Fight Against Extinction: The Critical Role of the ITU in a World Failing to Address Climate Commitments

A submission by the "Latin American Institute of Terraforming"[1] *for the special consultation called "The Environmental Impacts and Benefits of the Internet," launched by the ITU Council Working Group on International Internet-related Public Policy Issues (CWG-Internet) in October 2021.*

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Summary:

According to a November 2021 survey of IPCC scientists, a large majority believe that we are heading for a 3,0°C global temperature increase due to political inaction. In this context, it is urgent to rethink the role of digitalization and its contribution to global warming, according to scientific evidence. It is risky to assume that the new efficiencies enabled by ICT will suddenly start creating significant carbon savings in the economy at large without a strategic role for governance. Therefore, the catalytic role of the ITU must be even more critical, assertive, and decisive for the challenge of the climate crisis so as to be able to drive digital environmental justice. To this end, we suggest five actions (of many others that can be implemented), based on scientific evidence, that can be considered by ITU around greenhouse gas emissions due to ICT use:

1. Adopt the precautionary approach on the contribution of ICTs to energy efficiency and, consequently, to their supposed contribution to reducing CO2 emissions from other sectors. Until scientific consensus indicates more unambiguous evidence for action (which relates to our proposal number 2), the precautionary principle should be standard for ITU, industry, and States.
2. Promoting multidisciplinary and independent scientific research, both empirical and theoretical, on the environmental impact of ICTs (especially the digital rebound effect and the intensive use of other natural resources).
3. Encourage States and the ICT industry, as well as industrial sectors benefiting from the innovations of digitization, to produce standardized open data on energy use and the environmental impact of technologies in their production areas. This is key for our proposal one and two.
4. Promote with the States standardized methodologies and incentives that encourage ICT sector companies, differentiated according to their size and sector, to commit to achieving net-zero or carbon-negative emissions before 2050, and establish a detailed roadmap of sectoral targets.
5. Promote initiatives for enterprising States to stimulate innovative, socially acceptable, and sustainable technological developments and policies with all stakeholders.

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I. Introduction

As international evidence points out, to meet the Paris Agreement target of not exceeding 1.5°C of global warming, the world economy needs to progressively reduce its CO_2 emissions by more than 42 % by 2030, by more than 72 % by 2040, and by more than 91 % by 2050 (Freitag et al., 2020).

Information and communication technologies (ICT) directly and indirectly affect the environment. The direct environmental effects of ICTs include the resources used and emissions caused by the production, use, and disposal of ICT hardware. Indirect environmental effects (which can be second-and third-order, also known as higher-order impacts) are ICT-induced changes in production in other industries and in changing social patterns that have environmental effects.[2] Both types of effects make ICT a relevant factor for the achievement of the United Nations Sustainable Development Goal (SDG) 12 (SDG): "Responsible consumption and production" (Bieser & Hilty, 2018).

In particular, the impact that the ICT sector has on climate change can be expressed as a carbon footprint: that is, an estimate of the number of greenhouse gases (GHG) released from a product or activity from all phases of its life cycle. This includes embodied emissions (GHG emissions released from the extraction of the necessary raw materials, the manufacturing process and transport to the company or user), use phase or operational emissions (from energy use and maintenance), and end-of-life emissions (emissions after disposal).

Along these lines, in February 2020, the International Telecommunication Union (ITU) aligned itself with the scientific consensus of the Intergovernmental Panel on Climate Change (IPCC) and launched its L.1470 standard, which encourages the ICT industry to reduce GHG emissions by 45 % by 2030, and to net-zero by 2050, in line with limiting global

[2] Second-order" or "secondary" effects (also referred to as indirect effects) are the indirect environmental effects of ICTs due to their power to change processes (such as production or transportation), resulting in a modification (decrease or increase) of their environmental impacts. "Third-order" or "tertiary" effects (also referred to as systematic effects) come from the medium- or long-term adaptation of behaviors (e.g., consumption patterns) or economic structures due to the stable availability of ICTs and the services they provide (Hankel, 2014).

