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FOUNDATIONAL PRINCIPLES FOR DIGITAL RESILIENCE FRAMEWORK

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FOUNDATIONAL PRINCIPLES FOR DIGITAL RESILIENCE FRAMEWORK

1. INTRODUCTION

Holistic digital resilience helps individuals, organizations, communities, and nations recognize and effectively manage the wide variety of risks emanating from natural disasters and extreme climate events, health crises like the COVID-19 pandemic, and online threats.

A clear lesson from COVID-19 is that the future will continue to be disruptive—new trends and shocks will continue to affect lives—which is why resilience building is more crucial than ever. Another clear lesson is the importance of digitalization and digital resilience as the world becomes more dependent on digital systems and technologies to cope, recover, adapt, and evolve in this new reality.

Today, people are growing up in an increasingly digital world, and digital technologies are present in most areas of life. Despite the digital divide among different sections of society, digitalization overall is increasing and contributing to our interconnectedness. Furthermore, the rapid rise of Digital Transformation and the Fourth Industrial Revolution are driving the widespread adoption of these technologies. The 2030 Agenda for Sustainable Development firmly positions digital technologies as enablers to achieving the Sustainable Development Goals (SDGs) by stimulating innovation and enhancing efficiencies.[1] For example, digital technologies have extended healthcare to remote areas, improved agricultural productivity and farmers' access to markets, and promoted financial inclusion through mobile money. More recently, digital technologies have been playing a vital role in supporting COVID-19 response and recovery.

At the same time, COVID-19 has exposed how vulnerable our interconnected systems are at every level. The world has experienced the downside of being dependent on global supply chains to fulfil local demand for medical protective equipment, common household supplies, and even basic food supplies. There has also been a rise in cyberthreats and online fake news with very real impacts on public health and safety. The most critical lesson from the pandemic is that it is imperative to rethink and redesign our strategy for enhancing digital resilience and adopt a holistic approach to solving these problems.

The systemic nature of the transformation that is needed post-COVID-19 has significant consequences for public policy, i.e., if governments address each new crisis as it arises, with the same growth narrative and perverse

[1] United Nations General Assembly, "Transforming our world: The 2030 Agenda for Sustainable Development," seventieth session, agenda items 15 and 116 (A/RES/70/1), https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E.

incentives as before, there will be a similar disjointed response and again face similar disruptions, undermining development gains and the capacity to protect and enhance quality of life.

"THE ADOPTION OF HOLISTIC DIGITAL RESILIENCE BY DESIGN, NOT BY DISASTER, IS ESSENTIAL POST-COVID-19."

A review of national and organizational policies and strategies on digital resilience over the past decade reveals that their narrow focus on the physical and technical elements of protecting digital infrastructures, systems, data, and products from external threats such as cyberattacks and disasters, has been inadequate for responding to COVID-19. Furthermore, as recent cyber-attacks have shown, even with such a narrow focus many of these policies and strategies have been utterly ineffective. They have left out the human, economic, societal, and environmental elements, particularly, in increasing the opportunities of digital innovations to meet the diverse needs of communities and individuals, while reducing the barriers and harms caused by these digital technologies on vulnerable communities and individuals with limited resources and capabilities.

The adoption of holistic digital resilience by design, not by disaster, is essential post-COVID-19. This will require involvement at all levels of the social fabric including government, the private sector and civil society. An integrated "people, planet and prosperity" recovery model[2] and concerted investment in research, digitalization and innovation-led transformation will allow the world to emerge from this pandemic more resilient as individuals, as organizations, and as communities.

2. PURPOSE

Keeping in view the need to redesign systems, the intent is to develop a holistic Digital Resilience Framework. To that end, foundational principles have been developed that will be reflected in the framework, which will guide individuals, organizations, and communities in assessing and crafting a strategy to address the immediate threats of COVID-19 and build long-term resilience in a holistic and integrated manner across society, the economy, and the environment. The framework comprises 25 elements across four interrelated pillars: (1) foundational; (2) human; (3) environmental; and (4) cross-cutting themes. They are essential for strengthening communities and countries against future shocks and crises, and enabling citizens to fully reap the benefits of digital technologies and improve their lives.

This framework is for use by all individuals, private organizations, and government agencies involved in ensuring the well-being of society as a whole and its individual segments through digitalization in the face of disruptions caused by catastrophes like COVID-19. The implementation of this framework should be viewed as a supplement to existing resilience ecosystems. In addition, close consideration should be given to the role of this framework in safeguarding the most vulnerable sections of society.

[2] European Commission, "Protect, prepare and transform Europe: Recovery and resilience post COVID-19," ESIR Policy Brief No. 1, May 2020, https://ec.europa.eu/info/sites/info/files/research_and_innovation/groups/esir/ec_rtd_esir-recovery-resilience-covid19.pdf.

3. CRITICAL MULTI-SECTOR STAKEHOLDERS

The successful implementation of the Digital Resilience Framework requires the involvement of a variety of stakeholders including governments and regulatory authorities, industries and the private sector, United Nations agencies, development banks, universities and research institutions, civil society, and non-profit organizations, and most importantly citizens and communities.

It is clear that no one sector, group, or country can address the complexities of current and future crises and challenges alone. Cooperation and collaboration among multi-sector stakeholders are important in building holistic digital resilience to help ensure coordinated response and recovery in future crises and disasters. Collaborative efforts range from mobilizing and sharing knowledge, expertise, and technological innovations, to investments and financing at local to global levels.

This means bridging traditional sector silos and merging different disciplines, establishing interoperability, forming partnerships, and ensuring that no one is left behind.

The United Nations Secretary-General's High-level Panel on Digital Cooperation calls for multi-stakeholder collaboration that involves a more diverse spectrum of stakeholders and more diverse voices, "particularly from developing countries and traditionally marginalized groups such as women, youth, indigenous people, rural populations, and older people." [3]

4. FOUNDATIONAL PILLAR

To help ensure holistic digital resilience, it is necessary to build-up the foundational infrastructure and systems to allow everyone access to fast, reliable, and low-cost digital services.

