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In Times of Climate Change

Like other socially responsible managers, for some time now we have been setting our minds to issues related to the ESG (environmental, social, and corporate governance) aspects of our investments. Our value investing tradition means we're interested in all matters that could have a material impact on our portfolio companies. Generally, these subjects are confined to sectoral dynamics or concern the internal organization of companies. Sometimes important issues originate in more distant orbits and from there trigger effects that cascade downstream. Therefore, in order to understand their "fundamental" reasons, we need to investigate further. The "E" in ESG, by its nature, constitutes a global, planetary theme, the discussion/resolution of which takes place primarily in "atmospheres" outside companies and thence radiates throughout the fabric of business and enterprise segments.

This Report (and the next one too) reflect our effort to follow and seek to understand at the frontier phenomena that will be increasingly present in Board agendas and Management decisions. The risky journey — outside the comfort zone of our circle of competencies — is justified under the premise that such understandings bring relevant benefits as they start to guide our tactical movements in our interaction with companies and in the management of our portfolio.

As we will see below, the environmental issue has become urgent, even if its consequences are perceived to be spread over a lengthy period. On the other hand, in the global agenda to work in concert, the actions necessary to address the problem already have important short-term repercussions on the competitiveness of companies. Hence the gradual nature of the implementation of regulatory initiatives. In our collaborative approach with companies, we need to steer a course that avoids fostering lethargic insensitivity and at the same time does not encourage premature voluntarism, the one without substance. Calibration errors on both sides could have unwanted repercussions. As we will see in more detail below, the challenge of the time dimension lurks behind every nook and cranny of the climate issue.

From all appearances, we seem to have entered a period of climate emergency. Recent reports (IPCC, 2021 and 2022)[1] compiling 34,000 scientific studies concluded that human action, in an "unequivocal" and "unprecedented" manner, has been causing warming and rapid changes in the atmosphere, oceans, and surface of the planet. Carbon dioxide (CO_2) concentrations the atmosphere are at levels not seen in 800,000 years, with a clear uptick since the middle of the last century. CO_2 levels need to be limited in order to contain the increase in temperature of the planet to a maximum of 1.5 °C. Otherwise, we

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1 *As usual, in order to make the text more fluid, we're keeping citations short. The complete references for the material we've consulted for this and the next Report can be found on our website, in the library menu, at* https://www.dynamo.com.br/pt/biblioteca.

We also opted to keep most of the acronyms in English. The Intergovernmental Panel on Climate Change (IPCC) mentioned in some passages is the United Nations body responsible for climate issues; many consider IPCC to be the highest technical/scientific authority on the subject.

will have to live with a higher incidence of extreme climate events. The consequences, especially for the most vulnerable populations, would be dramatic. It is estimated that between 3.3 and 3.6 billion people live in areas highly vulnerable to climate change. Looking forward to the end of the century, hundreds of millions of individuals may be forced to relocate (IPCC, 2022); and some 23% of global GDP would be compromised (Burke & Hsiang, 2015), with projections of more than nine million climate-related deaths/year (IPCC, 2022). The effects on biodiversity are also grim: projections of more acidic scenarios indicate that 49% of insects, 44% of plants, and 26% of vertebrates could lose more than 50% of their natural habitats (Warren et al., 2018). According to experts, in view of the gravity of the situation, we need to act urgently.

In 1972, Stockholm hosted the first United Nations international conference on issues related to the environment. At the time, the main concern was conservation of the planet's natural resources. The meeting, which was attended by 114 countries, produced a manifesto with recommendations on the more rational use of the Earth's finite resources and suggested the creation of a global environmental governance. In 1979, the World Meteorological Organization gathered experts in Geneva to discuss climate issues. In 1985, the Vienna Convention was held and, in 1987, the Montreal Protocol on the ozone layer. In 1988, the UN General Assembly passed a resolution calling on governments to engage with the climate issue — "a common concern of humankind." In 1990, the first IPCC report was published. At Rio-92, important documents were drafted, such as the Earth Summit (Rio Declaration), Agenda 21, and the Convention on Biological Diversity, reflecting the maturity of the discussions on the sustainability of the Planet's ecosystems. In 1995, Berlin hosted the first COP (Conference of the Parties) under the United Nations Framework Convention on Climate Change (UNFCCC), which has since become the main global forum for discussing climate issues. Since then, there have been 26 meetings, the last one in Glasgow in November 2021.

The Conferences produced a vast volume of documents, resolutions, recommendations, guidelines, and principles, in addition to bringing together over decades a large contingent of diplomats, politicians, heads of state, scientists, and academics. In addition to the official delegations, the Conferences attracted a wide ecosystem of stakeholders, public and private managers, shareholders and executives, media professionals, financial agents, educators, academics, and various representatives of civil society. Countless technical associations, NGOs, think tanks, research institutes, and public and private entities have been dedicating time and resources to understanding and monitoring the impacts of human activity on the Planet's natural resources. Yet, despite all this prolonged effort, here we are at the edge of the climate precipice.