warming to 1.5°C, which is also aligned with ISO standards[3] and the GHG protocol.[4] The scope of the ITU recommendation includes mobile networks, fixed networks, data centers, enterprise networks, and end-user devices but excludes ICT services. Over the next decade, it is accompanied by reduction targets for each ICT subsector. For example, data center operators adopting the standard will have to reduce emissions by at least 53 %, mobile network operators by 45 %, and fixed network operators by 62 %. It also requires companies to set targets for Scope 1 and 2 and some Scope 3 emissions in the supply chain. Most of these reductions between 2020 and 2030 are expected to come from a shift to more renewable and low-carbon energy sources.

The ITU standard is voluntary, the targets the standard sets are less ambitious than some public commitments by individual large companies (such as BT, Sky, and Microsoft, who are committed to achieving zero emissions by 2030 or 2040), and its emergence may seem late due to the time constraints we have to act as humanity on the issue and the steady growth in CO2 release that more developed economies continue to have. Also, the standard only contemplates assessing a single service, i.e., it focuses on the direct and value chain environmental impacts of ICT companies but does not focus on multi-services (Coroamă et al., 2020). But all in all, these standards are an important milestone, as they send a strong signal that the world needs zero-emission and science-based targets and could provide a model for policymakers.

However, as we review the scientific evidence in the context of the climate emergency we are experiencing, which compels us to act more ambitiously and quickly, we must ask ourselves whether the ICT industry and, in particular, whether the role of the ITU can be further deepened, especially concerning the digital rebound effect that could be key to global warming.[5]

II. From the enabling effect to the digital rebound

Industry, international agencies, States, academia, and even civil society organizations have seen the ongoing rapid digitization as a potential key factor in reducing (or at least

[3] International Organization for Standardization (ISO). 2006. Greenhouse gases – Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals. ISO 14064-1:2006

[4] GHG Protocol. 2011. Corporate Value Chain (Scope 3) Accounting and Reporting Standard. Supplement to the GHG Protocol Corporate Accounting and Reporting Standard.

[5] In addition to greenhouse gas emissions, ICTs have many more critical environmental impacts. But, due to time constraints, we will concentrate on greenhouse gas emissions in this particular submission.

mitigating) carbon emissions and resource consumption in various economic sectors (Coroamă & Mattern, 2019). According to Kunkel & Tyfield (2021), energy efficiency gains through digital technologies have been commonly related in areas such as video conferencing, e-commerce, optimization of transportation routes, and smart metering. In this sense, ICT can give rise to the "enablement effect," which, according to GSMA & Carbon Trust (2019), is any mechanism that facilitates the avoidance of carbon emissions, such as, for example, mobile banking, which would allow customers to avoid traveling to a bank branch.

This enabling effect of ICT, generally, can be developed through four mechanisms: i) substituting resource-intensive activities through ICT services, ii) making existing activities more efficient, iii) intensifying the use of existing activities (slightly different from the above in the sense that existing activities do not become more efficient per use, but can be used more frequently, such as enabling more trains per hour), and iv) informing existing consumption choices (Coroamă et al., 2020).

However, over the last 170 years, CO_2 emissions have increased planetary-wide at a rate of 1.8 % per year (Freitag et al., 2021). And although there has been a slight decrease in the last decade, we are still far from avoiding global warming of 1.5°C on a planetary scale. This context makes us wonder what the role of the ICT industry in this scenario is and what should be the position, based on scientific evidence, to be followed so that the enabling effect of ICT can be a reality beyond the industry sector itself.

For this reason, we believe it is relevant to review whether the efficiency of ICTs in various sectors of the economy has ended up in a "digital rebound effect" and, therefore, what concrete, objective, and evidence-based measures should be taken so that ICTs can fulfill their promise or, failing that, propose a realistic course of action that will help the planet to meet the climate objectives we face.

