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Topic: **Peruvian Foreign Policy and the Fourth Industrial Revolution**

MA Candidate: Sandra Patricia Velásquez Salas

Faculty Advisor: Louis Goodman

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TABLE OF CONTENTS

ABSTRACT	3
1. INTRODUCTION.....	4
2. RESEARCH QUESTIONS.....	6
3. METHODOLOGY.....	6
4. LITERATURE REVIEW	7
4.1. The Fourth Industrial Revolution: Generalities.....	7
4.2. Effects of the Fourth Industrial Revolution	9
4.3. Opportunities and Challenges of the Fourth Industrial Revolution	10
<i>4.3.1. Opportunities and Challenges in the International Sphere.....</i>	<i>10</i>
<i>4.3.2. Opportunities and Challenges inside a country</i>	<i>16</i>
5. ASSESSMENT OF THE FOURTH INDUSTRIAL REVOLUTION IMPACT IN THE PERUVIAN CONTEXT	29
5.1. Peruvian accessibility to the resources of the Fourth Industrial Revolution.....	29
<i>5.1.1. Peruvian digital infrastructure.....</i>	<i>30</i>
<i>5.1.2. Peruvian human capital and the management of new technologies.....</i>	<i>32</i>
<i>5.1.3. Peruvian Institutional framework regarding the Fourth Industrial Revolution.....</i>	<i>36</i>
5.2. The Peruvian Digital Divide.....	40
<i>5.2.1. The Peruvian Culture and the digital divide</i>	<i>41</i>
<i>5.2.1. Peruvian generational digital divide</i>	<i>43</i>
<i>5.2.3. Peruvian digital gender divide</i>	<i>44</i>
5.3. Peru's digital diagnostic: strengths and weaknesses to successfully join the Fourth Industrial Revolution	46
5.4. The Fourth Industrial Revolution and the Peruvian Foreign Policy	48
5.5. Particular benefits and challenges that Peru could obtain and face from the scenario proposed by the Fourth Industrial Revolution	50
6. FOREIGN POLICY RECOMMENDATIONS.....	54
7. CONCLUSIONS	71
8. BIBLIOGRAPHY	73

ABSTRACT

Change is a defining feature of our time. Today's world is experiencing a Fourth Industrial Revolution characterized by the simultaneous wave of technological innovations in different areas that blur the boundaries between the physical, digital, and biological worlds. The speed of evolution of the emerging technologies and their repercussions on an increasingly globalized world have no historical precedent, creating a universe of possibilities never experienced before.

Although the shifts produced by this revolution can be beneficial, they can also create multiple risks and threats both on the international stage and within countries' internal spheres. In this framework, this paper aims to determine how a country like Peru can face the new disruptive scenario shaped by the Fourth Industrial Revolution and join it successfully.

This research argues that if Peru does not want to lag behind the rest of the world in the new global rearrangement that this revolution is prompting, it has to adopt a holistic approach where the strategic management of its foreign policy is crucial.

1. INTRODUCTION

Today's world is experiencing a Fourth Industrial Revolution. This Revolution is progressively producing substantial changes in people's action patterns, triggering diverse disruptive trends that affect individuals, societies, and states —transforming their needs, interests, and interactions.

Previous industrial revolutions have produced a significant impact on the structure of the global order, some labor patterns, and the way people around the world develop different kinds of activities. The First Industrial Revolution was launched by the construction of railroads and the invention of the steam engine, which caused the emergence of mechanical production. The Second Industrial Revolution was triggered by the creation of electricity and assembly lines that transformed productivity patterns and fostered mass production. The Third Industrial Revolution was produced by the invention of the computer and the subsequent development of the internet, remaining nowadays in a transformation process embedded by “the Fourth Industrial Revolution” —a milestone considered as an inflection point in which technologies and automation are going to reach their full potential, opening room for outcomes that have never been feasible before.

Each Industrial Revolution has been nurtured by the previous one. Each of them has therefore contributed to the shape of our current world. They have allowed humanity to witness a horizon of continuous evolution, where transformation options are infinite and “change” seems — paradoxically— to be the only variable persistent through time.

The impact of these revolutions has had both positive and negative global implications. They have involved shifts in production and consumption dynamics, means of communication, sources of information, and even entertainment options. However, while these shifts have improved some social, economic, and political conditions, they have also created multiple risks and threats. Hence,

it is important to assess what outcomes the Fourth Industrial Revolution produces, the trends and consequences those outcomes could create, and identify their possible advantages and disadvantages.

Against this backdrop, this research is focused on Peru and its foreign policy. This selection allows us to assess the implications of the Fourth Industrial Revolution on a country that is not precisely considered part of the developed world. This condition encourages one to look at the international scenario to find opportunities that this country could leverage to join this new era successfully.

Thus, this paper pursues three main goals: 1) to increase awareness of the comprehensiveness and speed of this revolution and its impact, 2) to assess the possibilities of harnessing its advantages and minimizing its disadvantages, and 3) to provide useful insights that can support recommendations for countries like Peru regarding foreign policy decisions and actions that could help them to deal with the new global context in the best possible way.

With these aims in mind, this paper is organized into three main parts: The first part is oriented to the methodological explanation of this research (sections 1, 2, and 3); the second part is concerned with its analytical development, based on the review of specialized literature about the Fourth Industrial Revolution and the assessment of its implications for Peru (sections 4 and 5); and the third part is devoted to recommendations for the strategic management of Peru's foreign policy within this new framework (section 6).

2. RESEARCH QUESTIONS

This study will attempt to address the following questions:

- a. What is the impact of the Fourth Industrial Revolution?
- b. What are the challenges and opportunities that the outcomes of this revolution could produce?
- c. How should Peru face the new scenario shaped by the Fourth Industrial Revolution?

3. METHODOLOGY

The approach of this research is interpretative. Since the world is experiencing a Fourth Industrial Revolution, this paper aims to analyze its impact assessing its consequences in the economic, social, and political fields; in the redesign of the global order; and in the multiple interactions on the international stage.

The methods of this study are fundamentally qualitative, based on desk research. They are focused on a literature review about this topic and the assessment of the Peruvian context, trying to understand its assets, weaknesses, opportunities, and possible threats. This analysis will allow us to propose possible guidelines that Peru's Foreign Policy could take into account to capitalize on the trends catalyzed by this new era.

Although the Fourth Industrial Revolution has a broader impact than the one encompassed by this research, this study has tried to stick to the repercussions of this new transformative age linked to issues that represent a new exigence for states' foreign policy management.

4. LITERATURE REVIEW

4.1. The Fourth Industrial Revolution: Generalities

The term “industry 4.0” was used for the first time in Germany to refer to the transformation of the global value chains through the convergence between virtual and physical manufacturing. The first registry of the use of this term appeared in a document titled “Recommendations for Implementing the Strategic Initiative INDUSTRIE 4.0” —published by Acatech, in April 2013, as an answer to the German strategy that sought the global leadership in the supply of equipment and solutions for industrial production through the integration of global value chains and the digitalization of industrial processes.¹

Although the term “industry 4.0” was initially used to refer exclusively to the new range of possibilities offered by what is called “the Internet of Things (IoT),” now it is linked to a global phenomenon characterized by the conjunction of digital, physical, and biological elements that are changing our current world.² It involves multiple advanced technologies such as the IoT, 3D printing, robotics, biotechnology, artificial intelligence, quantic computing, genetic sequencing, and nanotechnology, among others.

In 2016, Klaus Schwab, the World Economic Forum founder, introduced the term “Fourth Industrial Revolution” as a way to encompass all the new transformations that the world was progressively experiencing. He referred that the Fourth Industrial Revolution represents a new chapter in human development, motivated by the increasing availability and interaction of diverse

¹ National Academy of Science and Engineering, *Recommendations for Implementing the Strategic Initiative INDUSTRIE 4.0* (Munich: ACATECH, 2013), 5-7.

² Valeria Perasso, “*Qué es la cuarta revolución industrial (y por qué debería preocuparnos)*” [What is the Fourth Industrial Revolution (and why should we care)], *BBC Mundo*, Oct. 12, 2016, <https://www.bbc.com/mundo/noticias-37631834>

technologies that are producing a transition toward new systems built from the outcomes of the three previous industrial revolutions, especially the third one.³

Whereas the First Industrial Revolution used steam to set in motion mechanized production, the Second used electricity for mass production, and the Third used electronics and information for production automation; the Fourth Industrial Revolution began at the turn of this century and represents an inflection point from the digital era. It is characterized by the simultaneous wave of further breakthroughs in different areas that blur the boundaries between the physical, digital, and biological worlds.⁴

The velocity, scope, and impact of this new era are the main reasons Schwab considers it a new revolution and not only a prolongation of the third one.⁵ The speed of evolution of the emerging technologies has no historical precedent, and its repercussions in a highly and increasingly globalized world are also new. These features promise a disruption that will transcend beyond the latest digital innovations, making possible a universe of possibilities never experienced before.

As Valenzuela warns, this new revolution is different from the previous ones because even the human being is going to be no longer necessary for the production of most part of the things and services that society requires.⁶

³ Klaus Schwab and Nicholas David, *Shaping the future of the Fourth Industrial Revolution*, (Geneva: World Economic Forum, 2018), 19-21.

⁴ Petre Prisecaru, "Challenges of the Fourth Industrial Revolution," in *Knowledge Horizons-Economics*, Vol. 8 No. 1 (Bucharest: Dimitrie Cantemir, 2016), 61.

⁵ Klaus Schwab, *The Fourth Industrial Revolution*, (Geneva: World Economic Forum, 2016), 8-9.

⁶ José Luis Valenzuela. "América Latina y la Cuarta Revolución Industrial" [Latin America and the Fourth Industrial Revolution], in *Diplomacia* No 133. (Santiago de Chile: Academia Diplomática de Chile "Andrés Bello", 2016), 23.

4.2. Effects of the Fourth Industrial Revolution

As Rave mentions: “Industrial revolutions bring with them abrupt and radical changes in the economic, social, and political structures, also entailing a leap in industrial production and human integration.”⁷ The main effect of the Fourth Industrial Revolution is a process of continuous and rapid innovation, which involves both the fast development of new technologies and their quick diffusion worldwide. This revolution implicates the use of digital tools as means of automation, changing patterns of productivity, manufacturing, and commercialization, among others.⁸

The growing harmonization and integration of so many different disciplines and discoveries make this revolution particularly innovative, allowing the generation of mixed outcomes that can be mutable and adaptable for different purposes. Moreover, this revolution is producing the emergence of a new ecosystem coexisting in parallel with the physical world, integrated by physical devices, robots, digital assistants, applications, platforms, and utilities that are constantly available to answer human queries and even anticipate them.⁹

As Manuel Castells refers: “Technology will reshape every domain of society,”¹⁰ and this seems to be true when it refers to the technologies generated within the Fourth Industrial Revolution framework. These technologies are challenging businesses, governments, countries, societies, and individuals in many different ways, beginning with the empowerment or disempowerment of those who have access or not to these innovations, as we will see through this research.

⁷ Roberto Rave, “La cuarta revolución industrial en Latinoamérica” [The Fourth Industrial Revolution in Latin America], *CNN*, Jan. 25, 2019. <https://cnnespanol.cnn.com/2019/01/25/la-cuarta-revolucion-industrial-en-latinoamerica-opinion-rave/>

⁸ Schwab, *The Fourth Industrial Revolution*, 14.

⁹ Schwab, 15.

¹⁰ Manuel Castells cited by Anne-Marie Slaughter, *The Chessboard and the Web: Strategies of Connection in a Networked World*, (Connecticut: Yale University Press, 2017), 8.

4.3. Opportunities and Challenges of the Fourth Industrial Revolution

In this section, we are going to assess the impact of the Fourth Industrial Revolution at the country level, addressing the opportunities and challenges created in the international sphere —where foreign policy decisions converge— and the ones produced inside countries —where political, social, and economic dynamics could result affected.

4.3.1. *Opportunities and Challenges in the International Sphere*

The Fourth Industrial Revolution and its disruptive innovations have multiple effects on the international sphere and the relationships among the actors immersed within it. Although there is no agreement about the positive or negative impact of these effects, I have tried to classify them between those that could offer an opportunity and those that could represent a possible threat to a country like Peru. However, in most cases, the real impact of these effects will depend on every country's particular characteristics and decisions.

Thus, we are going to start reviewing the opportunities and challenges that the effects of the Fourth Industrial Revolution could trigger on the international scene.

4.3.1.1. Opportunities

- a) *New possibilities of international relations due to the borderless digital environment:* In this new era, the relevance of geography and territory seems to be outdated, thanks to the instant connectivity provided by the digital context and its diverse tools.¹¹ Technologies have made it possible for countries to amplify the spectrum of their foreign policy and project new international relations with territories that it was usually impossible or

¹¹ Nayeb Al-Rodham, “Meta-Geopolitics: The Relevance of Geopolitics in the Digital Age,” in *E-International Relations*, May. 25, 2014, 1.

impractical to maintain close bonds in the past. It means that issues such as physical distance are no longer insurmountable obstacles to building cooperative ties.

- b) *More channels and tools for strengthening public diplomacy and countries' soft power:* If we consider that the foreign policy deployed by a state aims to amplify its presence beyond its borders, the Fourth Industrial Revolution provides an exceptional environment for achieving this goal. The advances in communication and digital tools offer unprecedented opportunities to reach more people, establish connections between them, and get the most out of what we call public diplomacy.¹² Additionally, the new available channels for spreading information allow countries to strengthen their soft power by promoting abroad—easily and quickly—their cultural expressions, traditions, gastronomy, and so on.
- c) *New and faster communication channels between states and their representatives:* It is becoming more frequent to see the highest states' representatives using digital platforms as means of '*express communication.*' Digital platforms have turned themselves into an ally for stating a position, making a decision transparent, and testing preliminary reactions while avoiding the formality of official interstate communication channels. They offer opportunities for exchanging information in faster ways that could also support dynamics linked to the transfer of good practices, the implementation of transnational working groups, and the delivery of technical assistance.
- d) *New sources of information and tools for data management that can be useful for the foreign policy decision-making process:* One of the most important roles of diplomats who are in charge of foreign policy execution used to be the search and processing of

¹² Renio Díaz Triana, "Las TICs y las Relaciones Internacionales: apuntes para la reflexión" [ICT and International Relations: Notes for Reflection], in *Revista de Estudios Estratégicos* No. 2. (La Habana: July-December, 2014), 103.

information. Nevertheless, this role is being transformed due to the massive availability of information and the emergence of big data applications for processing it using algorithms optimized by artificial intelligence and machine learning mechanisms.