If the diagnosis of urgency is correct (and the evidence suggests that it is) a transformation agenda needs to be deployed, with a broad scope of action in dimensions such as formulation of public policies, regulatory requirements, international trade rules, and mobilization of public and private resources. Of course, all of this will have obvious repercussions on the competitive dynamics between and within sectors. In parallel, the growing understanding of the sensitivity and urgency of climate issues moves consumer values, voter choices, and employee preferences, demanding enormous inventiveness and adaptability from companies. Some businesses will be more exposed, such as those directly involved with the energy transition issue; however, no one will come out unscathed. Hence our interest in broaching the subject.

Besides being of fundamental moment, the topic of climate permeates through numerous circuits. But we did not achieve the desired degree of conciseness. The text became too long, and we decided to divide it into two Reports. Before daring to infer any conclusions about an uncertain future, which is only beginning to take shape, let us take a step back in order to understand the context of how we got here. In this Report we deal with an intriguing observation:

why, despite the fact that climate issues have been on the agenda of global discussions for so many decades, involving such a large number of leaders and opinion makers, have we reached this delimiting, acute, and unpostponable situation? How did we let a problem that has been known and articulated for so long become chronic? How to explain so much interest and discussion and, at the same time, so little in the way of effective resolution?

Having set the context, the following Report seeks to answer the questions that naturally follow: How can we make up for lost time and move forward with the necessary transformations? Is there a design for a more pressing and recommendable public policy? If so, when implemented, what repercussions would we see in the business environment? How would the competitiveness of companies under our radar be affected? What role does an active shareholder play in the companies they invest in, like Dynamo?

While the issue is not new, we do recognize that it has awakened to our investment agenda relatively recently. We are at the beginning of our knowledge journey, in a way trying to catch up and dedicating time to these issues that we believe will be increasingly relevant for companies and investors, especially those who are, like us, connected to the long-term fundamentals of business. Naturally, we intend to adjust our portfolio as we build more conviction. So, let us venture out to meet the challenge of seeking answers to the dilemmas we have set forth above. Our internal reflections and discussions suggest that we address the first conundrum from two complementary perspectives.

Complexity

The first line of response considers the nature of the problem. Environmental processes are governed by their own characteristics. These are non-linear, cumulative phenomena, which self-feed and propagate, and are silent, invisible, and irreversible. They feature hotspots, sudden thresholds of phase transition, regions that trigger instability and experience acute changes in behavior, characterized by rapid and unanticipated discontinuities. Indeed, no one sees the tons of greenhouse gases that are accumulating in the atmosphere. Nor do they see the loss of biodiversity of natural ecosystems. They are subliminal processes that escape our everyday gaze. And they end up being left out of our daily agenda of priorities, battled against by seemingly "more pressing" and visible resolutions. However, today there is no longer any doubt that the gases that have been accumulating in the atmosphere for decades and decades increase the temperature of the earth and the oceans. The initial effects of warming are amplified by feedback mechanisms triggering various phenomena such as the collapse of polar layers and changes in ocean circulation, whose changes cause, among other effects, an increase in the frequency and intensity of hurricanes and increases in the speed of species extinction. And so, climate consists of an "emergent property" of innumerable complex subsystems that dynamically interact within various space-time scales.

Some examples can illustrate the non-linear nature of climate phenomena. According to the IPCC (2021 and 2022), the extreme temperature events that would occur every fifty years in the pre-industrial period would occur every five years and eight months if we move towards a 1.5 °C increase in the planet's temperature. If we go to 2 °C, the frequency will increase to every three years and seven months, and in the case of 4 °C we would have an extreme temperature event every fifteen months. Likewise, it is estimated that the total area of protected land on the planet that could be affected by changes in ecosystems when exposed to a two-degree Celsius temperature increase is 13%. If the increase is 1.5 °C, the size of the region affected would be 6.5%. Thus, a difference of "only" 0.5 °C would be able to reduce the extent of the problem by half. Furthermore, it is estimated that the risk of biodiversity extinction in a scenario in which the temperature rises from 1.5 °C to 3 °C increases tenfold. In other words, 'marginal'

variations in temperature produce exponential effects on ecosystems.