4.1. HOLISTIC DIGITAL INFRASTRUCTURE

A resilient digital infrastructure is necessary to support the platforms of a digital economy and society. The digital infrastructure is the physical hardware and related software that enables end-to-end information and communications systems to operate. It includes the Internet backbone, fixed-broadband infrastructure (fiber-optic cable networks), mobile communications infrastructure and networks, broadband communications satellites, data and cloud computing facilities, end-user equipment [computers, IEEE 802.11 (Wi-Fi), IEEE 802.15 (Bluetooth) networks], software platforms, and network edge devices (sensors, robots).

Advanced digital economies have leveraged frontier technologies, such as artificial intelligence, big data, blockchain, the Internet of Things and robotics to tackle COVID-19, facilitate physical distancing, accelerate recovery, and promote growth. However, to fully reap the potential of frontier technologies, countries need

[3] United Nations Secretary-General's High-level Panel on Digital Cooperation, "The Age of Digital Interdependence," June 2019, https://www.un.org/en/pdfs/HLP%20on%20Digital%20Cooperation%20Report%20Executive%20Summary%20-%20ENG.pdf.

high-speed broadband connectivity. Yet, many middle- and low-income countries continue to lack readiness to adopt and apply frontier technologies because of their inadequate digital infrastructure preparedness. This includes the lack of availability and coverage of digital infrastructure, particularly in rural and remote regions that are not commercially viable, and the low speed and reliability with which data flows in these economies.

Additionally, there are growing interlinkages and interdependencies between critical infrastructures, including with transport and energy infrastructures, which are needed to support global supply chains and help ensure food security. Without reliable power grids and micro-grids, power digital solutions cannot be powered. At the same time, critical infrastructures are becoming digitalized and made "smart" through the roll out of smart grid, smart city, and intelligent transportation system projects, which further increase our reliance on a resilient digital infrastructure.

"EFFORTS TO ENHANCE NETWORKS AND INFORMATION SYSTEMS' RESILIENCE INCLUDE PROMOTING RESILIENCE-BY-DESIGN BY ENSURING REDUNDANCY AND DIVERSITY OF NETWORK ROUTES AND EQUIPMENT IN THE DIGITAL INFRASTRUCTURE; AND INCREASING THE SPEED AND SCALE AT WHICH RESOURCES CAN BE MOBILIZED AND ACCESSED FOR RESTORATION OF SERVICES WHEN ATTACKED OR HIT BY CRISES OR DISASTERS."

4.2. NETWORKS AND INFORMATION SYSTEMS RESILIENCE

A system is resilient if it continues to serve its purpose efficiently and effectively in the face of adversity,[4] that is, if it provides the required capabilities despite excessive stresses that can cause disruptions. Networks and information systems must be resilient to enable governments and organizations to effectively deal with disruptions caused by adverse events like COVID-19 and provide continuity of service. Government agencies, private entities, and individuals must share responsibility for developing and maintaining the resilience of systems necessary for timely provision of critical public services in difficult times and ensure that network systems are well maintained and administered through life.

Efforts to enhance networks and information systems' resilience include promoting resilience-by-design by ensuring redundancy and diversity of network routes and equipment in the digital infrastructure; and increasing the speed and scale at which resources can be mobilized and accessed for restoration of services when attacked or hit by crises or disasters. This would require preparedness planning, establishment of cooperation mechanisms to facilitate emergency access to relevant resources and infrastructure sharing, and conduct of regular drills and tests of the emergency plans.

[4] Donald Firesmith, "System Resilience: What Exactly is it?" Software Engineering Institute, Carnegie Mellon University, 25 November 2019, https://insights.sei.cmu.edu/sei_blog/2019/11/system-resilience-what-exactly-is-it.html.

4.3. INTEROPERABLE AND COMPATIBLE SYSTEMS AND DATA

Interoperability is the ability of digital content to perform all its functionalities in interaction with the digital environment.[5] The interoperability and compatibility of digital systems can enhance data and information available to the public, foster transparency in the larger community and enhance collaboration with government agencies, the public, and non-profit and private entities involved in developing digital resilience during and post-COVID-19.

It is important that governments promote strong inter-state and inter-agency collaboration, develop interoperable digital content and standards for use by the collaborating agencies, and ensure implementation of these standards within existing government infrastructure, as well as develop tools and resources to assist the private sector in adopting the standards.

4.4. ACCESSIBILITY, AFFORDABILITY, AND INCLUSION OF VULNERABLE COMMUNITIES

Over half the world's population continue to have no or low bandwidth Internet access and are unable to reap its benefits.[6] COVID-19 has exposed the depths of this gap. While enabling work, education, health, commerce, and cultural and social services to move online, the digital divide—the uneven access to and use of digital technologies between demographics and regions—has never been more pronounced.

Today, a third of the global population still do not have 3G coverage, which means they do not have access to a reliable Internet connection.[7] Beyond coverage, there is a divide in adoption where those with coverage may not use the Internet due to lack of affordability. Although the cost of devices and data plans have fallen in recent years, they remain too high for many—nearly 2.5 billion people live in countries where the cost of the cheapest available smartphone is a quarter or more of the average monthly income.[8] The COVID-19 crisis could make devices and data plans even less affordable with the disrupted supply chains and increased poverty, further aggravating existing divides.

Marginalized and vulnerable communities are often excluded because of inadequate infrastructure, the lack of affordability of devices and data plans, and the lack of relevant content and skills. Today, the majority (80%) of

[5] Wolfgang Kerber and Heike Schweitzer, "Interoperability in the Digital Economy," Journal of Intellectual Property, Information Technology and E-Commerce Law, vol. 8, no. 1 (2017), https://www.jipitec.eu/issues/jipitec-8-1-2017/4531.

[6] Mahe Bayireddi, "Access For All: Why Digital Accessibility Matters And What Tech Professionals Can Do About It," Forbes, 22 October 2019, https://www.forbes.com/sites/forbestechcouncil/2019/10/22/access-for-all-why-digital-accessibility-matters-and-what-tech-professionals-can-do-about-it/?sh=70f74417b4ea.