While this can be considered a threat to diplomats, it also represents an opportunity for backing their analysis, providing more elements in support of a specific foreign policy decision. However, this opportunity will depend on the access to those tools that a country and its officials can have and their capacity to use them for nurturing the foreign policy decision-making process.¹³

4.3.1.2. Challenges

- a) *The disruptive and continuous changes triggered by the Fourth Industrial Revolution could outweigh states' adaptation capacity:* Considering the velocity and scope of the changes that the Fourth Industrial Revolution is triggering, the structures and dynamics present within the international system will probably no longer be the same. This new era is producing shifts in the way in which diplomacy, international trade, cooperation, and even conflict are deployed, creating the necessity of new approaches, regulations, capacities, skills, and assets that are not necessarily going to be developed quickly and successfully. In fact, some of these changes could even imply turning the traditional theories of international relations into insufficient means for explaining the new scenario and understanding its new dynamics.

¹³ Fatima Al Fahim, "Data Diplomacy: Turning Bytes into Insights in the Foreign Service," *Blavatnik School of Government*, Feb. 4, 2022. <https://www.bsg.ox.ac.uk/blog/data-diplomacy-turning-bytes-insights-foreign-service>

- b) *The availability of new sources of empowerment could broaden the gap between developed and developing countries:* The environment shaped by the Fourth Industrial Revolution offers new sources of empowerment, such as innovation capacities and adaptation skills.¹⁴ However, they depend on the states' level of access to last-generation technologies, adequate infrastructure, and trained human capital, features that are not common among developing countries. This unequal access to the assets needed for showing a better digital and technological performance could broaden the gap between developed and developing countries if the latter do not find suitable ways to overcome their obstacles.
- c) *The disruptive changes produced in this era are challenging the regulation capacity of the international system:* Emerging technologies are arriving well ahead of the rules and standards needed to govern them. In fact, there is little global consensus about how to regulate them or whether they should be regulated at all. Regulations usually require sufficient evidence that a specific technology has to be oversight which is difficult to prove at the time of its invention. Even when a technology has clearly negative repercussions, as in the case of weapons, global agreements to constrain their use requires states' political willingness. This demands the participation of the world's great powers, who could not always have the same incentives, motivations, and positions regarding ethical dilemmas of the use of technologies, creating challenges for the rest of the world, especially the less empowered countries.¹⁵

¹⁴ Peter Engelke, "Three Ways the Fourth Industrial Revolution is Shaping Geopolitics," *World Economic Forum*, Aug. 24, 2018. <https://www.weforum.org/agenda/2018/08/three-ways-the-fourth-industrial-revolution-is-shaping-geopolitics/>

¹⁵ See note 14 above.

Similarly, as it was explained before, unequal access to technologies determines the unequal access to their benefits and increases the odds of suffering the consequences of their side effects. Therefore, as Schwab and David state, the international scenario needs to promote more collaboration across the different stakeholders to reach a better distribution of the benefits of this new era and the effective containment of its possible externalities.¹⁶

d) *The competition for the 4th Industrial Revolution leadership —mainly between China and the U.S.— could affect the rest of the world:* Both the United Kingdom and the United States have capitalized greatly on economic and political benefits from their early leaderships regarding the previous industrial revolutions expanding their values to the rest of the world. However, the Fourth Industrial Revolution could mark a change in the global predominance of western values if the leadership of the new era is occupied by a non-western country. Whoever achieves technological supremacy will have an undoubted competitive advantage when it comes to being able to impose their geopolitical, economic, commercial, or even cultural interests.

In that sense, in the current international landscape of competition between China and the U.S. for the global hegemony, there is a high risk that the technological ecosystem will end up being fragmented. If the mere proliferation of technological disruptions and specific standards issued by these superpowers can be a platform to consolidate their global expansion, it is highly possible that the rest of the countries could be conditioned to join specific developments and not the others.¹⁷ Actually, 5G has already become a conflictive

¹⁶ Schwab and David, *Shaping the future of the Fourth Industrial Revolution*, 16.

¹⁷ Fernando Sandoval Zagarra, *La Cuarta Revolución Industrial en el Marco de la Competencia entre China y Estados Unidos por la Hegemonía: Una Propuesta para la Política Exterior del Perú* [The Fourth Industrial Revolution within the Framework of competitiveness between China and the United States for the global hegemony: A Proposal for the Peruvian Foreign Policy], Lima: Academia Diplomática del Perú, 2019, 48-49.

arena between these superpowers about which, using national security reasons, both have tried to protect their national companies and dispute the imposition of their own technology.¹⁸

- e) *The shift of power from state to non-state actors could change the dynamics of the international context imposing new challenges for countries' foreign policy:* The new technologies have made it possible for non-state actors to wield influence or shift political outcomes on a scale and in a way that was not possible just a decade ago.¹⁹ Currently, the management of most of the new technologies rely on the private sector, changing the dynamics of interaction within the international environment, and forcing states to adapt their actions and decisions as faster as they can to avoid being overwhelmed by this new pattern.
- f) *The change in the nature of international security and its common threats could be one of the major challenges imposed by this new era:* Cyberwarfare represents one of the most serious threats of our time, constituting a significant challenge because of its multiple possible targets and the difficulty of tracking the origin of an attack. In cyberspace, any network or connected device, from military systems to civilian infrastructures such as energy sources, electricity grids, or traffic controls, can be hacked and attacked. States cannot always be sure of who is defying their national security systems because threats can come from both state and non-state actors, including hackers, terrorists, criminals, and other possible foes. The increased connectivity provided by the emerging technologies also

¹⁸ Vicente Moret, How the expansion of 5G technology is causing a geopolitical battle, *BBC*, Jun. 17, 2019, <https://www.bbc.com/mundo/noticias-48663470>.

¹⁹ Luminae Group. "The Geopolitical Repercussions of the Digital Age," Dec. 12, 2019, accessed February 6, 2022, <https://www.luminaegroup.com/blog/geopolitics-digital-disruption>.

supports the recruitment of followers by extremist groups and criminal organizations, allowing their easy transnationalization and broadening the scope of their attacks.

Further, every day more sophisticated and advanced deadly technologies are becoming easier to acquire and use, opening room for new weapons and attack modes, including autonomous weaponry, war drones, new imperceptible biological and chemical substances, among others.²⁰

g) Other challenges linked to the increased availability of information sources: The new scenario could also represent a risk to the secrecy of certain issues particularly sensitive for countries' national security due to the increased number of information channels available and their minimal regulation.

Also, while digital channels provide opportunities for spreading information and organizing action for good causes, they can defy states' national security allowing the spread of malicious content and propaganda that can lead to a range of awful outcomes, from random violence to xenophobic attacks.²¹

4.3.2. Opportunities and Challenges inside a country

The Fourth Industrial Revolution also has many repercussions on countries' internal dynamics, impacting political, social, and economic patterns, and creating both opportunities and challenges that states should take into account in their decision-making processes.

²⁰ Schwab, *The Fourth Industrial Revolution*, 80-82.

²¹ Luminae Group, "The Geopolitical Repercussions of the Digital Age".

4.3.2.1. Opportunities in the political field

a) *New technologies can open room for strengthening e-governance, transparency, and accountability:* Technologies produced within the framework of the Fourth Industrial Revolution can support the modernization of government structures to allow them to show a better performance regarding their levels of transparency and accountability.²² Also, they can provide greater accessibility for citizens to different public services thanks to the use of digital platforms complemented by AI and other technologies that makes possible virtual interactions, automatized responses, bots assistance, among others.

Modernization always represents a chance for improving the engagement between governments and citizens.

b) *The new era offers new opportunities for spreading information and organizing action for good causes:* The diverse channels available for spreading information allow government messages to reach more people in less time while testing public reactions practically in real-time. It also allows the population to spread specific information and news, promoting people's mobilization for good causes. In that sense, new technologies could be considered tools for socializing messages, providing a new way for people to voice their opinions and get support for reaching beneficial goals that require cooperative actions.²³

c) *Permanent innovation processes could provide new responses against current threats:* The Fourth Industrial Revolution could have the potential to tackle the most pressing human challenges such as climate change, pollution, water scarcity, disaster resilience, and so on. New technologies could be developed to support the creation of distributed "off-grid" water

²² Schwab, *The Fourth Industrial Revolution*, 66.

²³ Schwab, 67.

and energy resources; improve climate modeling; produce alternative fuels; create smart transportation options, smart cities, and homes; strengthen skills for habitat restoration and species protection; among other innovations that could bolster the human well-being.²⁴

Further, new technologies can offer opportunities to improve the capacities to perform diverse tasks or to produce goods and services that could help the development of more positive health outcomes ranging from wearables that allow humans to enhance their self-managed healthcare to visual aids for optimizing surgical procedures,²⁵ as well as the development of vaccines such as the ones created recently to contain the COVID-19 spread.

4.3.2.2. Challenges in the political field

- a) *The access to new technologies could create new power asymmetries:* Although inequality is a concern that I will address in the section of social challenges, it is essential to notice the empowerment and disempowerment capacity that the access and management of new technologies may provide. Even asymmetries of information might lead to significant asymmetries of power since whoever has the knowledge to operate new technologies also has more power.²⁶ This issue creates worries about the possibility that businesses harness this scenario against ordinary citizens who do not have enough mechanisms to avoid lagging behind the first. Therefore, the broad access to new technologies and the know-how to use them represent goals governments should pursue to prevent a significant power imbalance within their societies.

²⁴ Price Waterhouse Coopers, *Fourth Industrial Revolution for the Earth: Harnessing Artificial Intelligence for the Earth*, PwC, 2,3,8, accessed February 12, 2022, <https://www.pwc.com/gx/en/services/sustainability/publications/ai-for-the-earth.html>

²⁵ Schwab, *The Fourth Industrial Revolution*, 110.

²⁶ Schwab, 71.

- b) Most of the new technologies come from the private domain challenging governmental control:* Governments' oversight of private sector activities is not an easy task, especially when there is not adequate regulation to do so. However, excessive regulations could also be a disincentive for some businesses, which could prefer moving their operations to countries where regulations are not strict. Establishing the right degree and form of regulation is vital for governments to promote innovation while avoiding and deterring its possible externalities.
- c) The velocity of the new scenario demands a rapid decision-making process:* Decision-makers used to have enough time to study a specific issue and then create the necessary response or the appropriate regulatory framework. Currently, leaders and decision-makers need to act rapidly, having less time available for arriving at measured, principled, and calibrated responses.²⁷
- d) Classified information in the public domain could affect governments' decision-making dynamics:* In the new scenario, governments face a particularly difficult challenge in keeping some issues in reserve. This is because of the increased availability of channels for spreading information. It, therefore, complicates governments' decision-making dynamics.
- e) The Fourth Industrial Revolution could defy the current environmental status:* The model of development produced by previous industrial revolutions has largely come at the expense of the planet leading to many of the world's current environmental problems. The Fourth Industrial Revolution could exacerbate the existing threats or create entirely new risks regarding which decision-makers have to be permanently aware.²⁸ For instance, due to the

²⁷ Schwab, 68.

²⁸ Price Waterhouse Coopers, *Fourth Industrial Revolution for the Earth*, 1-3.

fast pace at which technology is evolving, electronic devices usually have only a few years of useful life. Their rapid turnover produces increased electronic waste, posing a new environmental challenge for the world.²⁹

- f) *The use, manipulation, or misuse of the emerging technologies could produce negative consequences both deliberately or unintendedly:* Any change by itself creates some opportunity costs and side effects that should not be overlooked. Risks, within the framework of the Fourth Industrial Revolution, could range from attempts to illegal manipulation of the human genome to the hacking of a system used for the delivery of an essential service. The emergence of new disruptive technologies produces the rise of ethical dilemmas about how to use or not the new developments, and the lack of regulation does not allow adequate responses against their possible threats. Moreover, while the increased sophistication level of the emerging technologies could lead to unintended consequences, they could also fall into the hands of unscrupulous people seeking to cause damage through their use or misuse.

4.3.2.3. Opportunities in the social field

- a) *New technologies could broaden the scope of government policies offering countries new opportunities for inclusion, fairness, and prosperity:* The emerging technologies provide new channels for the delivery of public goods and services that governments could use to improve the wellness of those sectors in society seldom reached by the current channels of governmental action.

²⁹ Santhanam Needhidasan, et al. Electronic Waste-An Emerging Threat to the Environment of Urban India. In *Journal of Environmental Health Science & Engineering* 2014, 12:36, 3.

b) Immediate communication channels promote the emergence of better-informed societies:

Thanks to the rapid spread of information and its greater accessibility, citizens are more aware of what is happening in their countries and abroad, experiencing new ways of participating in civic life.³⁰ Also, they have access to new sources of knowledge that can allow them to develop new capacities and skills.

c) Increased connectivity could leverage the cohesion between individuals of the same society:

Digital technologies augment social interaction allowing citizens of the same country to connect with others. This reality can create opportunities for social cohesion, especially within countries that are characterized by a rich diversity.³¹ However, new technologies could also have the opposite effect, as we will address in the social challenges section of this research.

d) Innovations could offer new entertainment options: The growing evolution of technologies promises individuals a wide variety of entertainment options. For instance, the recent announcement of a *metaverse* promises a new space where people will be able to hang out with friends, join events, play, shop, and do multiple other activities without moving physically from their houses.³² These kinds of initiatives are not unusual or isolated within the framework of the new era. Leisure breakthroughs are part of our daily experience with streaming platforms, virtual reality and reality augmented games, digital libraries, virtual guided tours, among others.

³⁰ Schwab, *The Fourth Industrial Revolution*, 90.

³¹ Allen Bartley, Francis Collins and Jay Marlowe. "Digital Belongings: The Intersections of Social Cohesion, Connectivity and Digital Media," in *Ethnicities*. Vol. 17 (I) (SAGE: February, 2017), 100.

³² Leydis Becerra. "¿Qué es el metaverso anunciado por Mark Zuckerberg y cómo funciona?" [What is the metaverse announced by Mark Zuckerberg and how will it work?] *Bloomberg*, Oct. 28, 2021, <https://www.bloomberglinea.com/2021/10/28/que-es-el-metaverso-anunciado-por-mark-zuckerberg-y-como-funcionara/>.