The fundamentals of the processes governing planetary warming began to be understood exactly two centuries ago. In 1822, Joseph Fourier published *The Analytic Theory of Heat*, whose mathematical elements used in research on thermal propagation inspired his studies on the Earth's temperature. Fourier found that our planet was warmer than should be expected if the only source of warming was solar radiation. In a pioneering way, the versatile mathematician conjectured that the atmosphere could cause this insulating effect. It was the Irish physicist John Tyndall in the 1860s who proved that the warming of the Earth's surface occurred due to the absorption of infrared rays in the atmosphere, thus establishing the empirical and quantitative basis of the science of greenhouse gas behavior. Through tireless experiments, Tyndall measured the thermal radiation absorption capacity of different gases, including carbon dioxide (CO_2). Then, at the turn of the century, another definitive step. Enter on scene Svante Arrehenius, a scientist ahead of his time and an interdisciplinary mind who made major contributions in many areas, from electrochemistry to radiation physics, from the molecule to the universe. Arrehenius described with remarkable accuracy how variations in atmospheric composition caused by a molecule with very low concentration such as CO_2 could affect the temperature of the planet; indeed, he was recognized as the first scientist to conclude that emissions caused by human activities would be important enough to cause warming of the planet (Krauss, 2019).

Since then, there has been remarkable progress in understanding the way in which matter and energy from the various elements that make up the climate interact. Fluctuations in temperatures, topographic differences, vegetation patterns, winds, ocean currents, glacier movements, water vapor transport, and solar radiation incidence had their dynamics deciphered and described in differential equations that feed the simulations of sophisticated general circulation models (GCMs). These contain up to a million lines of code. Despite the brutal complexity involved due to the interaction and self-feeding of these various elements, the models have proven to be quite faithful to reality, thanks to the extraordinary advance in processing capacity and memory of supercomputers, which are able to perform the fourteen trillion calculations per second required. More accurate calibration of the models has also decreased the uncertainty spectrum. For example, the best estimates of climate sensitivity (i.e., what happens to the planet's temperature when Anthropocene emissions double) which ranged from 1.5 °C to 4.5 °C, recently saw their range reduced to 2.5 °C to 4 °C (IPCC, 2021). This shows a significant advance when we›re reminded that 0.5 °C makes a significant difference. If the mechanics of physical and chemical processes are increasingly domesticated, the same cannot be said of the impacts of climate change because here, behavioral, economic, and social elements interfere, thus generating a considerable increase in uncertainty (Pindyck, 2021). Still, increasing confidence in the models has authorized the IPCC (the recognized spokesperson of the science that interests us) to employ for the first time such incisive language to describe the effects of human activity on the planet.

Typically, the characteristics of natural phenomena are attributes of complex adaptive systems. They are silent, non-linear processes that accumulate, forming critical regions and frontiers of regime change. Hence the "surprise" at the increased frequency and intensity of extreme natural phenomena. Intense droughts, unprecedented floods, and record temperatures are emerging properties of these systems and make headline news daily. The naked eye does not perceive the critical accumulation until the system collapses into catastrophes, which are then, well, noticeable. This same pattern that governs the climate also governs the ecosystems of the biosphere. It is already known that the resilience of biomes has critical limits beyond which the balance of network relationships collapses irreversibly.

A typical example is the trends in tropical forest degradation. Hence the enormous concern with the advancing deforestation in the Amazon, whose "savannization" process is no longer a hypothesis, but a real threat (Nobre, 2021).

Climate change and biodiversity loss are the Siamese sisters of the environmental problem. It is known that species adapt to optimal temperature ranges. In general, the more complex they are, the more exposed they become to variations in climate conditions. At the same time, terrestrial and aquatic ecosystems are responsible for capturing about 50% of the planet's CO_2. The threat to the survival of species compromises the absorption capacity of greenhouse gases, which is likely to lead to an even greater rise in temperature. Climate affects biodiversity, which in turn interferes with climate. Additionally, human responses to the impacts resulting from these events trigger new incidences and unexpected knock-on effects. The three systems — climate, ecology, and human behavior — interact at various scales of time and space, creating a dynamic, self-reinforcing spiral whose intertwined effects are exponential.

In these two Reports, we chose to focus on the climate issue, where the manifestations of "emerging phenomena" — storms, droughts, typhoons, hurricanes — are most evident, and especially because several companies that make up our portfolio are already implementing initiatives and adaptation strategies. Our understanding at Dynamo is that the most robust responses to environmental problems require initiatives that work on all three fronts (climatic, ecological, and social) concurrently. Not coincidentally, as we will see at the end of the next Report, we are after investment opportunities that contemplate or intend to contemplate more "systemic" solutions, compatible with the complex nature of the issue.

Complex systems challenge our way of thinking and perceiving the world with the naked eye. Computer models and satellite images enable us to "see" the tons of carbon dioxide equivalent in the atmosphere and measure the extinction of species of animals, plants, and microorganisms that sustain ecosystems. But this is non-obvious knowledge that requires a minimum level of access to information. Such phenomena need reflection, science, and proper instruments to be admitted.