[7] World Economic Forum, "Accelerating Digital Inclusion in the New Normal: Playbook," July 2020, http://www3.weforum.org/docs/WEF_Accelerating_Digital_Inclusion_in_the_New_Normal_Report_2020.pdf.

[8] Teddy Woodhouse, "Mobile devices are too expensive for billions of people — and it's keeping them offline," World Wide Web Foundation, 6 August 2020. Available at https://webfoundation.org/2020/08/mobile-devices-are-too-expensive-for-billions-of-people-and-its-keeping-them-offline/.

online content exists in only 10 different languages, when there are thousands of languages spoken worldwide.[9]

As access to and use of digital technologies open doors to other opportunities, such as employment, knowledge, networks, market information and public services, this exclusion of digital access has ripple effects on people's ability to build their resilience and improve their socioeconomic outcomes.

All-inclusive and affordable digital infrastructure development and provision should be at the heart of the policymaking process going forward especially considering the needs of vulnerable communities including persons with disabilities, migrants, internally displaced persons, senior citizens, and people living in remotest areas. Accessible, affordable, and inclusive connectivity must become the top priority and stakeholders and the United Nations have set out targets: by 2025, broadband Internet user penetration should reach 75% worldwide, and broadband should cost no more than 2% of earnings.

4.5. CYBERSECURITY AND RESILIENCE

COVID-19 has unearthed various risk considerations for both individuals and organizations across all industries and raised questions about the adequacy of cyber-insurance policies and cyber-resilient infrastructure. Increased online transactions during COVID-19 have been matched with a significant rise in cyberattacks. With more people working from home, many companies' cybersecurity frameworks are at risk. The popularity of online shopping has dramatically increased, while the sophistication of consumers has not. This has led to the mushrooming of exploitation, by both the incumbents and start-ups. Many lack the discipline, desire, or infrastructure to protect against viruses, phishing attacks, and data breaches. Cybercriminals are very likely to continue to exploit the pandemic over the coming weeks and months.[10]

For organizations to survive and thrive during these tough times and in the post-COVID world, ensuring and maintaining cyber-resilience is of the utmost importance. Organizations need to develop and implement a holistic cyber-risk management strategy that prioritizes resilience while giving due consideration to security. This all-encompassing strategy must address the people, process, and technology aspects of cyber-risk. Cyber-resilience can only be achieved with active engagement from the senior management of the organization.

4.6. DIGITAL IDENTITY

COVID-19 has highlighted the urgent need for digital ID systems to enable governments to provide timely and transparent social and financial assistance to those in need. Digital ID systems are also essential for digital financial inclusion to help ensure access to financial services and resources during crises and disasters. Digital IDs allow authentication to access services and receive benefits, and digital signatures.

[9] World Economic Forum, "Accelerating Digital Inclusion in the New Normal: Playbook," July 2020, http://www3.weforum.org/docs/WEF_Accelerating_Digital_Inclusion_in_the_New_Normal_Report_2020.pdf.

[10] Jessica Wright and Sunny Goel, "Advancing cyber resilience in a COVID-19 world," Willis Towers Watson, 7 May 2020, https://www.willistowerswatson.com/en-IN/Insights/2020/04/advancing-cyber-resilience-in-a-COVID-19-world.

Although approximately 200 countries have planned or implemented social security measures, many governments have struggled to identify informal workers who are not covered by existing welfare programs or social security systems.[11] On the other hand, digital ID systems have enabled some authorities to identify populations reliably and remotely, and make emergency cash transfers to vulnerable communities, such as women and girls, the poor, informal and migrant workers, people living in remote areas, and refugees.[12]

Governments should develop digital ID systems with inclusion and trust in mind. A particular area of concern that must be considered is the potential for abuse of digital ID systems. Inclusion does not only mean registering people, but also the use of their digital IDs to receive assistance and empower themselves economically, including those with low literacy and limited access to technology.

4.7. DATA ECOSYSTEM

A data ecosystem is a collection of infrastructure, analytics and applications used to capture and analyze data.[13] Data ecosystems provide organizations with data to better understand risks and user needs. In the context of disasters and crises like COVID-19, data ecosystems provide governments with the data that can be utilized to make informed decisions; trace, track, and test infected patients; isolate them; and take targeted actions to provide financial and medical support to those in need.

There is a crucial need to develop integrated data ecosystems for data-driven resilience building. This includes learning lessons and building on the tools and techniques used in the current pandemic to better respond to future crises.[14] There is also an urgent need for leadership in developing standards for collecting and sharing disaggregated data that contribute to understanding and forecasting the differential impact of COVID-19 and other crises so that interventions can be directed at those most in need. The current lack of data disaggregated by sex, age, race, ethnicity, ability, socioeconomic status, educational level, employment in different sectors, and other relevant factors means that the concerns of the marginalized and vulnerable remain invisible, and digital resilience efforts are inadequate.

4.8. ETHICAL AND INCLUSIVE DESIGN PRINCIPLES

Inclusive design is a methodology, born out of digital environments, that enables and draws on the full range of human diversity. Most importantly, it involves learning from people with a range of perspectives.[15] Technology companies and designers need to recognize exclusion while designing applications and strive to solve exclusion issues for everyone, learn from diversity, build a diverse team to design diverse experiences and create solutions

[11] Mari Elka Pangestu, "Harnessing the power of digital ID," World Bank Blogs, 20 August 2020, https://blogs.worldbank.org/voices/harnessing-power-digital-id.

[12] Michael Rutkowski et al., "Responding to crisis with digital payments for social protection: Short-term measures with long-term benefits," World Bank Blogs, 31 March 2020, https://blogs.worldbank.org/voices/responding-crisis-digital-payments-social-protection-short-term-measures-long-term-benefits.

[13] Mixpanel, "What is a data ecosystem," https://mixpanel.com/topics/what-is-a-data-ecosystem/.

[14] Bapon Fakhruddin, "A Data Ecosystem to Defeat COVID-19," International Science Council, https://council.science/current/blog/setting-up-a-data-ecosystem-to-defeat-covid-19/.