4.3.2.4. Challenges in the social field:

- a) *The current digital divide could be broadened:* The issue of digital exclusion (or digital divide) becomes ever more pressing, as it is increasingly difficult for people to join the Fourth Industrial Revolution without access to proper infrastructure and/or sufficient knowledge regarding the use of the new disruptive tools.³³ Hence, power may flow to those whose location, educational background, and income put them on the right side of a widening digital divide. In contrast, billions of others could end up being further excluded.³⁴ Disparities among genders, generations, and social and economic sectors within the same society could be exacerbated due to the possible concentration of the management of the new technologies in the hands of a few elites.³⁵
- b) *Privacy could be at risk due to the increased requirements by some technologies of people's consent to the access and sharing of their personal information:* As mentioned before, adequate regulation is one of the main challenges within the context of the Fourth Industrial Revolution. Rules around the collection, processing, and reselling of personal data are still weak or entirely lacking in many jurisdictions, opening avenues for cybercrime, phishing, identity theft, and other activities with illegal ends that threaten the privacy of people's personal life.³⁶
- c) *The increased exposure to ideas from different cultures could cause the redefinition of individual and cultural identities:* Upsetting one's perception is easier in the new era due to the quantity of information available and the increased exposure to information and ideas

³³ Schwab, *The Fourth Industrial Revolution*, 71.

³⁴ Schwab and David, *Shaping the future of the Fourth Industrial Revolution*, 74.

³⁵ Yuval Harari. *21 Lecciones para el siglo XXI* [Lessons for the 21st Century], Debate, 2018, 96.

³⁶ Schwab, *The Fourth Industrial Revolution*, 70.

that are not necessarily aligned to one's personal beliefs. The arrival of online connections allows many cultural exchanges making identities more fungible than previously.³⁷

- d) *New technologies could be manipulated to trigger more social polarization:* New technologies are capable to provide both data for categorizing people and different means for targeting them. In this regard, interest groups can design specific messages oriented around people's particular profiles. They are shielded from contrasting views, which could lead to more polarized societies in which citizens are encouraged to discord and mistrust, sharing less common ground and less understanding vis-à-vis those with different political ideologies, cultural identities, or different perspectives around specific topics such as immigration, gender equality, and so on.³⁸
- e) *Some technologies could cause addiction and favor escapism:* The excessive dependence on technology could impact individuals' relationships, devastating societies due to the emergence of every day more immersive experiences that allow people to abandon their problems by living alternate realities.

4.3.2.5. Opportunities in the economic field

- a) *New technologies have the capacity to improve productivity and competitiveness:* The Fourth Industrial Revolution makes it feasible, more efficient, and more flexible processes to produce higher quality goods and services at reduced costs. Innovative goods and services created in the Fourth Industrial Revolution can harness highly competitive markets via digital platforms, which result in lower prices, incentivizing higher demand.

³⁷ Schwab, 78.

³⁸ Philip Boucher, "Technology and social polarization", *European Parliament Research Service*, March, 2019, 1.

Additionally, thanks to the data and metrics available, businesses can develop products and services adjusted to customers' needs and behaviors or drive their marketing and sales decisions according to the insights provided by this data.³⁹

- b) *The Fourth Industrial Revolution allows the emergence of new business models that demand fewer assets and more knowledge:* Some business models such as the one executed by Uber, the largest taxi company which owns no vehicles, or Airbnb, the accommodation provider that owns no real estate, reflect the new opportunities provided by the digital era in which the success of a business could rely on the development of platforms rather than on the property of physical assets.⁴⁰

Likewise, the increasing trade of Non-Fungible Tokens (NFTs)⁴¹ demonstrates that there are no limits to innovation and that knowledge is more valuable than any other asset, opening room for many business opportunities and ventures that can support countries' economic growth and their markets diversification.

- c) *New technologies and business models increase employment opportunities, especially regarding cognitive and creative jobs:* The Fourth Industrial Revolution could improve countries' employment rates due to the emergence of new models of jobs, such as software developers, software quality testers, data detectives, and smart home designers, among others.

³⁹ Klaus Schwab, *The Fourth Industrial Revolution*, 35 & 58.

⁴⁰ Rubicon. "The Sharing Economy a New Way of Doing Business," *Wharton*, Dec. 11, 2015, <https://knowledge.wharton.upenn.edu/article/the-sharing-economy-a-new-way-of-doing-business/>

⁴¹ The Economist. "The market for non-fungible topics is evolving". *The Economist* (New York), Oct. 29, 2021. <https://www.economist.com/finance-and-economics/2021/10/29/the-market-for-non-fungible-tokens-is-evolving>.

Moreover, the chances for entrepreneurs to develop their own businesses are becoming more accessible thanks to the availability of digital platforms that allow them to sell and advertise their products and services on their own.

Simultaneously, the current expansion of remote work allows people to work for foreign companies without migrating abroad, which stimulates countries' economies thanks to the capital influx they produce.

- d) *New technologies provide greater access to financial services and opportunities for direct exchanges in the global market:* Digital technology offers opportunities for the financial inclusion of many people throughout the world, enabling individuals and businesses to join the global economy for the first time. According to the Global Findex database, since 2011, 1.2 billion adults (aged 15 and above) have opened an account, and 69% of them now have access to digital channels for moving money, saving, and managing their financial risks.⁴²

Innovations such as mobile payments, digital platforms, logistic technologies, and data-processing are opening avenues for new transactions, reaching foreign suppliers and customers, reducing transaction costs, and enabling new types of financial flows.⁴³

4.3.2.6. Challenges in the economic field

- a) *The access to new technologies could amplify economic inequality:* The wealth and well-being generated by previous industrial revolutions were, and continue to be, unevenly distributed.⁴⁴ The transitions triggered by the disruptive changes of the Fourth Industrial

⁴² Philippe Le Houérou and Dan Schulman, "Technology is Delivering Better Access to Financial Services. Here's How," *World Economic Forum*, April 20, 2018, <https://www.weforum.org/agenda/2018/04/digital-finance-can-fight-poverty-heres-how/>.

⁴³ Susan Lund, et al, "Globalization in Transition: The future of Trade and Value Chains," *Mc Kinsey Global Institute* Jan. 16, 2019, <https://www.mckinsey.com/featured-insights/innovation-and-growth/globalization-in-transition-the-future-of-trade-and-value-chains>.

⁴⁴ Schwab and David, *Shaping the future of the Fourth Industrial Revolution*, 26.

Revolution can also join into the dynamic of winners and losers that previous industrial revolutions have shown. This explains why it is important to implement adequate regulations and policies to offer broad access to new opportunities for more and more people.⁴⁵ Without such regulations, economic growth is not going to be possible since only those who can afford their access to new technologies are the ones who will enjoy their benefits which could improve their economic position evermore, broadening the current economic gaps among different sectors of the same society.

- b) *The Fourth Industrial Revolution could challenge the countries' labor market:* Automation and digital advances have shifted labor demand toward higher-level skills. Meanwhile, routine and middle-level skills jobs have progressively disappeared after being replaced by emerging technologies and other automated means.⁴⁶ However, disruptive innovations such as robots and AI are now also threatening the high skilled labor force,⁴⁷ due to their capacity to replace human reasoning and obtain better results. This creates concerns around the future role of individuals, and to what extent human intelligence and judgment are going to be needed to develop certain tasks.⁴⁸
- c) *Technological innovations regarding financial markets could be difficult to regulate using countries' traditional institutions:* As was mentioned before, financial markets are evolving thanks to the emergence of new technologies allowing faster, direct, and multiple transactions. However, these technologies, coupled with regulatory gaps and ambiguities,

⁴⁵ Zia Qureshi, "Technology, Growth and Inequality: Changing Dynamics in the Digital Era," *Global Economy and Development Brookings Institution*, Global working paper No 152, 6, February, 2021

⁴⁶ Qureshi, 10.

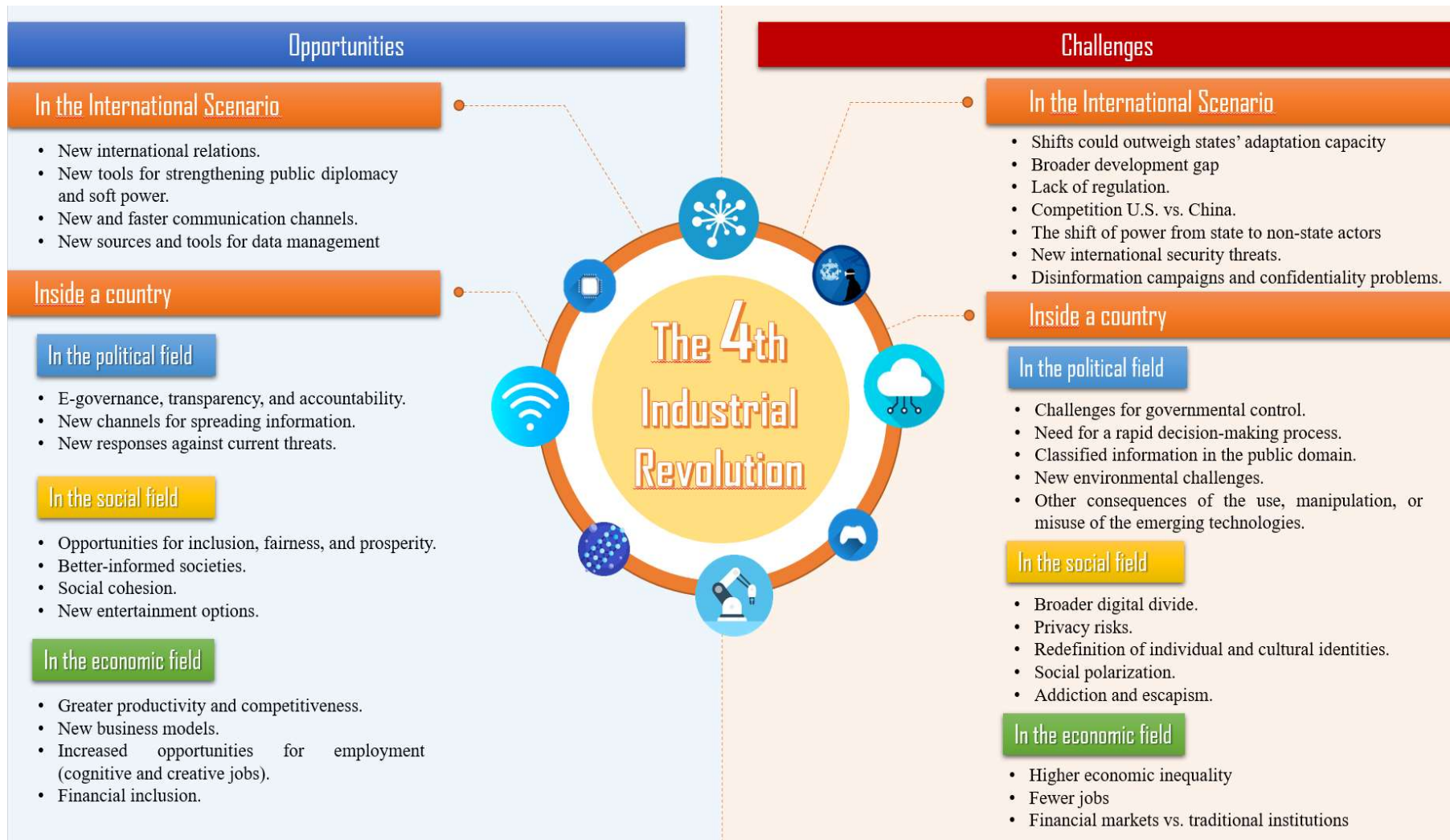
⁴⁷ United Nations Conference on Trade and Development. "Structural Transformation, Fourth Industrial Revolution and Inequality: Challenges for the scientific, technological and innovation policies." *Trade and Development Board TD/B/C.II/43* (Geneva: November, 2019), 7.

⁴⁸ Klaus Schwab and Nicholas David, *Shaping the future of the Fourth Industrial Revolution*, 161.

without enough oversight, could be hazardous. Some research demonstrates the challenges regulators may face in addressing the issues posed by technological innovations in this field.⁴⁹ Even though Central Banks can, to a certain extent, monitor these transactions when they are banked, the velocity of the emergence of new developments such as digital currencies imposes high pressure upon them. This increases the concerns regarding the limited scope of their functions vis-à-vis the progressive transformations that are taking place in the financial landscape.

⁴⁹Emilios Avgouleas, “Regulating Financial Innovation,” *Oxford Handbook of Financial Regulation* (London: Oxford University Press, 2015).

Graph No 1
Opportunities and Challenges of the Fourth Industrial Revolution



Source: Own elaboration

5. ASSESSMENT OF THE FOURTH INDUSTRIAL REVOLUTION IMPACT IN THE PERUVIAN CONTEXT

As we can conclude from the literature review, the effects of the Fourth Industrial Revolution within a particular context or on a specific group of individuals are tightly linked to whether or not there is a high or low degree of accessibility to the technologies provided by this new era, and to how much inclusive and equitable that accessibility is. In that sense, taking into account that this research is focused on the Peruvian context, first, we will assess the Peruvian level of accessibility to these technologies, and then we will review how these levels change within the Peruvian society depending on factors such as gender, age, and cultural roots, addressing the Peruvian digital divide.

5.1. Peruvian accessibility to the resources of the Fourth Industrial Revolution

Despite that one of the characteristics of the new era is its capacity to go beyond the states' territorial borders, it is not a global homogeneous phenomenon. Thus, the latest disruptive environment could represent in itself a challenge for some countries and individuals, while it could supply opportunities for others.

Regarding accessibility, which seems to be the primary determinant of the type of effects that this revolution triggers for countries throughout the world and their populations, it is not enough to talk about infrastructure. Knowledge of how to use technologies and regulations to broaden their access or to deter their malign use are in some cases even more important than the technological infrastructure itself. Therefore, we hold that three main elements shape the accessibility to the Fourth Industrial Revolution: 1) digital infrastructure, 2) human capital available, and 3) the decisions made by governments to provide large access to these technologies and/or to avoid their misuse. Thus, we are going to assess the current status of these three elements in the Peruvian context.

5.1.1. Peruvian digital infrastructure

In 2019, Peru launched a National Infrastructure Plan (PNIC), according to which it would need USD 110 billion over the next 20 years to bridge its long-term infrastructure gap.⁵⁰ In fact, taking into account Peru's digital infrastructure, it is estimated that the country needs an investment of USD 35,000 million over the next 10 years to reach the average level of connectivity as the OECD countries.⁵¹

One of Peru's most important problems regarding digital infrastructure relies on the heterogeneity of its territory, which makes difficult the accessibility to some regions, complicating the provision of cabling, electronic circuits, and antennas needed to amplify the scope of the digital coverage.⁵²

According to the Peruvian Telecommunications Regulator (OSIPTEL), of the 90,000 existing population centers, only 35,754 have access to mobile internet coverage, and just 480 have wired fixed internet.⁵³ These results illustrate Peru's disparity in the provision of digital infrastructure throughout its territory, most of which is highly concentrated in the Coastal and Sierra regions, as we can appreciate from the graphs displayed below.