Collective Action

The second element of the answer, which helps explain the difficulty of addressing environmental problems and climate change, in particular, is that it is a problem of global collective action on several time scales. Collective action problems typically involve common resources, or public goods, which have two striking features: they are non-rivalrous (because consumption by one individual does not reduce availability for others) and they are non-excludable (because it is not possible to prevent one individual from benefiting from the availability of the good). The efficient production of public goods requires collective action to overcome the inability of private agents to capture the benefits of this supply.

A collective action problem is typically a situation in which a personal initiative brings more benefits than costs to the individual while becoming more costly than beneficial to society. Or, put another way, it happens when the short-term interest of the individual conflicts with the long-term goals of collectivity, generating substantial risks so that the social benefit is not produced. This social dilemma produces a condition known as the tragedy of the commons, as individuals acting in their own self-interest deplete shared common resources to the detriment of the best collective use, thus producing negative externalities for others. And so, from a supply perspective, a non-excludable good generates a situation in which the cost of production is private and the benefit public. From the perspective of demand, a non-rival good creates a situation in which the benefit of consumption is private and the cost public.

The Earth's atmosphere is a global common good because it is indivisibly distributed throughout

the planet. On the other hand, the emission of greenhouse gases is a negative externality since those who produce the emission do not pay for this privilege, and those who are harmed are not compensated for it. Additionally, those who want to neutralize the negative effect of emissions will incur the full costs and realize benefits that are highly diluted. Under an individualistic logic, because it is so costly to internalize the benefit of mitigation strategies, the incentive to get a free ride on the efforts of others prevails. In the personal calculation, better to let others take care of the collective interest. If everyone thinks this way, no one avoids/neutralizes emissions and the tragedy of the commons sets in. Additionally, as the gases accumulate in the atmosphere for decades and even hundreds of years, the externality occurs not only among the participants today but is transferred to future generations.

The issue of climate change presents itself as a "problem of the commons" with a unique scale and complexity. The possibility of coordinated action among nearly two hundred countries appears challenging. Since the perceived effect of emissions is planetary warming, an additional ton of carbon equivalent reaches the atmosphere unsigned. Emitted by anyone, perceived by all. At the same time, historical emissions are known, and because they are cumulative, they have memory. In the Anthropocene era, energy intensity and economic development became synonymous. Whoever grew GDP the most emitted the most. Whoever accumulated the most productive capital, depleted the most natural capital. At the climate negotiation tables, which bring together countries with per-capita income ranging from US$ 600 to over US$ 100,000, on one side sit those who have emitted and developed, and on the other those who believe they need to emit in order to develop. To make matters worse, the effects of climate change are also disproportionately distributed. Small Island states have emitted little and will be hard hit. The great emitting powers should feel proportionally less. Russia and Canada might benefit.

Asymmetries in wealth and past emissions continue to generate tensions. At the last Conference of the Parties in Glasgow (COP-26), the negotiations were moving towards an agreement to ban coal as a source of thermal energy. At the end of the day, India's environment minister suggested a more gradual change, saying, "How can anyone expect developing countries to make promises about eliminating coal and fossil fuel subsidies? Developing countries still have to deal with their poverty reduction agendas".

The Indian representative's statement subtly telegraphs a message to the developed countries that have failed in their 2009 commitment to provide resources to help the energy transition of the poorest bloc. Without financial counterparts, it is reasonable for less dynamic economies to realize that reducing emissions alone would result in an increase in the cost of a strategic input that resides at the base of the economic gear. Under this view, decarbonization efforts may imply in the short term a loss of competitiveness, a drop in disposable income, unemployment in certain sectors, low allocative efficiency, and even a reduction in social welfare, since consumption today would be sacrificed to finance green investment. Not to mention the possibility of the so-called "carbon leakage," when "brown" production moves abroad to less environmentally compromised countries. Since the costs are present and local, and the benefits distant and diluted, the geographic and temporal dimensions of the climate problem tend to lead to inertia. Hence, the solution to the climate problem must necessarily undergo a coordinated and cooperative collective action among countries, as we will see below. Narrow self-interest cannot unravel this knot.

Additionally, the distant nature of payoffs does not matter to the political game with its ever-shrinking horizon. If one of the features of modern democracy is not knowing how to deal with generational trade-offs, it is understandable why the environmental agenda does not find adequate space in the priorities of public policies. There is a vast literature of empirical

studies that explains climate treaty negotiations in light of participants' political interests: from the perspective of reelection concerns, it's better to signal some participation in vague agreements with low levels of commitment and weak enforcement than simply not to participate (cf. Battaglini & Harstad, 2016). The result is a raft of announcements of agreements, with little subsequent effective action. Diplomacy ends up being captured by the supposed "national interest" and political opportunism. Or country-level greenwashing.