[15] Babar Suleman, "Design decisions that go a long way in creating inclusive experiences," InVision, 4 December 2018, https://www.invisionapp.com/inside-design/design-inclusive-experiences/.

that do not leave any community behind. Additionally, designers need to understand their audience and represented subjects, for example, through COVID-19 data visualization. They should consider bringing the voice of the audience into their process, particularly when visualizing sensitive data stories, including the human toll of COVID-19.[16]

Furthermore, the use of frontier technologies presents ethical challenges that need to be resolved. For instance, bias in the datasets used in an artificial intelligence application can perpetuate existing inequalities and create unfair exclusions of underrepresented groups. Questions around liability for the consequences of decisions that artificial intelligence systems make, and how those harmed can seek redress, also need to be considered. In decentralized finance and blockchain-based systems, ways to recover damage when there is no central authority in charge need to be considered. Similarly, if a 3D-printed product causes damage, who should be responsible—the owner of the printer, the manufacturer of the printer, or the person who printed the product? Societal laws, expectations and norms are woefully out of step with the complex and nuanced problems frontier technologies can present.

5. HUMAN-CENTRIC PILLAR

In order to survive and thrive in the post-COVID-19 world that is increasingly reliant on digital technologies, the building of digital resilience will need to keep human expectations and experiences in mind. Human-centric design and development has traditionally been considered from a narrow point of view with the sole purpose of designing a good-looking visual style and user-friendly technology. However, a human-centric approach should not be limited to design only. It is key to driving truly transformational change in any society. The following are some of the major human-centric elements to be considered in digital resilience building.

5.1. SAFETY, SECURITY, AND PRIVACY

With the surge in Internet usage during COVID-19,[17] there is a corresponding need for the public to use Internet services safely and securely. Threats from the online space are not new, but in the midst of COVID-19, the risks to society, the economy, and especially children and women, have grown enormously.[18] There has been a disturbing increase in online child abuse, which has led to significant growth in the number of suspected online child exploitation cases reported. Violence against women has also intensified with nearly three out of four women globally experiencing some form of online violence.[19]

[16] Katherine Hepworth, "Ethical Design Recommendations for COVID-19 Visualizations," Medium, 15 May 2020, https://medium.com/nightingale/ethical-design-recommendations-for-covid-19-visualizations-cb4a2677ae40.

[17] Suzin Wold, "COVID-19 is changing how, why and how much we're using social media," Digital Commerce 360, 16 September 2020, https://www.digitalcommerce360.com/2020/09/16/covid-19-is-changing-how-why-and-how-much-were-using-social-media/.

[18] ITU News, "Online safety and security during COVID-19," 12 May 2020, https://news.itu.int/online-safety-and-security-during-covid-19/.

[19] UN Women, "Online and ICT-facilitated violence against women and girls during COVID-19," April 2020, https://www.unwomen.org/en/digital-library/publications/2020/04/brief-online-and-ict-facilitated-violence-against-women-and-girls-during-covid-19; and UN Women, "Urgent action needed to combat online violence against women and girls, says new UN report," 24 September 2015, https://www.unwomen.org/en/news/stories/2015/9/cyber-violence-report-press-release.

Protecting Internet users from online threats during the pandemic calls for integrated proactive action by multiple stakeholders, increased capacity building of users to lessen vulnerabilities, and enhanced cross-border collaboration among countries. If users cannot feel safe and secure online, they are much less likely to go online or use Internet services, thereby losing access to the many benefits internet services can bring.

So far, a myriad of concrete actions has been implemented in response to online risks during COVID-19. At the country level, they include strengthened protection of data privacy, security and user rights through national policies and legislations, increased awareness campaigns developed by Computer Emergency Response Teams and issuance of cybersecurity alerts to the public. More such actions are needed from governments to ensure safe and secure online experience for the public. At the organizational level, organizations need to have sufficient investment in cybersecurity, plan for cybersecurity, build a security culture among employees, and adopt security-by-design and privacy-by-design principles. At the individual level, users should actively engage in debates about online safety, security, and privacy. Equally imperative is for people to adjust their online habits to protect their security and privacy through making careful choices when using the Internet.

5.2. DATA OWNERSHIP AND AGENCY

Corporations and governments are collecting and using all forms of data, including personal data, generated in real time and on a large scale from internet usage, social media sites, sensors, smartphones, other connected devices, and the Web. The analysis of large sets of personal and public data can uncover unknown correlations, market trends, customer preferences and other useful information. Findings can lead to more effective planning and marketing, new revenue opportunities, better customer service, improved operational efficiency, and competitive advantages over rival organizations. However, these tools must be used with caution as they can easily be manipulated for exploitative, unethical, or targeted retribution. Such big data has become a profitable commodity, as evident in targeted advertising, a multi-billion-dollar business. At the same time, big data has demonstrated growing potential in health monitoring and disaster early warning systems, as well as in disaster response. For example, mobile phone network data has been used to track population movements during COVID-19 and disasters, so response and allocation of social assistance can be better targeted.

With the growing potential of big data, the questions of who owns this data, who has access to this data, and who in the data ecosystem is liable when personal data is compromised or misused to exclude certain groups or perpetuate inequality, need to be addressed.[20] These are important questions given the power imbalance in the data ecosystem in which the rights of users are being overlooked by governments and corporate players. There is an urgent need to empower users to reclaim control over personal data and information.

In the current legal environment, users do not own the data that is collected about them. Current legal concepts of privacy and copyright are insufficient to deal with the concept of data ownership. Consequently, there is no legal concept that defines users as the owner of data they generate, or that recognizes that such data has value akin to tangible property. However, the General Data Protection Regulation of the European Union has set the

[20] Judith Duportail, "I asked Tinder for my data. It sent me 800 pages of my deepest, darkest secrets," The Guardian, 26 September 2017, https://www.theguardian.com/technology/2017/sep/26/tinder-personal-data-dating-app-messages-hacked-sold.

precedent in promoting users' data agency by requiring organizations to be transparent about how data is being used, and allowing users' rights to data access, rectification, erasure, portability, and restrict/object to data processing and automated decision-making and profiling.[21]

Data agency is being examined by many authorities in other jurisdictions to address the concerns of users and strike a balance between the use of data for betterment of society, especially for effective data-driven COVID-19 response, and the protection of privacy of the very users who generate that data.