In general, rebound effects occur when initial positive outcomes (e.g., increased energy efficiency thanks to technology) make a good or service even more attractive (through lower prices or other added benefits), which is likely to stimulate its demand (and, perhaps, that of other products), ending up in higher energy and resource consumption (and, consequently, more pollution), decreasing the initial positive effect or, in the worst case, even exceeding it (Coroamă & Mattern, 2019). The rebound effect can be direct (because the rebound occurs in the same service that had initially gained in efficiency, and because the rebound is a direct consequence of the price reduction that follows the drop in inputs to produce the service), or indirect (it can have various indirect rebound effects, such as induction effects, rent effects, substitution effects, and producer rebound).

Several academic research studies have recently focused on reviewing studies on the impact of ICTs on climate change. Still, many of them do not analyze the rebound effect and its consequences. The reason for that, from a scientific point of view, is that the methodologies for measuring the impacts of ICT are very different, and many are not suitable or are not adapted to take into account rebound effects, especially of the third order, which makes their results very different and sometimes even counterproductive (Bieser & Hilty, 2018, Coroamă et al., 2020, Freitag et al., 2021, Kunkel & Tyfield, 2021).

To the above, we can add fundamental political reasons: global orthodoxy in politics and business tends to presume that technological innovation is overwhelmingly positive and the primary pathway to solving social problems, including the climate crisis (Coroamă & Mattern, 2019, Kunkel & Tyfield, 2021). Along these lines, much of the research that does not consider the rebound effect is rather industry-driven, presenting a problem of data interrogability and potential conflicts of interest (Freitag et al., 2021).

From the research examining the rebound effect of ICT, it is essential to note that the results are not conclusive and instead call for caution. For example, according to Coroamă & Mattern (2019), the rule for most manifestations of digitization seems to be a robust digital rebound, mostly driven not only by energy efficiency but also by its efficiency concerning the use of time and planetary connection. For Santarius et al. (2020), most studies seem to lie somewhere in between, considering that rebound effects are not usually totally counterproductive, but in considering that they are high enough to counteract an absolute decoupling of energy demand from economic growth. For Horner et al. (2016), although these types of studies are more than 20 years old, the analysis of their results should lead us to uncertainty, so the current state of knowledge could be summarized with three related statements: the technical potential of ICT net energy savings is probably positive; the sign and magnitude of realized net energy savings are susceptible to the specific instance of ICT and how users interact with them; and finally, the actual net energy effect is unclear and difficult to assess, especially when considering higher-order impacts. The ITU (2014) acknowledged in its 2014 report on ICT and climate change that the rebound effect is expected to remain high, and energy policies may need to consider potential losses in energy savings due to this effect.

III. Suggested actions to ITU to avoid extinction

But the picture is worsening, and time is running out. According to a November 2021 survey of IPCC scientists, a large majority believe that we are heading for a 3,0°C global temperature increase due to political inaction.[6] In this context, it is urgent to rethink the role of digitalization and its contribution to global warming, according to the scientific evidence.

It is risky to assume that the new efficiencies enabled by ICT will suddenly start creating significant carbon savings in the economy at large, without a strategic role for governance (Coroamă & Mattern, 2019, Freitag et al., 2021). Therefore, **the catalytic role of the ITU must be even more critical, assertive, and decisive for the challenge of the climate crisis to be able to drive digital environmental justice.**

To this end, we suggest five actions (of many others that can be implemented), based on scientific evidence, that can be considered by ITU around greenhouse gas emissions due to ICT use:

1. **Adopt the precautionary approach on the contribution of ICTs to energy efficiency and, consequently, to their supposed contribution to reducing CO2 emissions from other industrial sectors.** *Until scientific consensus indicates more unambiguous evidence for action (which relates to our proposal number 2), the precautionary principle should be standard for ITU, industry, and States.*

The precautionary principle was enshrined in the Rio Declaration on Environment and Development (June 1992, Principle 15): "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental

[6] The survey can be consulted here: https://www.nature.com/articles/d41586-021-02990-w

degradation."[7] Unlike the principle of prevention, the precautionary principle is a guide for the management of unavoidable scientific uncertainty, especially in situations of potentially irreversible or catastrophic impacts (Artigas, 2001).