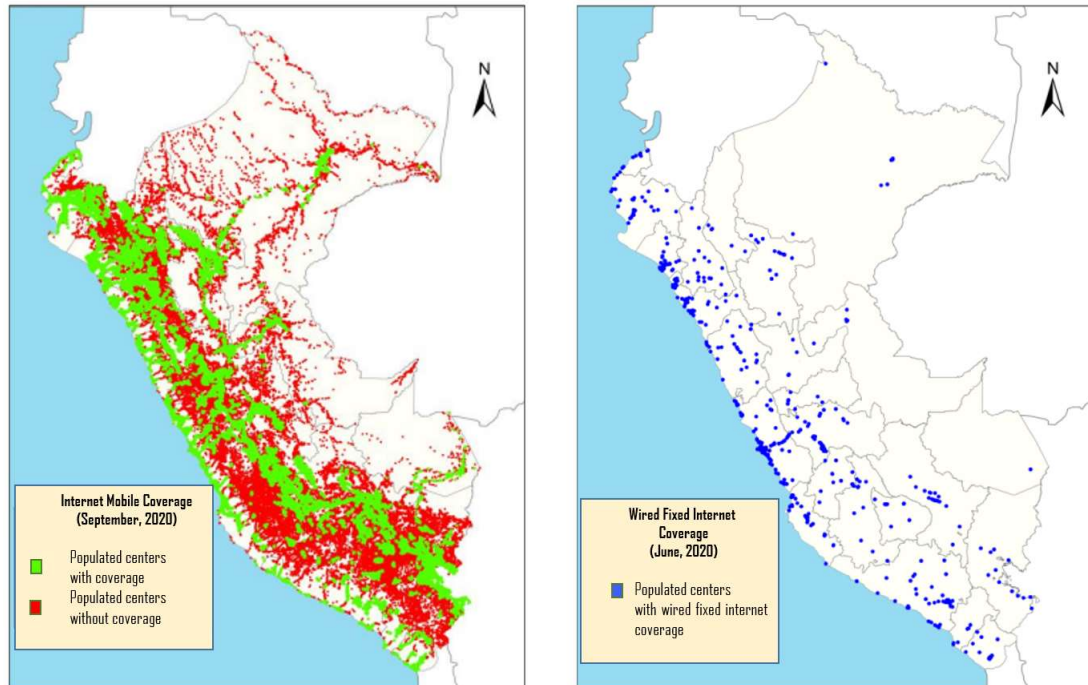
⁵⁰ International Trade Administration, "Peru-Country Commercial Guide." *U.S. Department of commerce*, accessed February 19, 2022, <https://www.trade.gov/country-commercial-guides/peru-infrastructure-development>.

⁵¹ Miguel de la Vega, *Perú es la Puerta de Ingreso para Inversiones de Corea del Sur a Sudamérica* [Peru is the gateway for investments from South Korea to South America]. Lima: El Peruano, <https://elperuano.pe/noticiaperu-es-ingreso-para-inversiones-corea-del-sur-a-sudamerica-65873.aspx>.

⁵² See note 49 above.

⁵³ Organismo Supervisor de la Inversión Privada en Telecomunicaciones (OSIPTEL), *Retos para Cerrar la Brecha Digital* [Challenges to bridge the Peruvian digital divide]. Lima: Osipitel, 2022, <https://www.osipitel.gob.pe/media/uaxgb32q/ppt-retos-cerrar-brechadigital.pdf>

Graph No 2
Peru mobile internet coverage



Source: OSIPTEL

Nonetheless, the Peruvian telecommunication infrastructure is not considered extremely inferior to other countries. In the *2016 International Ranking of Telecommunications Infrastructure*, which takes into account variables such as electricity production, mobile coverage rate, international bandwidth, and the number of secure internet servers, Peru ranked 72 out of 139 countries⁵⁴. However, to successfully join the Fourth Industrial Revolution, Peru needs more than broad access to 3G and 4G infrastructure. 5G connectivity is fundamental. As Sanchez stated, 5G is considered the ‘highway’ upon which most of the Fourth Industrial Revolution technologies will travel, such as the internet of things, big data, and artificial intelligence.⁵⁵

⁵⁴ BBVA, *Peru, Avances en Digitalización* [Peru, Digitalization Progress], Lima: BBVA Research, 2017, 46. https://www.bbvarsearch.com/wp-content/uploads/2017/11/Peru_Avances-en-digitalizacion_nov-17I.pdf

⁵⁵ Carlos Sanchez, *La Geopolítica del 5G se estrena con Huawei: La Guerra del Siglo XXI* [The geopolitics of 5G debuts with Huawei: The War of the 21st Century]. *El Confidencial*, February 19, 2022.

Given that the 4G infrastructure cannot be used at all for running 5G technologies,⁵⁶ it will not be easy for Peru to implement 5G coverage. It will require adequate telecommunications equipment, including mobile devices, servers, satellite antennas, broadband spectrum, and software infrastructure that allow the provision of supporting services for the new technologies.

Currently, indeed, the 5G coverage in Peru can be considered highly restrictive, being managed by two private companies and being geographically concentrated around 19 districts in Lima and 2 other provinces. Additionally, there is not a good prospect about its expansion and accessibility due to the high costs involved and the predominant trend in Latin America of working first to bridge the gap regarding 3G and 4G digital infrastructure.⁵⁷

In that sense, Peru needs to think about the ways in which it could adjust its digital infrastructure, involving both the participation of the private sector and also the engagement with specific international actors that could provide the country the support it needs.

5.1.2. Peruvian human capital and the management of new technologies

The technologies developed within the framework of the Fourth Industrial Revolution represent a severe challenge for the labor market due to the high possibility of replacing workers with robots or human analysis by the use of AI and machine learning. The replacement capacity of the new advancements can affect the labor market and also every single task that humans can currently develop.

⁵⁶ Karen Guardia, *¿Cuántas Antenas Necesitará Perú para Hacer Posible la Tecnología 5G?* [How Many Antennas Are Going to be Needed by Peru to Make Possible 5G Technology], *Gestión*, accessed February 19, 2022, <https://gestion.pe/economia/telefonía-movil-cuántas-antenas-necesitará-el-peru-para-la-tecnología-5g-noticia/>

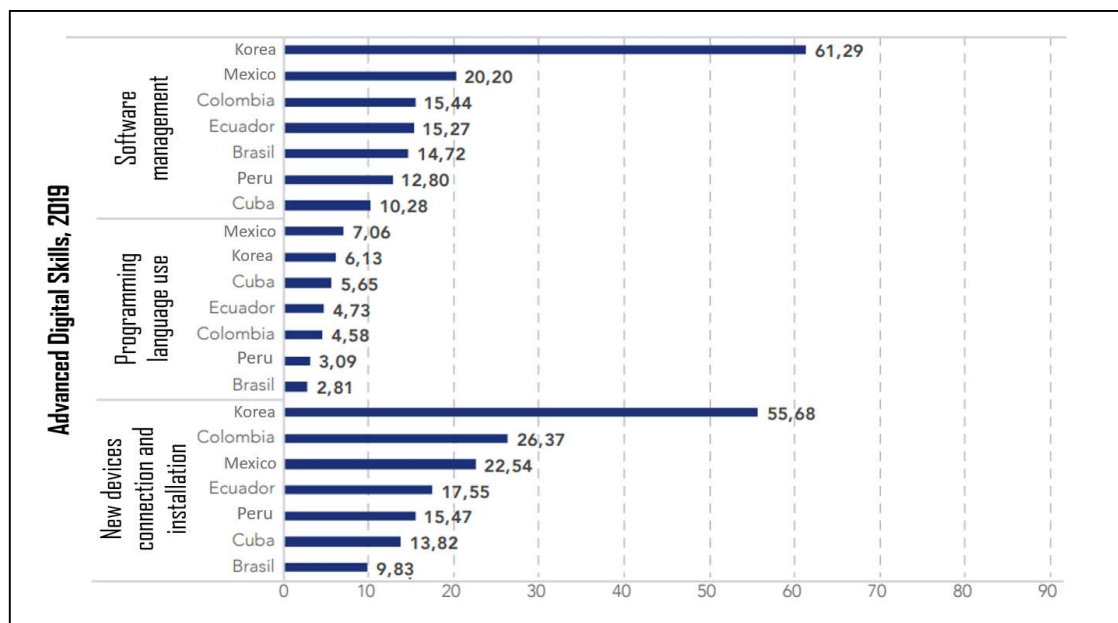
⁵⁷ Lorena Guarino, *¿Es la tecnología 5g una realidad posible para Latinoamérica?* [Is 5G feasible in Latin America?], *Bloomberg*, Jan. 2022, <https://www.bloomberglínea.com/2022/01/19/es-la-tecnología-5g-una-realidad-posible-para-latinoamérica/>.

To take advantage of the whole package of opportunities that this era promises, it is indispensable to enhance the human know-how regarding the use of the new technologies and their development. Countries that spend less time doing so will increase their development levels, assuming the leadership of the new global order proposed by this revolution.

Thus, Peru needs to anticipate and respond to the changing and challenging conditions of the new environment preparing its people and giving them the tools and facilities they need to manage the emerging technologies. However, current statistics show that the Peruvian and Latin American performance regarding this issue is falling far behind the developed world.

In the following graphs, elaborated by ECLAC,⁵⁸ we can appreciate the performance of selected countries in Latin America regarding their population digital skills in comparison to the Korean one. These Graphs make evident the technological knowledge gap between these countries.

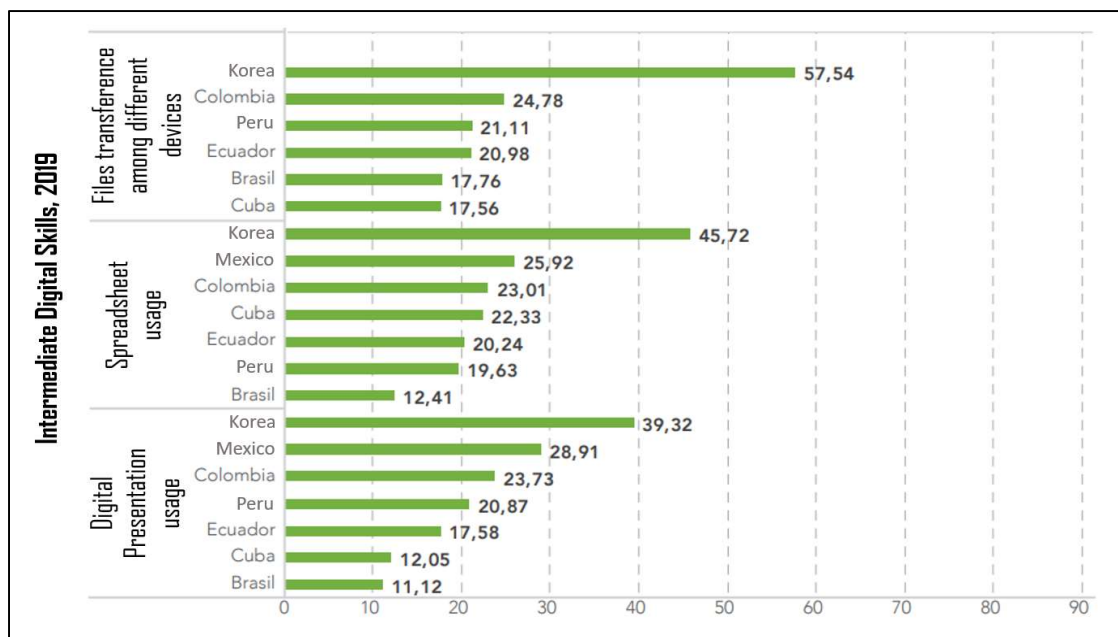
Graph No 3
Advanced Digital Skills: Latin America selected countries versus Korea



Source: ECLAC

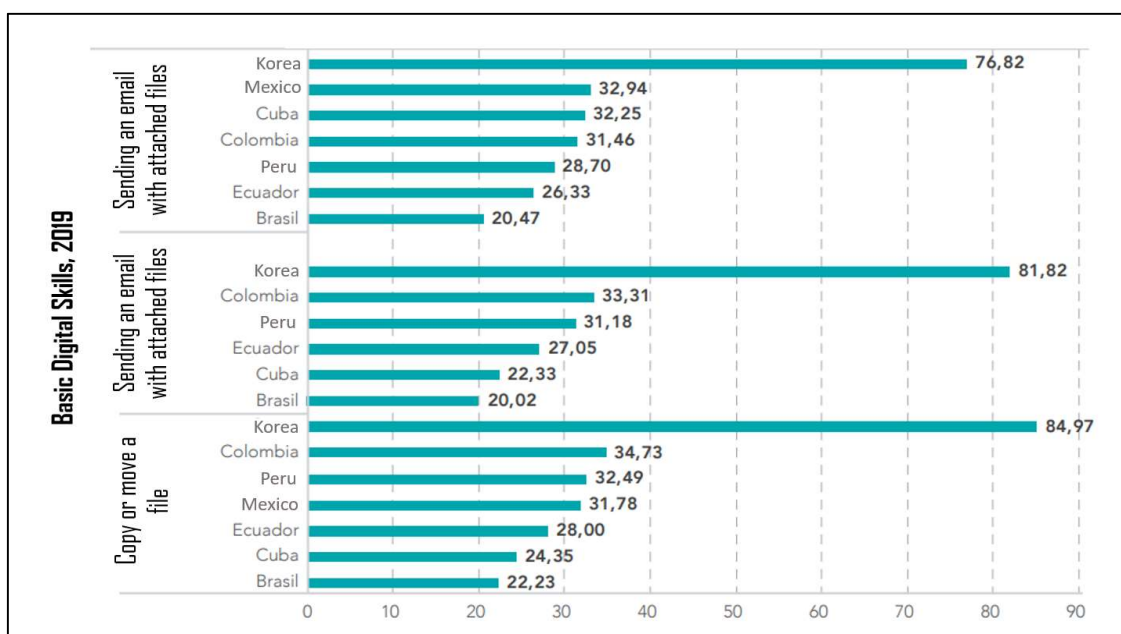
⁵⁸ United Nations Economic Commission for Latin America and the Caribbean, *Datos y Hechos sobre la Transformación Digital*. [Data and Facts Regarding Digital Transformation], Santiago: ECLAC, 2021, 33-34.