Because the activities that originate emissions are spread everywhere — energy, industry, transportation, construction, agriculture, livestock, land use in general — there are many jurisdictions and regulatory bodies that oversee them, whether at the international, national, regional, or local level. There are also numerous supranational institutions that address the issue (UNFCCC, UNEP, CSD, FAO, WHO, WMO, WB), albeit each with its own distinct mandate, objectives, competencies, and practices. Under this multi-layered arrangement, it is common for blind spots to appear (i.e., incomplete coverage and limited accountability), thus hindering governance and preventing proper coordination. The problem is exacerbated by the principle of national sovereignty, which imposes safeguards on the ability of citizens to be reached by international institutions.

The larger the group, the more challenging it becomes to solve a collective action problem. Thus, there are more interests to reconcile; transaction costs increase; and negotiations fall victim to the so-called "law of the least ambitious," where the commitment level of the least interested party ends up limiting the effectiveness of an international agreement (cf. Esty & Moffa, 2019).

The Conventions

Given the complexity of the elements, the multiplicity of actors involved, and the dispersed interests, it is unsurprising that the trajectory of climate conciliation has been so sinuous. A look at the long history of conferences shows searches for alternative paths, hard-fought progress, and forced returns. At first, a top-down approach was sought, where the COP-3, which adopted the Kyoto Protocol (1997), stood out as the main reference. In Kyoto, an agreement was reached where industrialized countries committed to an average 5% emissions reduction (1990 base year) for the 2008-12 budget. Commitment by developing countries would be voluntary. An international carbon offset scheme, the Clean Development Mechanism (CDM), was also inaugurated to provide greater flexibility in meeting targets. On paper, the obligations would be "legally binding." In practice, things didn't turn out that way. There were no sanctions, and important definitions about future commitments were left open. A negotiating chasm was created between the two blocks. Then, the United States and Canada left the agreement. Further down the road, Japan and Russia failed to deliver on their targets — without any punishment or formal repercussions for either party.

At COP-15 in Copenhagen (2009), a new arrangement was established: this time bottom-up, from which it would be up to countries to define their mitigation pledges on a voluntary and transparent basis. Copenhagen did bring some interesting news: the recognition of the scientific view that the increase in global temperature had to be limited to up to 2 °C and the creation of the Climate Fund (reflecting the financial promises of the developed countries to disburse USD 100 billion/year to help the efforts of developing countries). But the agreement failed badly, being rejected at the convention which merely "took notes" of the proposals without any formal implications.

In Paris (COP-21, 2015), a warming goal of "well below 2 °C" was set, preferably to 1.5 °C above pre-industrial levels. The pledges would be the so-called «Nationally Determined Contributions» (NDCs), designed two years earlier in Warsaw. NDCs are set by the countries themselves with expectations of periodic progressions, updated every five years, a

mechanism known as "pledge and review.» Despite the status of «legally binding» mitigation obligations, in practice, these are "conduct" obligations rather than "results" obligations. They are procedural, not enforceable, as they represent unilateral proposals by member countries rather than collectively agreed-upon goals. According to advocates, for practical purposes, all this makes them weak links (cf. Bodansky & Rajamani and Wewerinke-Singh & Doebbler, 2016).

The understanding behind the design of the Paris convention is that each country can see its own interest in participating in something so important for the future of the planet, regardless of what others do. Under the scope of a sovereign decision, there would be a global benefit from acting on the premise that others would do the same. And so, since there are no sanctions or enforcement, it is all about expectations. The central idea is that a change in mentality and expectations would be enough to drive initiatives and thus transform reality (cf. Tubiana, 2021). The basic premise is that the most committed countries could spur the adoption of the others, generating a ratchet mechanism and producing a self-fulfilling prophecy toward a more sustainable world, net zero if possible, by 2050.

The Accord has gained almost universal acceptance. One year after the convention, countries representing 99% of global emissions had released their NDCs. However, the aggregate contributions, even if strictly adhered to, have never set the planet on a course for the desired temperature goal. Additionally, the well-known problems of indiscipline remain. Once again, the United States pulls out of the Agreement by decision of the Trump administration.

The last COP, the 26th, was held in Glasgow in November 2021. There was a lot of expectation since the IPCC's sixth report, published only three months earlier, echoed a cry of warning from science with dire projections for the planet if we do not take urgent effective action. Glasgow brought some noteworthy results: (i) definitions of the rule book that were still open from Paris, mainly in relation to Article 6, providing for the global carbon market; (ii) restrictions on the supply of coal and subsidies for fossil fuels; (iii) announcements of unprecedented voluntary commitments, such as pledges to reduce methane emissions and halt/reverse deforestation; (iv) intention of unprecedented cooperation between the United States and China; (v) active participation of the financial system; (vi) involvement of civil society.