Within this framework, there are at least three fundamental reasons for adopting this precautionary approach to the effect of ICTs on CO_2 emissions:

- First, the evidence of the positive impact of ICT on CO_2 emissions, especially in other industries, is inconclusive, and the accelerated pace of emissions growth in recent years suggests that the supposed positive effects are not having the expected impact, at least not at the speed that is needed. It is not clear that accelerating digitization (through, for example, the massive implementation of the Internet of Things) will save energy.
- Second, although ICT could offer opportunities that would enable CO_2 emissions reductions in other sectors, the data do not support its ability to achieve the significant carbon savings needed by 2050. Moreover, continued growth in the carbon footprint of the ICT sector cannot be justified on the basis that these technologies can enable sufficient savings in other sectors, especially since the estimates of emissions savings enabled by ICT in different sectors fall short of the meeting agreed targets, and there is a risk that the expansion of ICT in other sectors could increase emissions in those sectors (Freitag et al., 2021).
- And third, as recognized by the IPCC in its August 2021 report, we have a shrinking window of opportunity to act against global warming above 1,5°C, so the precautionary principle, at least limited in time until better scientific evidence is obtained, seems to be able to ensure the minor damage in the critical scenario in which we find ourselves.

To achieve a minimum shared scientific consensus among stakeholders interested in the ICT governance will only fortress the role of ICTs as a leading industry strongly and seriously acting in favor of our planet.

[7] The document can be consulted here: https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_CONF.151_26_Vol.I_Declaration.pdf

In this context, we urge ITU to encourage industry and, in particular, States to adopt the precautionary principle, limited in time, until better evidence and scientific consensus on the actual impacts of ICTs on GHG emissions is obtained. This precautionary approach cannot be seen as a passive role for the parties adopting it, but, on the contrary, it should drive bold parallel activities that will help us out of the uncertainty as soon as possible and stimulate the path to ICT innovation that responds to the size of the challenges we face today as humanity.

2. **Promoting multidisciplinary and independent scientific research, both empirical and theoretical, on the environmental impact of ICTs (especially the digital rebound effect and the intensive use of other natural resources).** *ITU can also standardize methodologies that allow the comparison of figures across industries and countries.*

In line with the achievement of the UN "Sustainable Development Goal 12: responsible consumption and production", there is a broad consensus among researchers pointing to the need to produce more evidence regarding the third-order effects of digitization, i.e., the induced changes in social practices and related consumption patterns, to fully understand the impact of digitization on global warming (Horner et al., 2016, Bieser & Hilty, 2018, Liu et al., 2019). Moreover, beyond empiricism, which may never lead to definitive and unambiguous conclusions, there is also a need to encourage a deeper theoretical understanding of the interrelationship between digitization and the drivers of production, consumption, and overall economic growth (Santarius et al., 2020).

Likewise, energy and carbon emissions are not the only environmental impacts associated with digitization that need to be examined, as the climate crisis, in turn, causes a broad-spectrum ecological problem. In this sense, other ICT impacts must be studied to take appropriate actions, as they are critical concerning environmental justice between territories, such as the depletion of natural resources as essential as water, ecotoxicity, and human toxicity, particularly in technologies that enable massive Internet use, such as data centers, mobile devices, 5G network, among others (Liu et al., 2019, Frietag et al., 2021). Moreover, it should be urgently taken into account that several essential resources for ICT devices are scarce for the level of demand they will mean in the coming years. This is the case, for example, of rare earth elements that are also essential for green energies. This growing double demand will make it challenging to increase the production of millions of digital devices in the future, as research on the substitution potentials of certain critical materials is still very weak (Santarius et al., 2020).

In this regard, ITU can not only encourage industry and governments to generate this evidence through independent scientific research but can also standardize methodologies that make it possible to compare figures between industries and countries and stimulate better technical and public policy decisions based on evidence.