Graph No 4
Intermediate Digital Skills: Latin America selected countries versus Korea



Source: ECLAC

Graph No 5
Basic Digital Skills: Latin America selected countries versus Korea



Source: ECLAC

As we can conclude from the information provided by the graphs above, Peru shows a better performance regarding basic and intermediate digital skills. However, as its partners in the region, in any case, not even half of its population reports having at least basic digital knowledge.

At the regional level, less than 40% of the population have basic informatics knowledge, which involves activities such as copying a file or sending an email. Regarding intermediate activities such as the use of a spreadsheet, the creation of an electronic presentation, and the transferring of files between computers, the percentage of the population apt to do it represent only 30% of the region's population, while people with advanced technological abilities such as connecting and installing new devices, and downloading and installing a software represent less than 25%. Actually, in various Latin American countries, including Peru, less than 7% of people report having written a computer program using programming languages, which is considered a highly advanced technological skill within these countries.⁵⁹

According to the Survey of Adult Skills (PIAAC), applied in Peru between 2017 and 2018, some 6.6% of adults (aged 16-65) are proficient at *Level 2 or 3*⁶⁰ in problem-solving in technology-rich environments compared to the OECD average of 29.7%.⁶¹ These results confirm the evidence of a knowledge gap between the developed world and countries like Peru.

Thus, it is important for Peru to work hard with its population to allow them to have the know-how needed to discover, understand, and develop new technologies, which implies investments in training and education but also in scientific support. Actually, the IMD World Digital

⁵⁹ See note 58 above.

⁶⁰ According to the Survey of Adult Skills (PIAAC): "At *Level 3* adults can complete tasks involving multiple computer applications, a large number of steps, and the discovery and use of ad hoc commands in a novel environment. At *Level 2*, adults can complete problems that involve a small number of computer applications, and require completing several steps and operations to reach a solution."

⁶¹ Organization for Economic Cooperation and Development, "Skills matter: additional results from the survey of Adult skills," (OCDE, 2019), 2. https://www.oecd.org/skills/piaac/publications/countryspecificmaterial/PIAAC_Country_Note_Peru.pdf

Competitiveness Ranking 2021 considers all of these elements as sub-factors that determine a country's digital performance, and its results seem to be discouraging for Peru, which has dropped from position 55 to 59 in terms of population digital knowledge regarding its last year results.⁶² Reversing this trend should draw the attention of Peruvian decision-makers, especially considering that the most important component of the new environment shaped by the Fourth Industrial Revolution is the human being because only individuals can contribute to the progressive development of new technologies and because they are the most affected by this technological evolution.

5.1.3. Peruvian Institutional framework regarding the Fourth Industrial Revolution

As was mentioned before, governments can also procure to broaden technologies' accessibility and to avoid their misuse by their decision-making processes. This involves the establishment of an adequate framework of rules that guides public and private actions within the new disruptive context of challenges and opportunities, even more considering that the lack of regulation is one of the transversal threats that this era is triggering to every country and the international ecosystem as a whole.

In that sense, we are going to assess the current institutional framework developed by Peru regarding this new era, which entails policies, laws, and organisms created by this country in order to optimize its scientific, technological, and digital innovation.

- a) *National Agreement*: The *National Agreement* (in Spanish: *Acuerdo Nacional*) is the document within which we can find the Peruvian state policies considered the highest level political regulations in Peru, according to which all the government action has to be

⁶² International Institute for Management Development, *World Digital Competitiveness Ranking 2021* (Lausanne: IMD Business School, 2021), 40, accessed February 19, 2022. <https://www.imd.org/centers/world-competitiveness-center/rankings/world-digital-competitiveness/>.

organized and deployed. Policy number 35 within this document is titled: “Information and Knowledge Society,” which regulates the promotion of universal access to knowledge through information and communication technologies (ICT) as well as the development of mechanisms to strengthen the accessibility and connectivity throughout the country. It also establishes that the state must work on fostering and modernizing its digital infrastructure, implementing smart cities, establishing guidelines to avoid digital threats in the labor market, and promoting the use of ICT to impulse national productivity and competitiveness, among others.⁶³

- b) *National Policy for the Development of Science, Technology, and Innovation*: Established in 2016, this instrument was considered an essential step in the consolidation of the Peruvian Innovation System, whose general objective is to strengthen and improve the performance of science, technology and technological innovation in the country. This aim requires the accomplishment of the following six strategic goals: 1) the generation and transference of scientific knowledge aligned to the Peruvian needs; 2) the development of new incentives to increase the activities linked to the ICT use; 3) the generation of qualified human capital; 4) the improvement of quality levels of technological research and development centers; 5) the implementation of a registry that allows monitoring the quality of actors involved in the Peruvian Science, Technology, and Technological Innovation System; and 6) the strengthening of the country’s institutions of science, technology, and technological innovation.⁶⁴

⁶³ *Política N.º 35 del Acuerdo Nacional* [Policy No. 35 of the National Agreement] (2017).

⁶⁴ *Política Nacional para el Desarrollo de la Ciencia, Tecnología e Innovación* [National Policy for the Development of Science, Technology, and Innovation]. Lima: El Peruano, 2016. <https://portal.concytec.gob.pe/images/publicaciones/politicas/politica-nacional-cti.pdf>

- c) *The 2019-2030 National Plan for competitiveness and productivity*: This instrument entails a set of measures to leverage the country's medium and long-term economic growth, recognizing the importance of digital transformation for harnessing the opportunities that the technological disruptions are offering. Its main objective involves the development of innovation capacities and the adoption and transference of technical improvements.⁶⁵
- d) *Law No. 31250 - Law of the National System of Science, Technology, and Innovation (SINACIT)*: Issued in 2021, this law creates the SINACIT, determining the structure, functions, and coordination levels among the different public institutions concerned with the impulse, promotion, improvement, and consolidation of technological capacities and skills throughout the country.⁶⁶
- e) *The Multisector Commission of Science, Technology, and Innovation*: Established in 2021, this Commission is responsible for monitoring and controlling the accomplishment of the objectives defined by the National Policy for the Development of Science, Technology, and Innovation, issuing technical reports to guide its possible actualization. This Commission is integrated by the President of the National Council of Science, Technology, and Innovation (Concytec), twelve cabinet ministers including the Minister of Foreign Affairs, and the President of the National Assembly of Regional Governments.⁶⁷

⁶⁵ *Plan Nacional para la Competitividad y Productividad* [National Plan for Competitiveness and Productivity]. Lima: Ministerio de Economía y Finanzas, 2019. https://www.mef.gob.pe/concdecompetitividad/Plan_Nacional_de_Competitividad_y_Productividad_PNCP.pdf

⁶⁶ *Ley N.º 31250: Ley del Sistema Nacional de Ciencia, Tecnología e Innovación* [Law No. 31250: Law of the National System of Science, technology and Innovation]. Lima: El Peruano, 2021. <https://busquedas.elperuano.pe/normaslegales/ley-del-sistema-nacional-de-ciencia-tecnologia-e-innovacion-ley-n-31250-1968664-1/>

⁶⁷ *Decreto Supremo N.º 025-2021-PCM: Creación de la Comisión Multisectorial de Ciencia Tecnología e Innovación* [Supreme Executive Order No 025-2021-PCM: Establishment of the Multisectoral Commission for Science, Technology and Innovation], (2021). <https://busquedas.elperuano.pe/normaslegales/decreto-supremo-que-crea-la-comision-multisectorial-de-cienc-decreto-supremo-n-025-2021-pcm-1928760-2/>

- f) *The High-Level Committee for a Digital, Innovative and Competitive Peru*: This Committee is a political and strategic body whose main objective is to allow the multisector articulation to promote actions related to the development and consolidation of e-government, innovation, and digital economy, using digital technologies to strengthen the competitiveness, productivity and socio-economic wellness in all the Peruvian regions. It was created in 2018 by the Supreme Executive Order No 118-2018-PCM, which also declares all of these issues as part of Peru's national interest.⁶⁸
- g) *The E-government law*: This law establishes the framework for e-government efforts involving data management, digital services, and interoperability, among others. This law also creates the E-government Secretary, a public body responsible for the Peruvian digital transformation at the government level, and the E-government and Digital Transformation Laboratory, a body in charge of producing and designing digital platforms and technological solutions for the public sector.⁶⁹
- h) *The Peruvian Telecommunications Regulator (Osiptel)*: This is a specialized and decentralized public body attached to the Presidency of the Cabinet of Ministers. It is in charge of regulating and promoting competition among the diverse telecommunication companies, being responsible for monitoring the adequate private investment in this sector.⁷⁰

⁶⁸ Peruvian Government Web Portal, *Comité de Alto Nivel por un Perú Digital, Innovador y Competitivo* [High-Level Committee for a Digital, Innovative, and Competitive Peru], accessed February 23, 2022, <https://www.gob.pe/15726-comite-de-alto-nivel-por-un-peru-digital-innovador-y-competitivo-que-hacemos>

⁶⁹ *Ley del Gobierno Digital* [E-Government Law]. (2018). <https://cdn.www.gob.pe/uploads/document/file/353216/decreto-legislativo-que-aprueba-la-ley-de-gobierno-digital-decreto-legislativo-n-1412-1691026-1.pdf>.

⁷⁰ Organismo Supervisor de la Inversión Privada en Telecomunicaciones (OSIPTEL). *¿Quiénes somos?* [About us], accessed February 23, 2022, <https://www.osiptel.gob.pe/>

- i) *The National Council of Science, Technology, and Innovation (Concytec)*: Concytec includes members from the academy, the state research institutes, business organizations, communities, and civil society. Its purpose is to regulate, guide, encourage, coordinate, supervise and evaluate the state's actions in the fields of science, technology, and technological innovation, promoting their development through concerted efforts and the complementarity between the projects executed by the different governmental sectors.⁷¹

As we can notice, during recent years, the institutional design of the Peruvian digital and technological agenda has been improved. However, some features can still be optimized. For instance, there is not a budget specifically oriented to the technological and digital fields, and the different plans and policies adopted do not have specific baselines and goals, making the assessment of progress difficult. Also, there is a lack of coordination mechanisms within the public sector that allows the government to provide a standard and unified vision of innovation and digital transformation. These issues represent flaws in the Peruvian attempt to successfully join this new era, reducing its opportunities to get the most out of it.

5.2. The Peruvian Digital Divide

The term digital divide is related to all of the concepts previously assessed within this paper: infrastructure accessibility, human knowledge, and regulations. It is defined by the OECD as the “gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access ICT and to their use of the Internet for a wide variety of activities.”⁷² Accordingly, this phenomenon can be addressed either at a global

⁷¹ Consejo Nacional de Ciencia Tecnología e Innovación Tecnológica, *¿Quiénes somos?* [About us], accessed February 23, 2022, <https://portal.concytec.gob.pe/index.php/concytec/quienes-somos>

⁷² Organization for Economic Cooperation and Development, “Understanding the Digital Divide”, Paris, 2001, 5. <https://www.oecd.org/digital/ieconomy/1888451.pdf>.

level by assessing the existent gap between countries or at the individual level, considering the gap between people who belong to the same country.

Although we have already reviewed the Peruvian level of accessibility to the new disruptive technologies, we still need to assess how much equitable and inclusive that accessibility is. Hence, as part of our diagnosis regarding Peru's digital performance, we are going to develop a brief analysis of the digital divide within this country, focusing our assessment on some variables of its demography that could have a significant impact on the dissimilar patterns of digital access, use, and innovation showed up by its population.

5.2.1. The Peruvian Culture and the digital divide

Technology affects all of us and hence all cultures. However, patterns of technology used across different ethnic groups do not necessarily have to be uniform. This can be attributable to both: a lack of government action and the diverse cultural emphases that different ethnic groups can have about digital value.

In Peru, according to the last 2017 national census, there are at least 2,703 native communities that identified themselves as part of one of the 44 indigenous groups of this country. Among them, only 2.9% reported having internet access and just 0.5% cell phone services. Moreover, 57% of them do not have access to any means of communication, having simultaneously a low rate of accessibility to basic utilities such as electricity, water, and sewage.⁷³

Although one of the possible explanations for these low average rates of digital accessibility among indigenous communities could be their location within the Peruvian territory, since their population

⁷³ Instituto Nacional de Estadística e Informática (INEI), *III Censo de Comunidades Nativas 2017* [III Census of Native Communities 2017], Lima: INEI, 2017, 38-40, https://www.inei.gob.pe/media/MenuRecursivo/publicaciones_digitales/Est/Lib1598/TOMO_01.pdf.

is mostly scattered in rural areas where the Peruvian government has not been capable to implement a basic digital infrastructure, according to a survey applied by the Peruvian telecommunications regulator, the main reasons to not acquire internet within rural areas and among indigenous communities are not only the lack of service availability, but also its high costs, the lack of need for connection by not having a computer or a cell phone, and the simple lack of interest regarding digital connectivity.⁷⁴

In that sense, we can argue that while there are some causes for the low digital access among these communities that can be attributed to the governmental performance, there are other conditions linked to people's beliefs that are going to be more difficult to address given their intrinsic linkage with a cultural idiosyncrasy.

The digital divide at the cultural level involves some cultural beliefs and different experiences that no government policies are able to address because they are part of everyone's personal decisions. In this regard, considering Peru as a multicultural country, the Peruvian government needs to focus on how to provide the same opportunities —infrastructure and capabilities— for its whole population, letting them decide whether or not to engage with the services available, according to their interests and needs. However, at the same time, if it is capable to prove what are the concrete benefits of these technologies,' it can encourage the use of them reaching a greater involvement of the Peruvian population within the new framework.