This last aspect deserves a separate note. Glasgow saw an unprecedented mobilization of diverse segments of civil society. More than setting a record for the number of participants among all other conferences, this fact signals a major phenomenon that promises to usher in a new stage in the history of climate talks. With the growing involvement of civil society, discussions on climate change are now part of the daily lives of citizens, consumers, and voters, who, in turn, exert greater pressure on companies, media, financial agents, governments, and legislative bodies, with repercussions on diplomacy itself. This decentralized, bottom-up movement is designed as a fundamental ally for the advancement of the environmental and climate agenda.

Following the example of the evaluations of past Conferences where the most optimistic highlight advances, the skeptical harbor doubts. The coal ban lost momentum at the last minute, exposing — in the words of the Secretary-General — the "contradictions" of political wills in today's world. Critics point out that the agreements are about future goals, without specific commitments as to their implementation. Likewise, the announcement of cooperation between the two major powers came without the backing of concrete measures. Additionally, important commitments, such as the coal commitment, have not been signed by the five largest emitters. Calculations based on the NDCs already updated, if delivered in their entirety, point to a 68% probability of temperature increase between 1.9 °C and 3 °C, with a median of 2.4 °C, that is, well above

the necessary 1.5 °C level. Taking 2019 as a base year, we would have to reduce annual emissions from 56 Gton CO_2/year to somewhere around 25 Gton. The reduction implied by the updated NDCs amounts to only 4 Gton.

Similarly, from another angle, a recent study (Ou et al., 2021) signed by researchers at the University of Maryland in partnership with the U.S. Department of Energy's Northwest Laboratory estimates, based on the commitments of the countries in Paris, that the chances of managing to limit global warming to 2 °C or 1.5 °C at the end of this century would be 8% and 0%, respectively. Updating the Glasgow NDCs, assuming they would be met in full, the same calculation estimates that the chances increase to 34% (2 °C) and 1.5% (1.5 °C). Finally, considering the other agreements signed in Glasgow and assuming that countries will present even more ambitious pledges after 2030, the chances increase to 60% for the 2 °C target and 11% for the 1.5 °C. In other words, the results admit a wide margin of interpretation: some see the ratchet mechanism working with the gradual advance of the promises; others emphasize that we are still far from the ideal and that the march has been slow and insufficient.

And its Divergences

Looking back on fifty years of climate discussions, there is no doubt that progress has been made. But while the climate negotiating tables sought to build consensus, the pragmatism of economic interests prevailed and ended up being stymied by political hesitation and strategic disagreements. Emissions have only increased, the result of the imperative of GDP growth and monopolistic expression of aspirations for social ascension. Much has been said about the need to increase the ambition of the climate agenda. The fact is that, in the balance of ambitions, the economic one has prevailed. An interesting illustration is the case of Canada. A Kyoto enthusiast from the first hour, the country ratified the treaty, committing to a 6% reduction (base year 1990) higher than the signatories' average. But in the years that followed, unconventional oil production in the tar sands of the province of Alberta grew considerably. In 2009, instead of a reduction, Canada's emissions grew by 17% on the same basis. Two years later, the country left the Protocol, without major consequences (cf. Nordhaus, 2021) .

Moreover, critics point out fundamental flaws in the design of the climate conferences. First, the desire for universality. The understanding has always prevailed (an inheritance since Stockholm) that because it is a global problem, resolutions on climate should involve as many participants as possible and deserve to be approved unanimously by the Convention. The intention of multilateral, inclusive, and democratic discussion is commendable. To imagine that the small island nations would have the same voice as the great powers at a global negotiating table is something unprecedented in the history of diplomatic construction.

Faced with the wide array of interests and the nature of the problem (which encourages free-rider behavior, making it difficult to forge stable alliances), leading voices — Nobel Laureates in Economics — suggest alternative arrangements in order to promote better coordination of interests and emission reduction strategies among countries. Joseph Stiglitz (2017) suggested that the agreement should start with a cohesive group forming a "coalition of the willing" and admitted that some recalcitrant countries might at first be left out. William Nordhaus prefers, as a more appropriate design, an arrangement of countries around restricted "clubs." Clubs are functional schemes for dealing with situations involving common resources that can be shared because production costs are shared among members and non-members can be excluded or penalized; as such, it would be possible to produce a stable "association" in the sense that no one has an incentive to leave it. The perception of the benefits gained from participation combined with external sanctions creates the strategic situation in which members, acting in their own interests, contribute to

the collective goals. Conceptually interesting — in practice, many believe there is no longer room in global diplomacy for a selective solution.