3. **Encourage States and the ICT industry, as well as industrial sectors benefiting from the innovations of digitization, to produce standardized open data on energy use and the environmental impact of technologies in their production areas.** *ITU can make the ICT industry a leader in initiating and facilitating this urgently needed process.*

A crucial part of the challenges raised by researchers is the lack of data or data transparency. This is somehow contradictory when today, thanks to the processing capabilities enabled by digitization, there is the ability to manage large amounts of data and use advances such as Artificial Intelligence to understand these datasets. In this sense, it is crucial to obtain the specific details of the implementation of technologies, user behavior, and evolution over time and should not be oversimplified in the quest to calculate a magnitude of effect (Horner et al., 2016, Bieser & Hilty, 2018).

The difficulties are many for this objective. For example, a recent Washington Post investigation showed how many countries underestimate their greenhouse gas emissions in their reports to the United Nations. A review of 196 country reports revealed a considerable gap between what nations state their emissions are and the greenhouse gases they are sending into the atmosphere. The United Nations Framework Convention on Climate Change (UNFCCC) attributes this difference to applying different reporting formats and inconsistency in the scope and timeliness of reporting (e.g., between developed and developing countries or between developing countries).[8]

[8] The report can be consulted here: https://www.washingtonpost.com/climate-environment/interactive/2021/greenhouse-gas-emissions-pledges-data/

In this context of standardization with data collection, processing methodologies, and the lack of capacity in some countries to meet the challenge, ITU has a key role in working with States and industry. Not only to seek formulas to stimulate the production of these data by the various industries, but also to coordinate technical committees to assist and train in the standardization of data collection and management methodologies, to coordinate the state-of-the-art computing capacity needed to meet the challenge, and to push for open and accessible formats to make them available, on the one hand, for interested scientists to advance their research independently and, on the other, to enable external and independent audits.

ITU and the ICT industry can be a leader and an example in one of the most critical challenges facing countries.

4. **Promote with the States standardized methodologies and incentives that encourage ICT sector companies, differentiated according to their size and sector, to commit to achieving net-zero or carbon-negative emissions before 2050, and establish a detailed roadmap of sectoral targets.** *The industry should also adjust its parameters to allow carbon offsets only to a limited extent.*

The ICT sector should adopt science-based net emissions targets that align with, or even better, exceed the ITU standard. However, the so far massive absence of net-zero or carbon-negative pre-2050 announcements from ICT companies makes it clear that industry self-regulation is not sufficient to achieve the necessary emissions reductions.

Also, the so-far fragmented approach of individual companies taking on zero or negative emissions commitments means there are no standards for publishing detailed and transparent action plans, making it difficult for individuals, governments, and researchers to monitor compliance. This is compounded by the unfairness of companies that take on these environmental challenges having to pay more competitive costs than those that do not (Freitag et al., 2021).

Unfortunately, there are no standard guidelines for achieving net-zero or carbon-neutral emissions. That means that companies and countries can create their own definitions. Moreover, companies that commit to carbon neutrality do not necessarily promise to eliminate CO2 from their activities. Instead, they can support environmental projects that offset their emissions through carbon offsets. But research by the Task Force on Expanding Voluntary Carbon Markets shows that less than 5 % of carbon offsets remove carbon dioxide from the atmosphere.[9]

The way forward to reduce emissions is a commitment from the entire sector to achieve the goal of zero emissions, for which ITU's role is critical: on the one hand, to work with States and suggest standardized incentives differentiated by company size (such as State contracting clauses that establish zero-carbon criteria and consequences in the event of non-compliance, as well as economic aid packages for rapid transition)—in addition, working with industry and States to end the fragmentation of commitments and to be able to share transparent universal compliance standards. The latter includes ICT companies giving absolute priority to reducing their emissions and only then offsetting only a minimal factor of their emissions with verifiable carbon offset methods (Freitag et al., 2021).