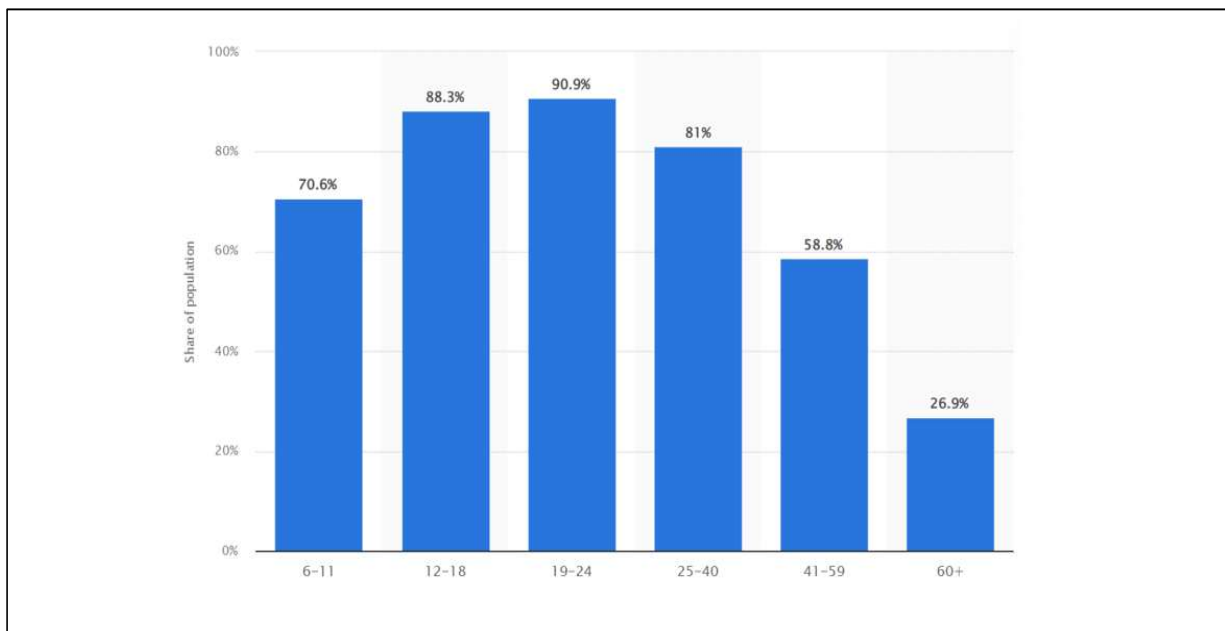
⁷⁴ Organismo Supervisor de la Inversión Privada en Telecomunicaciones (OSIPTEL), *Retos para Cerrar la Brecha Digital* [Challenges to bridge the Peruvian digital divide], 24-25.

5.2.1. Peruvian generational digital divide

The generational digital divide is the gap between the youth within a society who have achieved digital literacy and uses technology regularly, and the older generation who are less versed in that field.

In the Peruvian case, nearly 91% of people aged between 19 and 24 years have internet access and use it. Meanwhile, more than 70% of people over 60 report that they are not internet users.⁷⁵

Graph No 6
Peruvian Internet Penetration by Age Range



Source: *STATISTA*

Although there is no information available about the reasons for these results, it seems to be a common phenomenon worldwide, and every day more sophisticated technologies threaten to broaden this gap instead of helping to bridge it.

⁷⁵ STATISTA, “Internet user penetration rate in Peru in 4th quarter 2020, by age group.” <https://www.statista.com/statistics/982713/internet-user-penetration-rate-peru-age-group/#:~:text=In%20the%20fourth%20quarter%20of,and%20over%20used%20the%20web.>

While the differences in the use of digital tools can be a consequence of aging itself because of the natural decline of capacities produced by age, they also involve a generational effect about which it is particularly important to consider skills and adaptation as the causes of the greater or lesser use of digital services. This is because they determine whether or not a person is able to interact with the new technological environment.

Taking into account that the framework of the Fourth Industrial Revolution allows us to envision a future in which current technologies are only the first step of a highly interconnected world, no one is free to fall behind in the generational divide. In fact, more than an age-related issue, it is an adaptive-related one that demands everybody to be immersed in a permanent learning process to harness the opportunities that the upcoming technologies will offer.

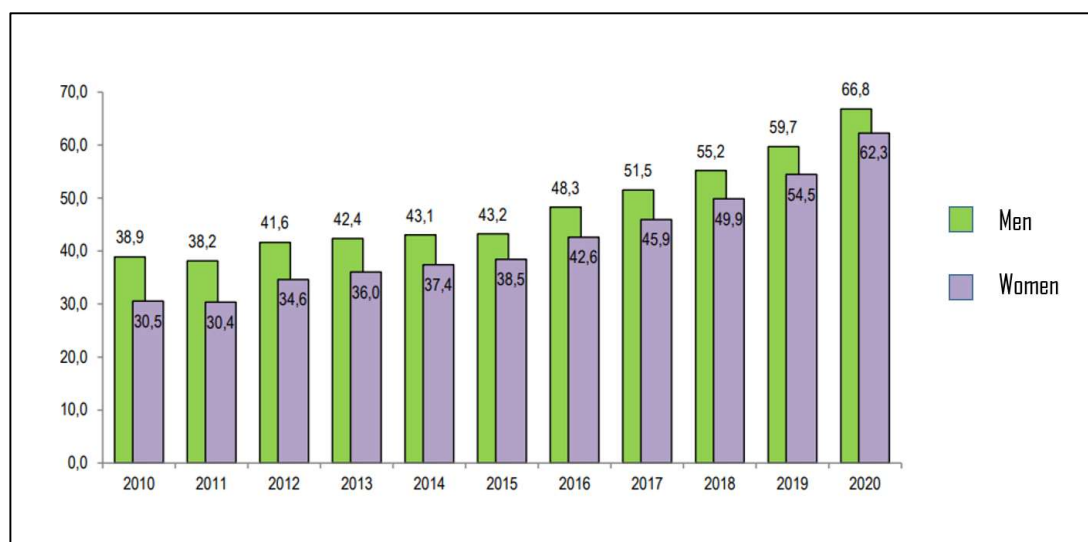
Thus, to keep its population ready and motivated to engage in the continuously evolving technological scenario, the government should invest funding and time in its population training and education.

5.2.3. Peruvian digital gender divide

Globally, the rates of internet use among men and women are not usually the same. In the case of Peru, although there is not a pronounced difference, these rates suggest that while women benefit from digital advances, they lagged behind men. Whereas in recent years, the volume of internet users in Peru has increased, the percentage of women users is still 4.5% below that corresponding of men.⁷⁶

⁷⁶ Instituto Nacional de Estadística e Informática (INEI), *Perú: Brechas de Género 2021* [Peru: Gender Gaps 2021], Lima: INEI, 2021, 116, https://www.inei.gob.pe/media/MenuRecursivo/publicaciones_digitales/Est/Lib1833/libro.pdf.

Graph No 7
Peruvian internet use by men and women, 2010-2022



Source: INEI

According to the data presented by the INEI, in 2020, 66.8% of men and 62.3% of women are internet users. This means that the number of women internet users is almost equal to the number of men. However, the distance between these percentages increases when we analyze them with other data such as age, place of residence, and language, among others. This allows us to notice that the use of technology by women in Peru is limited, whether due to the infrastructure coverage, economic reasons, gender violence, cultural roots, educational bases, or other issues.⁷⁷

To achieve gender equality in general terms, women need equal access to technology as men, and the government should ensure that access by providing adequate digital training and regulations. It is important for women to feel themselves safe online and to have the same opportunities to participate in the use and development of new technologies that men already have.

⁷⁷ Marieliv Flores and Denisse Albornoz, *Are we connected? Digital Gender Gap in Peru*, Lima: Hiperderecho, 2019, 5, https://hiperderecho.org/wp-content/uploads/2020/01/flores_digital_gender_gap_peru_2019.pdf.

Suppose women do not get involved in the digital and technological environment. In that case, the existing inequalities between both genders will be exacerbated, triggering all the threats that technologies could produce when there is no equitable access and distribution of their benefits, as has been analyzed in the literature review section of this paper.

5.3. Peru's digital diagnostic: strengths and weaknesses to successfully join the Fourth Industrial Revolution

After reviewing the levels of digital accessibility in Peru, we can conclude that while there have been some advances, there is still a long path to walk to ensure this country enjoys the full potential opportunities offered by the Fourth Industrial Revolution.

Firstly, regarding digital infrastructure, Peru —as well as its peers in Latin America— is still concentrated on bridging the gap of connectivity concerning 3G and 4G technologies. This means that the country is not prepared to deal with the magnitude of infrastructure that the new generation of 5G connectivity will demand. In fact, currently, just a little area of the Peruvian capital and two additional provinces have access to this type of technology, which allows faster connectivity and larger data storage, being a requirement for the use and development of new technologies, such as the internet of things.

Secondly, considering the capabilities and knowledge needed for the use and management of the new technologies, the Peruvian population does not show high proficiency levels in digital skills. Unfortunately, in general, its population is more familiarized with tasks that require basic and intermediate digital knowledge than with activities that demand advanced digital skills. Moreover, not even half of its population reports having at least a basic digital understanding.

Thirdly, while in recent years, the institutional design of the Peruvian digital and technological agenda has been improved with the implementation of policies, laws, and bodies devoted to the country's digital transformation; there are still some issues that can be and need to be improved such as the identification of clear baselines and goals regarding the country's digital performance, as well as the determination and the distribution of the budget needed to finance the achievement of these goals.

Further, it is important to consider the digital divide present in the country, which causes asymmetrical opportunities among its different population groups. This is an obstacle that Peru should solve to be able to pursue a major technological and digital engagement.

In short, our diagnosis of Peru's digital performance reveals that this country has made substantial efforts to achieve its digital transformation. Nonetheless, these efforts are incipient when they are measured against the magnitude of the disruptive evolution that the world is undergoing due to the technological and digital continuous innovation. We need to keep in mind that while digital transformation is fundamental, it is only the first step of the sequence of goals that a country needs to accomplish to be able to use, produce, develop and manage all of the technologies that the Fourth Industrial Revolution proposes. This means that the achievement of a comprehensive digital transformation in Peru is only a fraction of the objectives that the country should seek to be able to enjoy the benefits provided by the new era and to avoid lagging far behind in the new empowerment race that countries around the world are running.

Given that the Fourth Industrial Revolution is a worldwide phenomenon, it is important to broaden the scope of our assessment to consider also the actions and decisions deployed by Peru in the international arena to complement the efforts and the progress made within the national sphere. In that sense, in the following section, we are going to supplement the assessment executed until now

with an evaluation of the Peruvian foreign policy; an issue that will be particularly relevant for the aim of this paper, which is devoted to the formulation of foreign policy recommendations that allow Peru to successfully join the Fourth Industrial Revolution.

5.4. The Fourth Industrial Revolution and the Peruvian Foreign Policy

Foreign Policy is the section of the governmental activity responsible for the decisions that countries make on the international stage. This area encompasses countries' international projection and their relationships with other international actors. It could be considered as the political arm that each state deploys on the international stage to foster the satisfaction of its national interests, constituting the external variable that allows states to reach their nations' aims.

Peruvian foreign policy has as its central reference the strategic objectives and the state policies established in the *National Agreement*, a document that —as was seen before— contains the highest-level political regulations according to which all the Peruvian governmental activity has to be organized and deployed. In that sense, regarding our research topic, the Peruvian foreign policy should complement the endeavors performed at the local level to accomplish the policy number 35, promoting universal access to knowledge through the ICT as well as the development of mechanisms to broaden the digital accessibility and connectivity levels of the country. However, the Peruvian foreign policy is executed through the Ministry of Foreign Affairs following a plan known as the *Multiannual Sectoral Strategic Plan*, which does not have any direct reference to the Fourth Industrial Revolution and the actions that the country should develop in front of it.

Regarding the measures that the country should take in front of the increasing technological environment, this strategic plan supports the importance of working on strengthening and implementing mechanisms of bilateral and multilateral cooperation in science and technology, as well as organizing projects and programs that involve the promotion of science, technology, and

innovation for development⁷⁸. However, there is not an attempt to define the clear objectives of such cooperation or the countries and organisms that should be primarily approached.

Additionally, although there have been some attempts to develop specialized working groups and observatories linked to the Fourth Industrial Revolution, the initiatives deployed until now are still in their implementation phase.

Thus, we can conclude that despite the fact that the international environment can offer some alternative opportunities to enhance the capacity of the country to successfully address the phenomenon of the Fourth Industrial Revolution, Peru's foreign policy has not developed a specific strategy in order to harness these opportunities. This is an issue that is not aligned with the Peruvian priority of seeking its global positioning as an emerging regional power.⁷⁹ An objective that points out how important is for this country to act as a key referent within the Latin American region and, therefore, the necessity to work hard in bridging the country's gaps regarding its peers at the regional and the global level.

The lack of a specific Foreign Policy strategic plan for facing the Fourth Industrial Revolution should be considered an important concern. It could mean that Peru's foreign policy is not prepared to deal with the challenges triggered by this new era. Therefore, its responses will be doomed to be reactive rather than strategically planned.

⁷⁸ Ministerio de Relaciones Exteriores del Perú. *Plan Estratégico Sectorial Multianual* [Multiannual Sectoral Strategic Plan], 2015, 41. <http://transparencia.rree.gob.pe/index.php/2-planeamiento-y-organizacion/22-plan-y-politicas/222-documentos-de-planificacion/plan-estrategico-sectorial-multianual-pesem/ano-2016/8105-plan-estrategico-sectorial-multianual-del-sector-relaciones-exteriores-pesem-2015-2021/file>

⁷⁹ Ministerio de Relaciones Exteriores del Perú. *Plan Estratégico Sectorial Multianual* [Multiannual Sectoral Strategic Plan], 2015, 25.

5.5. Particular benefits and challenges that Peru could obtain and face from the scenario proposed by the Fourth Industrial Revolution

After the assessment developed above and taking into account the possible opportunities and challenges that the Fourth Industrial Revolution causes, we are going to analyze the particular scenario that Peru is likely to face if it does not do anything to overcome its weaknesses, paving the way for the recommendations that we are planning to propose later in this paper.

Beginning with the national internal sphere, in the political field, the Fourth Industrial Revolution could increase the asymmetries of power present in the Peruvian society. This issue is particularly dangerous considering that the spread of digital opportunities in this country is, to a certain extent in charge of a few businesses, which despite being under the oversight of a governmental body, are the ones who determine the costs of access to the digital opportunities available. They define who can access or not to the digital environment based on their business interests which are linked to profit maximization rather than to the achievement of an integral connectivity status throughout the country. Likewise, although the Peruvian institutional framework has been improved by the implementation of diverse regulations at multiple levels, the velocity of the new scenario imposes the need for a rapid decision-making process. Nonetheless, the fragmentation of the digital strategy in Peru does not allow an adequate articulation between the different public bodies involved in this process, and the absence of a specific budget devoted to these purposes forces every financial decision to go through the evaluation of the Peruvian Ministry of Economy, a process that is not precisely characterized for being quick. The fragmented management of the digital and technological environment also increases the risks for the country of being exposed to the manipulation and misuse of technologies in ways that the government is not yet prepared to stop.