The Conferences have such different structures and objectives that it is difficult for us to identify a common line of thought and orientation of principles. The work of the political scientist Elinor Olstrom, the first woman winner of the Nobel Prize in economics in 2009, invariably appears as a candidate for the source of inspiration for the design of conventions. Olstrom stood out for her dedication to empirical studies of communities that needed to solve problems surrounding common resource use. Unlike the outcomes expected under the logic of traditional theory (where individualistic incentives lead to free-rider behavior and suboptimal social outcomes) Olstrom observed that "a surprisingly large number of individuals facing collective action problems do cooperate" (Olstrom, 2014). Cooperative behaviors arise when facilitated by the presence of certain elements, such as (i) reliable information about the cost-benefit of individual actions; (ii) long-term horizon; (iii) recognition of reputational value in acting in a trustworthy and reciprocal manner; (iv) communication among members; (v) history of social capital and leadership, in combination with successful resolution of previous conflicts; (vi) possibility of monitoring and sanctioning. When such ingredients that facilitate the perception of mutual trust among participants are present, cooperation can emerge in a self-organized, bottom-up manner without the need for an external regulator (Olstrom, 2014).

The climate issue is a "problem of the commons" where there is no supranational institution (external authority) able to address it. The main purpose of the concerted effort of the negotiation rounds is, at the end of the day, to engender cooperation. Hence the novelty of the empirical results of Olstrom's work. Some (Johannesson, 2017) have tried to identify in the logic of the Paris Agreement the presence of Olstromian "design principles," elements that undergird and govern successful management of common resources. Several of these ingredients are indeed present in the structure of the Agreement (consistency between rules and local conditions, monitoring mechanisms, arrangements that allow modification of the operational rules); but others are not, in particular the ability to impose graduated sanctions. The most skeptical point out that the absence of sanctions violates an elementary Olstromian principle and thus Paris would also have failed to produce the much-desired cooperative engagement.

Well-founded economic theory highlights two ingredients necessary for proper design to address collective action problems: common reciprocal commitments and enforcement. The two together have never been present in the long history of climate treaties. The top-down period (Kyoto) divided the world into two large blocks and sought to establish binding commitments, albeit without success because there were no sanctions of any kind. In the bottom-up (Paris) period the scattered voluntary contributions also failed to create a focal point around which nations should cooperate. Because there was no common commitment, national interests were never aligned with collective goals; and so, the free-rider incentive prevailed. Results were achieved, but less than desired and far less than needed. Anchoring the solution to the difficult coordination problem in expectations would be possible in theory, but it is a much more fragile construction. When the United States left the Agreement, an important pillar broke down, causing the ballast of trust to shake. The assumption that expectations could replace enforcement did not prove valid.

A common commitment is a key element in creating a reciprocal understanding of what each can expect from the other. Thus, it is simply enunciated, "We will do what is required for the common good as long as you do as well" (Cramton et al., 2017). A properly designed reciprocity is a key ingredient in producing cooperation. Trust and reciprocity are mutually reinforcing. With a well-designed reciprocity, trust is established, cooperation emerges, and ambitions present themselves. Kyoto believed that trust could be legislated. Paris bet that voluntary

national interest would be sufficient to produce co-operation and ambition. NDCs are individual, non-comparable, and non-common commitments. And so they do not address the free-rider problem. An agreement where opportunistic selfishness remains attractive cannot prosper: it tends to generate a cascade effect of disengagement leading to little or no cooperation.

The literature produced by academics and experts on climate negotiations is vast. We make no claim to an original critical assessment. Our goal is much more circumscribed. It is striking that the successive chapters of the climate negotiations have ignored basic elements of a grounded theoretical understanding supported by empirical evidence. They also seem to have forgotten the lessons of successful international agreements. Among them, in the climate field, the Montreal Protocol (1987) stands out, which addressed the problem of the ozone layer by promoting a gradual reduction in the use of chlorofluorocarbon-based gaseous compounds (CFCs). There, an interesting design of incentives was created for developing countries to adhere to, whose costs would be partially covered by the developed ones (Multilateral Fund) who would also commit to transfer technology. There were also sanction mechanisms for when non-signatory countries were forbidden to trade with each other. Of course, the narrower scope made it easier. Experts also point out as important the support of DuPont, the main manufacturer of CFC-based products, whose patents had expired and whose research into alternative products was advanced (Kusnetz, 2021). Without a doubt the Protocol was a success: in 2003, the list of participants counted 184 countries. No relevant consumer was left out. Thirteen years after the signing, the world's CFC production had already been reduced by 86% (Brack, 2003).