5.3. DATA SOVEREIGNTY AND TRUST

Governments are confronted with the challenge of gathering the right data so that they can track infected persons and fight the spread of the virus. However, many individuals and organizations are growing reluctant to share their personal data due to lack of trust, privacy, and security concerns. Trust is a vital cog in the machine required to enable smooth data flow in today's transactional era.

Data sovereignty is the foundation of digital trust[22] and making data sovereignty a crucial design principle will inspire data sharing as the basis for enabling everyone including individuals, governments, and private entities to reap the benefits of personal data. Hence, there is an urgent need to build the necessary trust so that data owners can provide informed consent. Data sharing based on consent is key to keeping the data ecosystem functioning as it is crucial in the fight against COVID-19 especially in the context of curbing the spread of virus, saving lives, enabling effective and efficient pandemic response and recovery efforts, and stimulating economic growth post-COVID-19.

5.4. DIGITAL SKILLS AND KNOWLEDGE

One of the critical factors that hampers the development and uptake of digital technologies is the lack of skills and knowledge to develop, manage, and use digital technologies. Worldwide, it is estimated that 33% of individuals lack basic digital skills, such as using copy and paste tools; 41% have standard skills, such as using basic formulas on spreadsheets; and only 4% are able to use specialist language to write computer programs.[23]

Skills gaps and wage gaps are widening between those who can adapt to digital technologies and those who cannot. Automation and robotics could displace workers who do not have digital literacy skills and are thus unable to transfer their skills to new positions. Worldwide, it is estimated that automation in the workplace will amount to 1.2 billion workers losing their job.[24] Without effective policies, individuals' digital resilience and economic security will be undermined.

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[21] GDPR.EU, "Do consumers know their GDPR data privacy rights?" https://gdpr.eu/consumers-gdpr-data-privacy-rights/.

[22] Mariane ter Veen, "Dealing with data in the context of COVID-19 - A call for data sovereignty," Innopay, 9 April 2020, https://www.innopay.com/en/publications/dealing-data-context-covid-19-call-data-sovereignty.

[23] ITU, "Measuring the Information Society Report: Volume 1," 2018, https://www.itu.int/en/ITU-D/Statistics/Pages/publications/misr2018.aspx.

[24] ESCAP, Inequality in Asia and the Pacific in the era of the 2030 Agenda for Sustainable Development (Bangkok, 2018), https://www.unescap.org/publications/inequality-asia-and-pacific-era-2030-agenda-sustainable-development.

The digital skills and knowledge of three groups of people need to be considered and developed—users, providers/creators of digital applications, and governments.

Users will require a new mix of skills, from handling basic hardware and navigating operating systems to understanding data security and privacy; wider competencies to use digital technologies more productively and innovatively for teamwork, communication, entrepreneurship, and business administration; and skills that are harder to automate and so will be sought after, including empathy, manual dexterity, creativity, and judgement.[25]

Providers/creators of digital applications will require quickly evolving technical skills to develop and adapt new technologies to local use cases. Government officials and leaders will need to understand the broad opportunities and risks associated with digital technologies, as well as develop softer skills for a collaborative and inclusive approach to engage with the public in co-designing policies and initiatives.

5.5. EMPATHY

Empathy is critical to our individual well-being and that of society. A better understanding of what empathy means in the digital world would radically empower design, development, and adoption of new digital technologies to better cope with the impacts of COVID-19.

"EMPATHY IS CRITICAL TO OUR INDIVIDUAL WELL-BEING AND THAT OF SOCIETY."

Design for resilient empathy will help everyone, but most obviously it will assist healthcare workers who are at risk of burnout. It will also help empower non-profit organizations working to provide essential support to those in need, and providers/creators of digital technologies working to enable timely access to information, life-saving medicines, work, and education. Empathy-in-design can act as a pathway to build societal and digital resilience, bring social change, and resolve complex social problems.

6. ENVIRONMENTAL PILLAR

The environmental pillar focuses on the problems of existing economic and social systems, and the underlying societal and cultural barriers to digital resilience that need to be addressed to uproot inequalities and exclusions. These underlying root causes of vulnerabilities that undermine efforts towards achieving the SDGs need to be understood in order to redesign economic and social systems and identify targeted solutions. They include understanding rural-urban and gender divides, and the effectiveness of policy and regulation in stimulating uptake of digital services.

[25] UNESCO, "A Global Framework to Measure Digital Literacy," 19 March 2018, http://uis.unesco.org/en/blog/global-framework-measure-digital-literacy.

6.1. URBAN, RURAL, AND HARD-TO-REACH COMMUNITIES

Urban and rural communities face different types of challenges in building digital resilience. Cities are vulnerable to shocks and disasters as evident in the case of COVID-19 with 95% of all reported cases worldwide occurring in urban areas.[26] Looking ahead, the United Nations estimates that three in five cities with more than 500,000 residents are at high risk of exposure to natural disasters.[27]

COVID-19 is an opportunity for cities to draw the right lessons and harness smart city technologies to become more resilient, and overcome challenges related to overcrowding, poorly-constructed infrastructure and housing, water shortages, easily-transmitted diseases, criminal violence, traffic congestion and pollution. Cities are highly diverse in human and other resources, which adds to their resilience, and they offer economies of scale to provide education and healthcare and other social services within financial means.

It is important that cities adopt holistic digital resilience strategies, capitalize on frontier technologies, and engage diverse stakeholders, including marginalized and vulnerable communities in developing solutions against potential shocks and crises while safeguarding their security and privacy. This will enable cities to achieve balanced outcomes of economic growth, high quality of life and a sustainable environment.