In the social field, the digital divide represents one of the major challenges for this country. The issue of digital exclusion becomes ever more pressing considering that without access to proper infrastructure and/or sufficient knowledge, the population will not be able to enjoy the opportunities provided by this new era. In this scenario, economic position, housing location, and educational background could end up determining who is apt to enjoy or not these benefits, leaving millions of people excluded from them and broadening the gap between the different sectors of the Peruvian society. Therefore, the current disparities between genders, generations, ethnic groups, and social and economic sectors could be exacerbated due to the possible concentration of the access and management of the new technologies in the hands of a few.

In the economic field, inequality could also play an important role, since only those who can afford their access to new technologies are the ones who will enjoy their benefits, increasing, even more, their economic position. However, the big challenge in this field will be definitely the labor market. Nowadays, practically every job has a digital component, meaning that digital skills are becoming highly demanded. The disruption generated by new technologies such as AI, machine learning, big data, and robotics will aggravate this trend, and the Peruvian society does not seem to be prepared to deal with all of it given that more than half of its population is not even able to develop basic digital tasks.

Regarding the international sphere, taking into account the velocity and scope of the changes that the Fourth Industrial Revolution is triggering, the challenges will be numerous, and the absence of a unified strategy of foreign policy could complicate their adequate management. The new era encompasses a disruption in the way in which diplomacy, international trade, cooperation, and even conflict are deployed; creating the necessity of new approaches, regulations, capacities, skills, and assets that demand time to be strategically and adequately prepared.

In the environment shaped by the Fourth Industrial Revolution, innovation capacities and adaptation skills can be considered sources of empowerment. They should be developed rapidly and as soon as possible. If a country opts to rely just on its reactive capacity rather than innovating and adapting itself, its chances of success will be less than those of other countries better prepared.

Simultaneously, in the middle of the current competition between China and the U.S. for the leadership of the Fourth Industrial Revolution and the dominion of 5G technologies, it is not irrational to think about possible direct and indirect pressures upon Peru as well as the rest of the world demanding exclusivity or the preferential adoption to the sources of connectivity of one of them over the other. This issue has to be meticulously evaluated by Peru at the time to deploy its foreign policy to avoid getting immersed in this competition without the chance to determine from its own initiative what decisions to make to satisfy its national interests in the best way.

As well as technological dependence could condition Peru's technological future, there is always the risk that industries, manufacturers, and owners of digital platforms engage in illegal operations damaging the security, integrity, or system confidentiality of emerging technologies, especially considering the high flow of information they allow. Suspicions about the manipulation of information have actually been verified by some public cases that have shown the back doors that these technologies can have. Thus, given that the management of most of the new technologies relies on the private sector, governments need to develop mechanisms for controlling their reliability, setting standards and requirements to comply with, and sanctions to punish illegal operations. Regulations that are scarce or untrustworthy in the case of Peru due to corruption, the absence of an overall strategy, and the lack of preventive and coercive capabilities.

Peru should not overlook the threats to its national security that some of the new developments could represent. In cyberspace, any network or connected device can be hacked and attacked, and

states cannot always be certain of who is defying their national security systems because threats can come from both state and non-state actors. Cybercrime involves ransomware, malware, identity theft, crypto-jacking, and data breaches. Challenges that are threatening the entire world and require cooperative responses, in particular given that some criminal and terrorist organizations have tamed the use of technologies to their benefit better than states themselves. Thanks to the increasing connectivity, criminal and terrorist organizations are expanding their networks wielding direct influence over the global agenda, using media channels to appeal to their audience as part of their recruitment and influence campaigns, adding more challenges to the digitalized and interconnected world, against which, Peru will need international support to exert a proper defense and effective deterrence.

On the side of the opportunities, all of them will be conditioned to the deployment of a good performance in adapting the country to the new environment, meaning that Peru will not be able to harness them if it does not first strengthen its current capacities, bridging its gaps, overcoming its patterns of digital exclusion, and developing a coherent and unified strategy regarding the country's digital and technological transformation.

In that sense, taking into account that it is not in the interest of this paper to discourage the progress achieved by this country but to complement it, we consider that the international context could constitute a good ally that Peru should not overlook if it wants to successfully join this new era. It could offer chances for investment, assistance, cooperation, collaboration, and integration, among others; which could complement and leverage the efforts deployed locally to overcome the country's weaknesses, broadening the chances for its population to enjoy the benefits offered by this revolution.

Given that the international context is also immersed within this disruptive transformation, it could become itself a source of new opportunities not necessarily related to the achievement of a better digital or technological performance, but for the satisfaction of countries' diverse national interests. For instance, the capitalization on these opportunities could help Peru with its aim of becoming and consolidating its positioning as a regional power. That is why this paper considers relevant the strategic management of Peru's foreign policy, regarding which, in the following section, we will provide some recommendations.

6. FOREIGN POLICY RECOMMENDATIONS

The Fourth Industrial Revolution is a global phenomenon that involves multiple disruptive shifts worldwide. These shifts could be beneficial or not depending on countries' performance, their abilities to adapt themselves rapidly to the evolving environment, their innovation capacities, and their effectiveness to ensure broad and equitable access to emerging technologies for their populations.

As previous industrial revolutions have shown, these shifts also have the potential to produce a new global rearrangement that could bridge or broaden the gap between developed and developing countries based on how well they address the new scenario.

In the case of Peru, to avoid lagging behind the rest of the world, it should adopt a holistic approach within which the strategic management of its foreign policy will be an essential component. For this reason, in the next lines, we are going to suggest 13 foreign policy recommendations that this country could take into account if it wants to successfully join this new revolution, increasing its chances of becoming a regional power.

- *Stimulate the articulation between Peru's national interests and the execution of its foreign policy to get responses adjusted to the country's needs*

The challenges triggered by the Fourth Industrial Revolution are interconnected and require a comprehensive approach that can stimulate the understanding required to develop strategic responses. Thus, it is important to avoid deploying a compartmentalized foreign policy looking for opportunities abroad that are actually divorced from the scenario faced by the country.

The absence of a clear diagnostic of the country's needs led to unclear objectives, vague and imprecise indicators, and disarticulated responses. Against this backdrop, the Peruvian Ministry of Foreign Affairs should play an active role in the identification of the country's needs, keeping close coordination with other governmental sectors at the national, regional, and local levels to be able to define—in concrete terms—the country's interests, and subsequently, the objectives it should pursue at the international sphere for satisfying them.

Without such information, the odds of success will be minimal, depending on reactive measures rather than on strategic actions. If national interests can only be expressed through generic formulas such as achieving economic growth, poverty relief, digital accessibility, and transparency, among others, it will be impossible to determine what strategy should be deployed, limiting foreign policy execution to nothing else than just a bunch of good intentions.

- *Include the Fourth Industrial Revolution as part of Peru's foreign policy strategic objectives*

Peru's foreign policy is executed through the Ministry of Foreign Affairs following a plan known as the *Multiannual Sectoral Strategic Plan* which does not have any direct reference to the Fourth Industrial Revolution and the actions that the country should develop in front of it.

To be an effective agent of change and a relevant driver for achieving Peru's technological and digital transformation, the Peruvian Ministry of Foreign Affairs has to start by being aware of the dimension of the phenomenon encompassed by the Fourth Industrial Revolution and recognizing the importance of working on it.

Thus, to harness the opportunities offered by the international sphere regarding this new era, it is indispensable to include the Fourth Industrial Revolution as part of the strategic documents that guide the execution of Peru's foreign policy; otherwise, the efforts deployed will be just a consequence of isolated motivations rather than part of an overall institutional strategy.

- *Implement a Fourth Industrial Revolution neutral agenda independent of external interests*

One of the first steps that Peru should take is the definition of its objectives around the Fourth Industrial Revolution, setting an agenda aligned to the interests of the country and the needs of its population. The worst mistake that Peru could make is waiting passively to see what its peers in the region are going to do or what decisions the world powers expect it to make. While those elements should be part of the analysis to be carried out, Peru should be able to determine its own agenda independently of external influences.

Although Peru will need international support to accomplish its technological and digital objectives, it does not mean that the Peruvian Ministry of Foreign Affairs has to condition its role to other countries' priorities. On the contrary, this implies the need to adopt a proactive approach guided by the clear identification of the country's goals and the opportunities provided by the international sphere to achieve them.

Considering Peru's internal weaknesses, neutrality will be key for keeping doors open and managing multiple alternatives for the country, especially knowing that within the technological environment, simple decisions such as the acquisition of a particular technology could cause a dependency pattern. This could limit future decisions about suppliers, devices, complementary inputs, and accessories, among others.

- *Use the diplomatic network to collect information about new technologies and innovations developed worldwide as well as about possible sources of assistance and cooperation*

The Peruvian Ministry of Foreign Affairs is integrated by a network of more than 130 Foreign Service bodies where Peruvian diplomats carry out diverse functions around the world. This network constitutes an important source of information about what is happening in other countries and the multiple trends present in different regions. It has the potential to be used for specific purposes such as the collection of information about new technologies developed abroad and the identification of countries that could represent sources of prospective assistance and cooperation.

However, this labor should not be devoted to the sheer collection of information. It has to be accompanied by first approaches that allow a more reliable determination of the potential of the new inventions and the willingness of other countries to reach cooperation and assistance agreements in favor of Peru.

This whole information would be a valuable input for the decision-making process executed by the country at its diverse governmental levels.

- *Search and identify possible foreign financing sources for the deployment of scientific, technological, and digital projects in the country*

One of the problems of finding foreign financing sources is that they are often searched without a previous notion about how such investments are going to be used. This issue makes difficult the task of attracting prospective investors and/or cooperators.

On this matter, the Ministry of Foreign Affairs could develop an important role if it acts as an articulator between the internal needs of the country and the international opportunities available.

Using its diplomatic network, it should identify institutions, technological centers, companies, and other possible investors and prepare a database with their contact information and offerings, which should be shared with other governmental sectors that desire to explore the financing options available.

In parallel, domestically, it is important to encourage the preparation of a portfolio of projects that require financing, which should include basic information about the projects: their description, prospective outcomes, and estimated costs. This portfolio will be a fundamental input for getting such financing abroad.

- *Track the activity developed abroad by Peruvian scientists and startup developers, and reinforce the linkages between them and the country*

It is important to maintain close contact with the Peruvian scientific community abroad and with startup developers who no longer reside in Peru but who have been developing

successful careers in the scientific, technological, digital, and innovative fields. They are both reasons for national pride and also sources of inspiration for other Peruvians who wish to undertake activities in such fields.

The scientific community abroad could be interested in sharing their knowledge, capacities, inventions, and experiences with the country but they do not always find the means to do so, especially when the ties between them and the country have been weakened.

Through its consular offices, the Ministry of Foreign Affairs should approach them, encouraging their bonds with the country and providing them the means to spread and make known their achievements.

- *Analyze international trends, assessing the implications of the assimilation of specific technologies, according to the experiences observed in other countries*

The challenges triggered by the Fourth Industrial Revolution are not just challenges linked to the gap in digital infrastructure, accessibility, and connectivity. They are also a matter of data deficit, meaning that the collection of information should not be overestimated.

Technologies can have both positive and negative repercussions. Hence, determining what are the outcomes caused by the assimilation of specific technologies should be an indispensable input for the decision-making process devoted to the determination of which technologies the country should adopt.

Considering the privileged position of foreign policy officers for witnessing *in situ* other countries' experiences, it should be part of their role to analyze international trends and implications concerning the assimilation of specific technologies. This task should also

involve the elaboration of periodic reports that nurture the evaluation of the country regarding the pros and cons of adopting technologies of certain origin and characteristics.

In a totally interconnected world, it is not possible to make decisions ignoring what is happening abroad. Being aware of the security gaps experienced in other countries for adopting specific technologies and/or the benefits that have been derived from their acquisition allows the country to make better-informed decisions.

- *Support the implementation of mechanisms of global coordination and governance of the emerging technologies*

As we have reviewed within this paper, the emerging technologies developed within the framework of the Fourth Industrial Revolution represent both opportunities and challenges. In that context, it is crucial for a country like Peru to claim at the international stage for a fair distribution of its benefits and a joint response against its challenges.

Given the scope of the repercussions triggered by this new era, it is a global responsibility to ensure the establishment of a common set of rules that makes this revolution an opportunity for all. Thus, bearing in mind that the management of most of the new technologies relies on the private sector, they will require procedures and protocols to minimize the probabilities of undesired externalities as well as the risks linked to their deliberate misuse.

For instance, cybercrime represents one of the most serious threats of our time. Some criminal and terrorist organizations have expanded their networks thanks to the increasing connectivity, wielding direct influence on the global agenda and challenging the

predominant role of the states on the international stage. This issue should be a global motivation to reach greater agreement around this topic.

While countries like Peru had limited influence to shape the rules of the international context, they can integrate coalitions to support the implementation of mechanisms of coordination that allows spurring the international public debate about the political, social, and economic impacts of the emerging technologies. Peru ought to seek the creation of rules, parameters, and systems of checks and balances that could help it and other countries with similar characteristics harness the benefits and mitigate the threats of this revolution.

- *Analyze the policies applied by countries with outstanding digital and technological profiles and open channels for the reception of technical assistance and cooperation from them*

Apart from identifying possible sources of cooperation and technical assistance, Peru needs to get close to those countries which have already demonstrated a good performance in the digital, technological, and innovation fields. In that sense, approaching countries such as the U.S., China, Korea, and Switzerland should be a mandatory section of Peru's foreign policy agenda.

For a long time, the U.S. has embarked on a knowledge-led economic growth within which technological innovation has been coupled with a major institutional transformation. As the cradle of Silicon Valley, the structure of the U.S. innovation system is the result of a complex process of institutional development that has encompassed the adoption of different policies including the protection of intellectual property rights, the establishment of institutions for fostering research and development, the training of scientists and

engineers, the increase in public investment in education, among others.⁸⁰ One of the U.S. greatest strengths is its regulatory environment which deserves special attention from countries like Peru, whose technological and digital institutional designs are still emerging. In the case of China, the programs called “Made in China 2025” and “Industry 4.0” have guided the country to restructure its industrial sector seeking higher quality and production efficiency as well as the reduction of the Chinese dependence on external suppliers.⁸¹ Additionally, its advances in AI, nanotechnology, and the digital economy make this country an attractive source for the transference of good practices.