Perhaps what occurred was a path dependence problem: the conventions from the beginning adopted certain principles, such as the universality of the participants, but then became hostages to them. Perhaps diplomacy did not have enough decision-making authority to move the instances of power and create consensus around the necessary measures[2]. Perhaps, in the end, politicians and negotiators intentionally preferred the path of greater negotiating entropy in order to buy time (thus postponing costly commitments) or betting on a technological solution down the road. Perhaps the conventions started when there was still no definitive scientific conviction or evidence that the transition to a low-carbon world could actually take place, such as competitive prices for renewable energy, which are now a reality.

Complexity and collective action are two powerful mental resources capable of explaining

2 *The relationship of the United States to the Kyoto Protocol illustrates this point. The U.S. Senate voted unanimously (95 to 0) opposing both the binding targets (believing that they could compromise the American economy) as well as the lack of commitments from developing countries. Despite the warning from the Senate, the only body with the authority to ratify international agreements, Vice President Al Gore symbolically signed the Protocol. Four years later, the Bush administration formally withdrew the country from the negotiating tables. The message was clear: the United States would not accept its domestic climate policy being shaped by the Conventions.*

DYNAMO COUGAR x IBOVESPA
(Performance – Percentage Change in US$ dollars)

Period	DYNAMO COUGAR* Year	DYNAMO COUGAR* Since Sep 1, 1993	IBOVESPA** Year	IBOVESPA** Since Sep 1, 1993
1993	38,8%	38,8%	7,7%	7,7%
1994	245,6%	379,5%	62,6%	75,1%
1995	-3,6%	362,2%	-14,0%	50,5%
1996	53,6%	609,8%	53,2%	130,6%
1997	-6,2%	565,5%	34,7%	210,6%
1998	-19,1%	438,1%	-38,5%	91,0%
1999	104,6%	1.001,2%	70,2%	224,9%
2000	3,0%	1.034,5%	-18,3%	165,4%
2001	-6,4%	962,4%	-25,0%	99,0%
2002	-7,9%	878,9%	-45,5%	8,5%
2003	93,9%	1.798,5%	141,3%	161,8%
2004	64,4%	3.020,2%	28,2%	235,7%
2005	41,2%	4.305,5%	44,8%	386,1%
2006	49,8%	6.498,3%	45,5%	607,5%
2007	59,7%	10.436,6%	73,4%	1.126,8%
2008	-47,1%	5.470,1%	-55,4%	446,5%
2009	143,7%	13.472,6%	145,2%	1.239,9%
2010	28,1%	17.282,0%	5,6%	1.331,8%
2011	-4,4%	16.514,5%	-27,3%	929,1%
2012	14,0%	18.844,6%	-1,4%	914,5%
2013	-7,3%	17.456,8%	-26,3%	647,9%
2014	-6,0%	16.401,5%	-14,4%	540,4%
2015	-23,3%	12.560,8%	-41,0%	277,6%
2016	42,4%	17.926,4%	66,5%	528,6%
2017	25,8%	22.574,0%	25,0%	685,6%
2018	-8,9%	20.567,8%	-1,8%	671,5%
2019	53,2%	31.570,4%	26,5%	875,9%
2020	-2,2%	30.886,1%	-20,2%	679,0%
2021	-23,0%	23.762,3%	-18,0%	538,9%

2022	DYNAMO COUGAR* Month	DYNAMO COUGAR* Year	IBOVESPA** Month	IBOVESPA** Year
JAN	6.0%	6.0%	11.4%	11.4%
FEV	2.9%	9.0%	5.2%	17.2%

Average Net Asset Value for Dynamo Cougar (Last 12 months): R$ 6.922,8 milhões

(*) The Dynamo Cougar Fund figures are audited by KPMG Auditors and returns net of all costs and fees, except for Adjustment of Performance Fee, if due. Dynamo Cougar is destinated for qualified investors, defined accordingly Brazilian laws. The Fund is currently closed for new investments. (**) Ibovespa closing.

non-obvious phenomena that we encounter in our analytical work. We need to decipher multifaceted, densely interconnected realities whose morphologies change all the time through the purposeful decisions of countless dispersed individuals. Identifying the mechanics of these gears and the configuration of incentives in this collective arrangement becomes fundamental. Hence our particular interest at Dynamo in these two tools, frequent in our internal discussions and in our Reports.

In this case, the two analytical models combined have provided the lens through which we can investigate the dilemmas and understand the challenges that the climate issue poses. With this instrument in hand, we briefly covered the main Conferences of the Parties (COPs), a forum that centralizes negotiations and guides global climate governance. Next, we took a critical look at the design principles and outcomes of the conventions. Based on this understanding, in the next Report, we will discuss some possible developments, and also comment on our management efforts to adapt ourselves at Dynamo for these times of transition.

Rio de Janeiro, March 25, 2022.

Please visit our website if you wish to compare the performance of Dynamo funds to other indices:

www.dynamo.com.br

DYNAMO

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