Today, the rural-urban digital divide remains substantial, with those living in rural areas 37% less likely to use mobile Internet than those in urban areas.[28] Being located in rural and remote areas is often a disadvantage in terms of access, speed, and quality of connectivity. Those living in rural and remote areas are also more likely to have lower levels of education and lack digital skills to use digital technologies. Therefore, building holistic resilience requires concerted effort to close the rural-urban divide by supporting rural-centric initiatives that advance digital access, adoption, and use. This involves complementing top-down approaches by governments with bottom-up and community-based "smart villages" as solutions for holistic digital resilience.[29]

6.2. CULTURAL, TRADITIONAL, SOCIAL, AND SOCIETAL

Hindrances to digital resilience are not only economic in nature, but also social and cultural. This includes the limitation placed on the opportunities available to women and girls for personal expression and achievement, in both offline and online spaces. Sociocultural norms that restrict the role of women and girls in society serve

[26] PwC, "Building more resilient cities to endure COVID-19 and future shocks," https://www.pwc.com/m1/en/publications/building-resilient-smart-cities-endure-covid-19-future-shocks.html.

[27] UN DESA, "Majority of the world's cities highly exposed to disasters, UN DESA warns on World Cities Day," 30 October 2018, https://www.un.org/development/desa/en/news/population/world-cities-day-2018.html.

[28] GSMA, "The State of Mobile Internet Connectivity 2020," 2020, https://www.gsma.com/r/somic/.

[29] For the past two decades, the eWorldwide Group has been advocating for smart villages and evolving a holistic and integrated model by working with multiple stakeholders, which has culminated into a SMARTVillages4SDGs framework. Solutions have focused on ensuring access to diverse and relevant information related to agriculture and agribusiness, health and preventive care, and education and finance, as well as on promoting digital and financial literacy and skills. SMARTVillages4SDGs have enabled more resilient, inclusive and green villages, and they serve as vital building blocks for "building back better" from COVID-19 and accelerating SDG achievements.

to hinder their access to and use of digital technologies—worldwide, women are 20% less likely to use mobile Internet than men.[30]

The unavailability of safe spaces to use the Internet, lack of technical skills and know-how, and cultural constraints such as lack of participation in decision-making are some barriers that lead to women's marginalization.[31] Even when they are included, cyber-violence and online hate speech against women limit the continuous use of these technologies, while lack of legal frameworks fails to capture the prevalence of violence and the social and psychological harm it produces.[32] Globally, one in five girls have left or significantly reduced use of a social media platform after being harassed.[33]

Women and girls need to play a more active role in shaping the digital world. Gender-responsive policies are needed to create opportunities for women and girls to engage with strengthening digital resilience and enabling them to participate in content and technology production. Digital solutions are primarily designed by and for high-income groups and men. As a result, the needs of marginalized and vulnerable communities, including women and girls are invisible from the outset.[34] Their exclusion from using and designing digital applications means missing out on their perspectives and ingenuity in meeting challenges.

6.3. PROMOTING THE UPTAKE OF DIGITAL SERVICES

In order to get the full value from investments in digital infrastructure, communities especially in remote areas need to understand the usefulness of digital technologies and actively want to utilize them. In urban areas, it is highly likely that there will be an adequate number of visible applications to make a successful case for further investments. However, in remote areas, many residents may not be aware of potential digital technologies that can drastically improve their lives, especially in fields such as education, including distance learning, e-health, shared mobility, and logistics.

In a bid to avoid the underutilization of publicly-funded digital infrastructure, it is important to find ways of designing, testing, and showcasing applications to local communities in remote areas. Integrated and coordinated actions need to be taken to work with these communities to develop and enhance the use of digital services in rural areas.

[30] GSMA, "The State of Mobile Internet Connectivity 2020," 2020, https://www.gsma.com/r/somic/.

[31] World Wide Web Foundation, "Women's Rights Online: Closing the digital gender gap for a more equal world," October 2020, http://webfoundation.org/docs/2020/10/Womens-Rights-Online-Report-1.pdf.

[32] European Institute for Gender Equality, "Cyber violence against women and girls," 23 June 2017, https://eige.europa.eu/publications/cyber-violence-against-women-and-girls.

[33] Plan International, "Abuse and Harassment Driving Girls Off Facebook, Instagram and Twitter," 5 October 2020, https://plan-international.org/news/2020-10-05-abuse-and-harassment-driving-girls-facebook-instagram-and-twitter.

[34] UNICEF and ITU, Towards an equal future: Reimagining girls' education through STEM (New York, 2020), https://www.unicef.org/reports/reimagining-girls-education-through-stem-2020.

7. THEMATIC AREAS

The thematic areas highlight the cross-sectoral and multidisciplinary nature of digital resilience, and the interconnectedness of the foundational, human-centric, and environmental elements. It is no use building the foundational digital infrastructure if users do not have the relevant digital skills and if the sociocultural environment and norms prevent women and girls from using digital technologies safely and with dignity. In building the digital resilience of vulnerable communities like farmers living in a remote area, for example, a holistic approach should be adopted that ensures the accessibility and affordability of connectivity and devices (foundational), co-design of digital applications with farmers to improve agricultural value chain processes (human-centric), and transformation of livelihood and well-being in their communities that leads to the expansion of education, health, financial services, energy security, and water and sanitation systems (environmental). These thematic areas call for a new way of working that breaks traditional sector silos and promotes cross-sectoral and multi-stakeholder collaborations to build holistic digital resilience.

7.1. DISASTER AND CRISIS MANAGEMENT

With climate change giving rise to more frequent extreme weather events and natural disasters, digital resilience is essential for effective and quick response and recovery. As the pandemic, disaster events, protests, and conflicts in 2020 have shown, these shocks and crises have far-reaching cascading effects across interconnected economic (market and supply chain), financial, livelihood, health, and educational systems. They have set back SDG achievements, increased poverty levels, and created new vulnerabilities.

Disaster risks are expected to grow in significance and complexity, with extreme weather events affecting food and water shortages, forced migration, armed conflict and epidemics, resulting in the need for a holistic approach.