In the AI field, China has established a Plan which attempts to emulate Silicon Valley by the establishment of 17 entrepreneurial tech centers focused on this technology.⁸² In nanotechnology, alternative energy sources and catalytic nanomaterials have been two of the branches in which China has achieved some relevant advances thanks to copious government funding and the increasing number of foreign-trained nanotechnology researchers.⁸³ Lastly, in the economic field, China is considered the world leader of the digital economy. It accounts for 42% of the global e-commerce, a sector within which it has steadily tightened regulations for governing crypto-currency, B2C financing platforms, cross-border capital flows, and debt and securities markets.⁸⁴

⁸⁰ David Mowery, Technological Change and the Evolution of the U.S. National Innovation System. In *Innovation: Perspectives for the 21st Century*. BBVA, 2011, 129. <https://www.bbvaopenmind.com/en/articles/technological-change-and-the-evolution-of-the-u-s-national-innovation-system-1880-1990/>

⁸¹ Biblioteca del Congreso Nacional de Chile, *China Presenta su Plan Nacional para desarrollar Innovación en Inteligencia Artificial* [China has Presented a Plan to Develop AI Innovation], Aug. 25, 2017, <https://www.bcn.cl/observatorio/asiapacifico/noticias/plan-desarrollo-inteligencia-artificial-china>.

⁸² See note 81 above.

⁸³ Lydia Fagale, China: The Digital Silk Road of the 21st Century. Proyecto Sapiens XXI, accessed March 26, 2022, <https://proyectosapiens21.com/es/contenidos/57-nota-de-china.html?showall=1>.

⁸⁴ Andrew Sheng and Xiao Geng, China’s Digital Economy is a World Leader, But It Still Faces Challenges, *World Economic Forum*, Jan. 3, 2018, <https://www.weforum.org/agenda/2018/01/these-are-the-challenges-facing-chinas-digital-economy>

South Korea, for its part, has earned international recognition as a leading technological center worldwide. It has been the first country in the world to launch integral 5G services thanks to the advances developed in this field by ‘Samsung Electronics’ —one of its most representative companies.⁸⁵ In addition, it has been working on cybersecurity, adopting a cloud computing strategy as a tool for public data storage and as an alternative measure to network separation against cyber threats.⁸⁶ Its cutting-edge ICT infrastructure has allowed it to enjoy the world’s fastest internet speeds, standing as an important partner to strengthen Peru’s technological capabilities and as an alternative source of technological infrastructure, in particular regarding 5G.

On the other hand, only a few countries have consistently carried out a remarkable innovation performance, among which Switzerland has remained as the global leader. Ranking first in the Global Innovation Index from 2011 up to 2021⁸⁷, some of the fields in which this country has been developing important innovations include health research, drug discovery and design, biomedical engineering, data security, AI, storage technologies, IoT, robotics, and microelectronics, among others.⁸⁸

Tracking the records of innovation shown by these countries and studying their policies and the feasibility of their assimilation in the Peruvian context could boost Peru’s engagement in the framework promoted by this new era.

⁸⁵ Maria Massaro and Seongcheol Kim, Why is South Korea at the Forefront of 5G? Insights from Technology Systems Theory, in *Telecommunications Policy*, 2021, <https://doi.org/10.1016/j.telpol.2021.102290>.

⁸⁶ International Trade Administration. “South Korea-Country Commercial Guide.” *U.S. Department of commerce*, accessed March 26, 2022, <https://www.trade.gov/country-commercial-guides/south-korea-information-and-communication-technology>

⁸⁷ World Intellectual Property Organization, *Global Innovation Index 2021*, 14th Edition, 22, https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021.pdf.

⁸⁸ Foreign Policy, Switzerland-The World’s Innovation Champion, accessed March 26, 2022, <https://foreignpolicy.com/sponsored/switzerland-the-worlds-innovation-champion/>.

- *Diversify international relations with strategic actors and work with them in areas related to the Fourth Industrial Revolution*

It is important to work in building partnerships, associations, and coalitions with other countries that allow Peru to obtain a better political position within the international sphere to be able to articulate its own interests with independence regarding the decisions made by powers such as China and the U.S.

The diversification of relationships with other actors at the bilateral and multilateral levels is a mechanism for strengthening autonomy that can also help the country to face the multiple challenges derived from the new technological environment and its disruptive innovations.

Thus, using the information collected by its network of offices throughout the world, the Peruvian Ministry of Foreign Affairs should identify the strategic actors with which it can work for supporting its own interests and for strengthening its capabilities. The current borderless international environment makes it feasible to amplify the list of possible partners, providing also new channels for the exchange of experiences, the delivery of technical assistance, and the transference of good practices.

For instance, apart from the regional partnerships traditionally developed, it could be useful for Peru to strengthen its relations with India and Estonia. The first has used the Fourth Industrial Revolution as a platform for the achievement of the Sustainable Development Goals (SDGs), whereas the latter has used e-tools for tightening the linkages between government and society. Two experiences from which Peru can extract important lessons and good practices.

India has been tailoring technologies to address its local needs. It has used a combination of financial inclusion, biometric identification, and digital access for reducing its poverty and inequality levels. It has modernized some of its agricultural practices, empowering farmers with technologies for monitoring irrigation, analyzing soil quality, and expanding the scope of its public system of distribution of food with the aim of achieving zero hunger. Also, it has implemented a project that replaces manual scavenging with the use of robots in its sewage treatment system, improving its previously troublesome waste management.⁸⁹

In the case of Estonia, the state has rebuilt itself into an e-state within which the relationship between government and society has been strengthened by the design of a comprehensive digital ecosystem. E-Estonia is an ambitious technological project which has involved the country's holistic digital transformation allowing the implementation of convenient e-solutions for the deployment of millions of activities such as voting, banking, policing, health care provision, and so on. Now the country is expanding its national influence by offering its help to other countries to master their digitalization and develop e-solutions, promoting the sharing of its know-how and expertise in digital services as sources of soft power.⁹⁰

⁸⁹ Himani Mishra and Prateek Maheshwari, Achieving Sustainable Development Goals Through Fourth Industrial Revolution: An Indian Perspective. In *Indian Journal of Commerce & Management Studies*, Vol. XI, Issue 2, May 2020. 2020, 70-71, <http://scholarshub.net/index.php/ijcms/article/view/519/503>.

⁹⁰ "E-Estonia," accessed March 26, 2022, <https://e-estonia.com/>.

- *Promote joint regional strategies using the platforms of integration of which Peru is already part, such as the Pacific Alliance*

It is important to look for joint working spaces with regional peers who have similar gaps and face similar challenges. Platforms such as the Pacific Alliance —integrated by Mexico, Chile, Colombia, and Peru —, constitute interesting opportunities for the development of common guidelines, the exchange of good practices, and the deployment of regional initiatives.

Considering the commercial orientation of this bloc and the similarities of the countries that are part of it, the introduction of talks about digital opportunities could open avenues for the establishment of a regional digital market that allows the exchange of products and services through digital means, reducing transaction costs and revolutionizing the way of doing business within the region.

To achieve goals such as the one mentioned above, the members of this bloc need to overcome their weaknesses regarding digital infrastructure and skills, and working together offers better perspectives than doing it individually.

In fact, the recent admission of Singapore as an associate member of this regional platform offers good prospects for channeling technical cooperation and assistance in areas in which this country has obtained good results such as educational quality, technological value-added projects in the industrial sector, and the ability to train a relevant workforce.

On the other hand, Peru's peers within the Pacific Alliance have been standing out in the region for some of their decisions and advances regarding the Fourth Industrial Revolution. Hence, their experiences could be particularly valuable for Peru.

In Mexico, access to broadband internet services is considered a constitutional right that has to be guaranteed by the government. Thus, the country has deployed telecommunication networks that provide connectivity in public places, including schools, libraries, community centers, parks, and so on. In this line, Mexico has established a Fourth Industrial Revolution agenda under the name “*Mexico Conectado*.” This agenda encompassed the main axes of the country’s digital transformation: The National Digital Strategy, the Program for the Development of the Software Industry and Innovation, and the National Plan of Digital Literacy.⁹¹

In the case of Colombia, it has achieved the implementation of the first Fourth Industrial Revolution Center in the region affiliated with the World Economic Forum’s network of Centers,⁹² a source of knowledge that allows the country to manage additional inputs for its technological developments. Moreover, this center can also be used as a channel for the global spread and sharing of Colombian technological projects.

Chile, for its part, is the country with the highest penetration of mobile connections in the region.⁹³ Although its market is still dominated by 3G and 4G technologies, it is bargaining a technology integration project with China and Huawei for launching the region’s first 5G network.⁹⁴

⁹¹ Dirección General de Educación Normal y Fortalecimiento Profesional, *Mexico Conectado* [Connected Mexico], accessed March 26, 2022, [https://dgenyfp.edomex.gob.mx/mc#:~:text=Es%20un%20 proyecto%20del%20Gobierno, constitucional\).](https://dgenyfp.edomex.gob.mx/mc#:~:text=Es%20un%20 proyecto%20del%20Gobierno, constitucional).)

⁹² Amanda Russo, Colombia Assumes the Role of World Leader in the Fourth Industrial Revolution and Opens an Emerging Technology Center in Medellin, *World Economic Forum*, April 30, 2019, <https://www.weforum.org/press/2019/04/colombia-asume-el-papel-de-lider-mundial-en-la-cuarta-revolucion-industrial-y-abre-un-centro-de-tecnologia-emergente-en-medellin/>

⁹³ International Trade Administration. “Chile-Country Commercial Guide.” *U.S. Department of commerce*, accessed March 26, 2022, <https://www.trade.gov/country-commercial-guides/chile-information-technologies>.

⁹⁴ Dave Makichuk, Chile Opens the Door to Huawei 5G Bidding. *Asia Times*, March 25, 2021, <https://asiatimes.com/2021/03/chile-snubs-us-opens-door-to-huawei-5g-bidding/>

- *Explore digital and technological opportunities (platforms, products, and services) that can be useful to strengthen Peru's general capabilities, allowing it to face some of its national development problems*

As it was developed within this paper, some of the emerging technologies could be valuable tools for achieving a better performance in the economic, political, and social fields and have the potential to help countries like Peru to shrink their development gap both nationally and internationally.

In that sense, the Peruvian Ministry of Foreign Affairs should help and complement the efforts deployed domestically, looking for opportunities available abroad that can help the country to face some of its national development problems.

For instance, some technologies make it feasible more efficient, and more flexible processes to produce and offer higher quality goods and services at reduced costs thanks to the use of digital platforms and the introduction of new trade items. This opens room for many business opportunities and ventures that can support countries' diversification of their market. Outcomes that are particularly desirable by Peru due to its high economic dependence on natural resources exploitation.

Similarly, opportunities for achieving financial inclusion, fostering production, improving education, strengthening transparency, and others are available thanks to the technological environment. However, their identification requires a doubled sight: one that is able to recognize the country's needs and one that has the chance to know which opportunities are available. This task demands a major involvement of the Ministry of Foreign Affairs, which is the only governmental sector with international projection.

- *Seek the consolidation of the Ministry of Foreign Affairs as an institutional model of digital and technological transformation, deploying initiatives that can also allow the emergence of a new version of diplomacy aligned to the challenges that the new generation of technologies creates on the international stage*

It is difficult to predict how the world will look like in the future, especially considering the speed of the changes that it is currently experiencing.

Although the Ministry of Foreign Affairs is an important player for the satisfaction of the country's digital and technological needs and for its successful insertion in the Fourth Industrial Revolution, it also has to take part and get involved in the new technological environment. Thus, it is crucial that this institution engages itself in the use of digital and technological solutions for the delivery of its services and the deployment of its responsibilities.

Additionally, given that the nature of the international sphere is also being affected by the disruption of the new technologies, the Peruvian Ministry of Foreign Affairs has to transform the way in which it usually conceives its mission.

In that sense, apart from making diplomats aware of the importance of adding to their daily work the tasks derived from the recommendations that have been previously developed within this paper, they have to engage themselves with the challenges proposed by the new technological and digital framework.

Diplomacy, as well as other disciplines and affairs, can no longer be deployed in the same way they used to be executed. The new scenario offers a new landscape for the projection of states' power based on the control and management of the emerging technologies and

digital tools, creating the necessity of new approaches, regulations, and capacities and compelling diplomats to adapt themselves to this new context where non-state actors are also acquiring a predominant role.

Thus, Peru has to deploy its foreign policy in an innovative way aligned to the challenges of the new 4.0 reality, rethinking its priorities and redefining its strategies.

Some countries have already implemented what is called ‘Digital Ambassadors’ with the aim to prepare themselves for an increasingly digital world and ensure their dialogue and cooperation with international players in the technology sector, assigning ambassadors specifically to the task to deal with companies such as Apple, Google, Facebook, and so on. This is the case in Denmark, France, and Germany.⁹⁵

Although Peru has yet a long path to walk, every step that it could take will be essential. In that sense, it can start recognizing the magnitude of the Fourth Industrial Revolution and the importance of working strategically on it, following the recommendations delivered in this paper, and assessing the progressive adoption of the steps to come.

⁹⁵ Paul Esparza, Why Will Denmark Create the World’s First Digital embassy to Deal with Google, Facebook and Other Tech Giants?, *BBC*, Feb. 9, 2017, <https://www.bbc.com/mundo/noticias-38917336>.

7. CONCLUSIONS

The Fourth Industrial Revolution is a global phenomenon that began at the turn of this century and is characterized by the rapid evolution of emerging technologies with disruptive capabilities. These technologies are progressively producing substantial changes in the activity patterns of everyone; affecting individuals, societies, and states; transforming their needs, interests, and interactions; and creating a world of unknown possibilities.

The multiple shifts caused by this new revolution create many opportunities and challenges both in the international sphere and within countries' internal dynamics. However, these opportunities and challenges are not globally homogeneous; they depend on the particular characteristics of each country and the decisions they make to rapidly adapt to this evolving environment. Thus, new disruptive technologies could represent in itself a challenge for some countries and individuals, while they could also supply opportunities for others.

In Peru's case, although there have been some advances regarding its digital transformation, there is still much work to ensure the country successfully joins the Fourth Industrial Revolution. This work involves improving the notorious flaws within this country including: Its current infrastructure, its population's digital skills, and its institutional framework. Further, Peru should solve its digital divide in order to pursue major technological and digital engagement.

On the other hand, Peru's foreign policy has not yet developed a specific strategy to harness the opportunities presented by the international environment to address the challenges of the Fourth Industrial Revolution. This is an important issue of concern because it could leave the country condemned to adopt a reactive approach that will not allow the strategic management of the new context and its disruptive features.

Actually, considering that this revolution is likely to produce a global rearrangement that could either bridge or broaden the gap between developed and developing countries, Peru has to adopt a comprehensive approach, including the strategic management of its foreign policy, so that it does not lag behind the rest of the world. Peru's foreign policy execution should complement the efforts deployed locally to overcome the country's weaknesses, increasing the population's chances to enjoy the benefits of this revolution.

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