5. **Promote initiatives for enterprising States to stimulate innovative, socially acceptable, and sustainable technological developments and policies with all stakeholders.** *The main focus should be to avoid the digital rebound effect and thus position the ICT industry at the forefront of major political and economic change.*

Authors such as Mariana Mazzucato (2021) have developed part of their research calling for a new, bolder role for all actors involved in local and international governance to face better the complex challenges we face as humanity. In particular, there is a need for States that, with an active entrepreneurial role, take risks and invest alongside the private sector in initiatives that achieve public ecological objectives agreed upon by various sectors of society.

ITU, which encourages the vital role digital technologies have in mitigating the climate crisis, can play a leading role in opening a space for technical and political innovation, leaving behind the idea of “capitalism as usual”, and where States, partnering with industry and other stakeholders such as academia and civil society, explore, design, and develop techno-

[9] Net Zero Is Hard Work, So Companies Are Going ‘Carbon Neutral’. Bloomberg Green. July 2021 https://www.bloomberg.com/news/articles/2021-07-19/offsets-can-play-a-role-to-make-companies-carbon-responsible

political responses under novel conditions that seek to decouple the rebound effect of technologies. Some of the provocations that can be experimented with are:

- Sufficiency / efficiency:

In January 2021, the European Environment Agency questioned whether it was possible to fully decouple economic growth from environmental pressures and stated that "societies need to rethink what growth and progress mean" and that post-growth and degrowth alternatives offered "valuable perspectives."[10] In a context where the window for climate action is shrinking, approaches such as post-growth and degrowth have increasingly gained traction, including critical reflections on the role of ICT. For scholars such as Santarius et al. (2020), it is vital to investigate and innovate developments within the framework of digitization and degrowth and, in that context, to examine the role of other economic actors and the circular economy concerning ICT. For Cologna et al. (2020), digital technologies should reduce our society's environmental footprint and foster sufficiency-oriented lifestyles (e.g., by adopting data sufficiency standards, as suggested by Liu et al. -2019-), thus moving towards post-growth societies, which prioritize social and environmental well-being.

Authors such as Coroamă & Mattern (2019) posit that several conditions lead to no or moderate rebound effect in digitization, all of which are related to efficiency rather than post-growth sufficiency, such as, for example when rebound activities intrinsically have a smaller footprint or resource consumption than the original activities. For some authors, the only way to ensure that a digital rebound effect does not occur is with decisive policy intervention imposing a global carbon constraint (Freitag et al., 2021) or with carbon pricing (Kunkel & Tyfield, 2021), which would mean that productivity improvements through ICT-enabled efficiencies, both in the ICT sector and in the economy at large, would be realized, in the first case, without a rebound impact on carbon or, in the second case, with a minimized impact. In this context of carbon use restriction, the ICT industry would finally be positioned as the key to process efficiency in these new market conditions.

- Product substitution/addition:

The dematerialization of economies due to digitization has the potential to help us replace products with digital services. However, this promise has not necessarily been realized.

[10] The document can be consulted here https://www.eea.europa.eu/publications/growth-without-economic-growth

Rieger (2020), for example, concludes that while dematerialization has likely occurred in specific sectors-the digitization of music, books, and movies, as well as the rise of telecommuting and teleconferencing and the ubiquity of online shopping-this shift has not had an impact on consumption as a whole, and they end up being products that are additive rather than substitutes. For this author, for example, one of the reasons that could help dematerialization succeed is the design of policies that provide economic incentives to use ICTs to increase sustainability rather than reduce costs.

IV. Conclusion

At the "Latin American Institute of Terraforming", we believe that ICTs have a paramount role in several fronts in the fight against climate change. If effectively implemented, they can position the industry at the forefront of planetary decarbonization and the new economies of the 21st century. However, that role can only be fulfilled under bold political measures that, in a limited timeframe and with agreed objectives, seek to coordinate stakeholders on a path based on independent and auditable scientific evidence. That role can be fulfilled, we believe, undoubtedly to ITU.

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