It is important to leverage frontier technologies and sustainable data ecosystems for better disaster and crisis management, and for greater multi-stakeholder collaboration in addressing these complex cascading risks. Digital technologies can be used to collect, process, map and visualize data on disaster risks, and create platforms to facilitate multi-stakeholder engagements, disseminate and share information, and improve early warning systems.[35]

7.2. FOOD SECURITY AND INTEGRATED AGRICULTURE VALUE CHAIN

Smart logistics and traceability across the agriculture and food supply chain are necessary for timely provision of critical food supplies during disruptions caused by crises like COVID-19 to save lives. COVID-19 has exposed the frailties of food supply chains especially in areas where strict lockdowns have been imposed to curb the spread of the virus. With that in mind, governments need to develop integrated logistics networks and supply chains to ensure timely delivery of food supplies during future crises.

[35] ITU, "Emergency telecommunications," https://www.itu.int/en/mediacentre/backgrounders/Pages/emergency-telecommunications.aspx.

Digital technologies can contribute to more resilient rural communities and food supply chains when they are complemented with the expansion of power and telecommunications infrastructure, education and skills development, and increased investment in rural areas through holistic approaches such as smart villages.

7.3. HEALTHCARE ACCESS AND TELEMEDICINE

One of the grimmest vulnerabilities laid bare by COVID-19 was the initial lack of medical supplies. Countries need to invest in boosting self-sufficiency in medical supplies and establish mutual dependencies with other countries and regions to create leverage and prevent conflict, along with investing in critical production capacity and the development of key technologies.

At the same time, telemedicine and mobile health applications have increased access to healthcare services and supported health crisis management in the diagnosis and screening of patients, and in developing treatments and vaccines, as evident during COVID-19. However, interventions are needed to balance these digital innovations with respect for inclusiveness and human rights to privacy and security.

7.3.1. MEDICAL SUPPLIES, TESTING, TRACING, TRACKING, AND VACCINATION DISTRIBUTION

Smart logistics and traceability across the supply chain ecosystem assist in providing critical medical supplies, including personal protective equipment, lifesaving drugs and surgical masks. Connected and integrated logistics and supply chains are critical for transporting vaccines around the world through cold storage in a timely manner, and for carrying out swift relief activities during crises. Going forward, while learning lessons from the current pandemic, governments should work in cooperation with logistics service providers to develop enabling policies and invest in a resilient smart logistics infrastructure to enable smooth and timely supply of critical medical supplies and support services to people in need.

The lack of integration between systems in the health sector has far-reaching impacts on the provision of timely healthcare services. COVID-19 has allowed us to experience the potential of digital technologies in health services delivery through widespread utilization of video consultations, online prescription renewal, virtual collaboration tools and self-monitoring apps. The role of telemedicine, health information systems, and health informatics for predictive medicine and emergency response and recovery need to be examined. This would involve filling infrastructure gaps and needs, and leveraging opportunities presented by technological advancements for inclusive medical support to maintain continuous patient management, remote diagnostics, treatment and monitoring during natural disasters, pandemics, or crises. It is also critical to consider standards for data security, integrity and ownership, and the cyber security of the holistic ecosystem. Based on the lessons and good practices from deploying digital technologies during COVID-19, countries should start an extensive redesign of their healthcare system towards an integrated, holistic, and all-inclusive digital resilience approach that encompass big and specialized hospitals as well as small health units.

7.3.2. MENTAL WELLNESS AND ADDICTION

Public health measures implemented during COVID-19, such as social distancing, can make people feel isolated and lonely and can enhance stress and anxiety. However, these actions are necessary to curb the spread of COVID-19. To compound the challenges, the resulting economic slump has adversely impacted many people's mental health and created new barriers for people already suffering from mental illness and substance use disorders.

In a poll conducted in the US,[36] the number of adults that were negatively impacted due to worry and stress from COVID-19 rose from 32% in March 2020 to 53% in July 2020. Many adults reported specific negative impacts on their mental health and well-being, such as difficulty sleeping (36%) or eating (32%), increase in alcohol consumption or substance use (12%), and worsening chronic conditions (12%), due to COVID-19-induced worry and stress. In another poll conducted in April–May 2020 in the UK, a large proportion of UK healthcare workers had high occurrences of mental health symptoms.[37] As the pandemic wears on, ongoing and necessary public health measures will continue to expose many people to situations linked to poor mental health outcomes, such as isolation and job loss. One study projects that based on the economic downturn, an additional 75,000 deaths may occur by 2029 due to suicide and alcohol or drug misuse.[38]

Limited access to mental healthcare services is in part due to a shortage of mental health professionals, which is expected to be exacerbated by COVID-19. It is important that government authorities enhance the provision of mental healthcare services through telemedicine and relax certain regulations to reduce the impact of business closures and social distancing on access to needed care. Coping with stress in a healthy way can make individuals and communities stronger, so governments should encourage and provide guidance to people on taking care of themselves and their families.

7.4. RESTORING AND RECALIBRATING SOCIAL SECURITY SYSTEMS

The economic slump due to COVID-19 created rough conditions for many companies and communities around the world. Just like securing critical medical and food supplies and knowledge, a fundamental shift is needed to solve the issue of people losing jobs, especially part-time/flex and "gig" workers, and increase resilience and social cohesion post-COVID-19. Social security plays a central role in protecting those vulnerable against the current crisis and future shocks.

In response to COVID-19, many countries have introduced social security measures, and many are leveraging mobile money platforms to distribute emergency cash assistance to poor households safely and rapidly. Yet,

[36] Priya Chidambaram, "The Implications of COVID-19 for Mental Health and Substance Use," KFF, 21 August 2020, https://www.kff.org/coronavirus-covid-19/issue-brief/the-implications-of-covid-19-for-mental-health-and-substance-use/.

[37] James Gilleen, et al., "The impact of the COVID-19 pandemic on the mental health and wellbeing of UK healthcare workers," medRxiv, 25 November 2020, https://www.medrxiv.org/content/10.1101/2020.10.23.20218396v2.

[38] Well Being Trust, "The COVID Pandemic Could Lead to 75,000 Additional Deaths from Alcohol and Drug Misuse and Suicide," https://wellbeingtrust.org/areas-of-focus/policy-and-advocacy/reports/projected-deaths-of-despair-during-covid-19/.

studies show that low-income women who live in remote areas with limited connectivity, or who have low digital literacy, are less likely to access these benefits.[39] Digital technologies need to be integrated in social security systems for their potential to improve the efficiency and effectiveness of the systems, such as more efficient disbursement to beneficiaries through online or mobile payments and reduced opportunities for fraud. These solutions, however, require careful assessment to help ensure they do not create new challenges and embed exclusion.

