an ecosystem framework. This is in some ways a practical argument that could be addressed even without the complexity of the new governance model: my point is that the real innovation and discontinuity factor in our whole discussion would only and fundamentally be the governance formula. Let me say that even though AI and blockchain are breaking

points in technological evolution, we can expect to have many more of these discontinuities in the coming years. The governance formula should therefore live and evolve along with the available technologies and should incorporate our shared vision, rules and objectives, and all the necessary controls from different stakeholders. It is a dynamic and evolving governance formula, to be found collectively.

The last personal reflection concerns my understanding of the climate challenge. I learned a lot during this work; I was not aware of many of the climate issues, and, with some exceptions, I was not even familiar with many of the institutions and initiatives that were in the market. I tried to approach the topic by reading and observing, sometimes disorganized, reliable sources and personalities, but mostly I tried to understand the ecosystem from different perspectives, stakeholders, technology, finance, policy, regulations. My real focus was not climate change itself, but its ecosystem, and the discovery is that there is no real ecosystem yet, at least for what we have described so far. But there is also a multitude of micro contexts that we should probably call ecosystems, which are very vertical, too small, or too specific to be meaningfully relevant today; in my view they are seeds and evidence of the path we are naturally taking to deal with climate change. From this point of view, we must imagine an ecosystem composed of many smaller ecosystems, all interconnected and using the same standards, rules and services. I think we could be much more effective in the challenge if we created ecosystems instead of giving subsidies, especially in undeveloped countries.

I thank you reader for following me this far, I hope the journey has been useful, interesting, and perhaps inspiring; if you would like to consider this book as a "message in a bottle" with my small and limited contribution to share.

End.