To design a novel system that leverages digital technologies while avoiding unintended impacts, governments need to take a leading role and form a broad alliance with stakeholders representing all the different segments of the labor market to avoid exclusion.

7.5. BUSINESS CONTINUITY, TELECOMMUTING, AND TELEWORKING

The ongoing health and economic crisis due to COVID-19 and the required social distancing measures have forced many organizations to introduce teleworking on a large scale. In the US, a quarter of the employed workforce teleworked in August 2020 because of COVID-19.[40] Even though more widespread telework beyond COVID-19 has the potential to improve workers' productivity and other economic and social indicators, including the well-being of workers, gender equality, regional inequalities, housing and carbon emissions, its overall impact is unclear. This trend also carries risks particularly for innovation and the personal satisfaction of workers.

Increase in work from home practice during COVID-19 has highlighted the blurring of lines between work and private life.[41] In this context, it would be pertinent for governments to evaluate approaches and initiatives with the purpose of preventing large numbers of workers becoming physically and emotionally exhausted. Close cooperation and collaboration among social entities, employers, and government agencies hold the key to addressing concerns such as "hidden overtime" through different approaches, such as "right to disconnect" or how to balance work in office vs work from home options. Additionally, to maximize the advantages from teleworking for improved productivity and innovation, governments could promote and encourage the integration of managerial best practices, development of self-management and digital skills, increased investments in home offices, and ensure fast and reliable broadband across the board.

[39] Bill and Melinda Gates Foundation, World Bank, CGAP, Women's World Banking, "Digital Cash Transfers in the Time of COVID-19: Opportunities and Considerations for Women's Inclusion and Empowerment," 2020, https://www.cgap.org/sites/default/files/publications/2020.Digital-Cash-Transfers-in-Times-of-COVID-19-Opportunities-and-Considerations-for-Womens-Inclusion-and-Empowerment.pdf.

[40] US Bureau of Labor Statistics, "One-quarter of the employed teleworked in August 2020 because of COVID-19 pandemic," 15 September 2020, https://www.bls.gov/opub/ted/2020/one-quarter-of-the-employed-teleworked-in-august-2020-because-of-covid-19-pandemic.htm.

[41] OECD, "Productivity gains from teleworking in the post COVID-19 era: How can public policies make it happen?" 7 September 2020, https://www.oecd.org/coronavirus/policy-responses/productivity-gains-from-teleworking-in-the-post-covid-19-era-a5d52e99/.

7.6. EDUCATION, KNOWLEDGE, AND TELE-LEARNING

COVID-19 has led the largest disruption of educational systems in history, affecting nearly 1.6 billion learners in more than 190 countries on all continents.[42] Closures of schools and other learning spaces due to lockdowns has impacted 94% of the world's student population, up to 99% in low- and lower-middle income countries.[43] The crisis is worsening pre-existing education inequalities by plummeting the number of opportunities for many of the most vulnerable children, youth and adults especially those residing in remote areas, girls, refugees, persons with disabilities and internally displaced persons, to continue their education. Loss of access to education threatens to extend beyond this generation and undo decades of progress. Some 23.8 million additional children and youth may drop out or not have access to school next year due to the pandemic's economic impact alone.[44] Additionally, closure of schools hinders the delivery of essential services to children such as access to nutritious food, affects the ability of many parents to work, and increases the risk of violence against women and girls.

However, this disruption caused by COVID-19 has also inspired innovation in the delivery of education. Innovative practices have emerged in support of education and training continuity, from radio and television[45] to classes via online platforms. The variety of distance learning solutions has been enabled by rapid responses by governments supporting education continuity.

To stop this learning crisis from becoming a generational disaster requires urgent action from all including governments, educational institutions, technology companies, and other key stakeholders. In order to alleviate the potentially overwhelming consequences of the pandemic, governments and other key stakeholders should focus their efforts on suppressing the further transmission of the virus and plan meticulously for re-opening educational institutions, protecting education-related financing, building resilient educational systems for just and sustainable delivery of education, and recreating educational systems by encouraging and fostering the integration of digital technologies in teaching and learning.

7.7. PEOPLE-CENTRIC ECONOMY

COVID-19 has wreaked havoc on the global economy, leading to at least a 5% contraction in global gross domestic product and a six-year reversal in human development. It has also threatened the livelihoods of an estimated 1.6 billion workers in the informal economy.[46] Access to financial services using digital technologies helps increase incomes and build resilience.

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[42] United Nations, "Policy Brief: Education during COVID-19 and beyond," August 2020, https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2020/08/sg_policy_brief_covid-19_and_education_august_2020.pdf.

[43] Ibid.

[44] Ibid.

[45] Susannah George, "In the world's fifth most-populous country, distance learning is a single television channel," The Washington Post, 19 March 2020, https://www.washingtonpost.com/world/asia_pacific/pakistan-coronavirus-education-teleschool/2020/05/18/9ee159a8-8eee-11ea-9322-a29e75effc93_story.html.

[46] Robin Newnham, "COVID-19: Burden or Boon for Financial Inclusion?" Alliance for Financial Inclusion, 23 September 2020, https://www.afi-global.org/blog/2020/09/covid-19-burden-or-boon-financial-inclusion.

At the same time, innovation is increasingly based on digital technologies and on the new business models they allow.[47] Technologies, however, do not necessarily respond to the needs of marginalized and vulnerable communities, nor can these communities always access them. It is therefore important to empower local entrepreneurs to realize their innovative potential to serve their local communities, particularly during crisis situations. This involves providing access to finance and credit, opportunities to acquire skills, including digital skills, and promoting multi-stakeholder partnerships.

7.7.1. FINANCIAL INCLUSION

Financial inclusion refers to a state in which individuals have easy access to inexpensive financial services that meet their basic needs like expenses, business transactions, payments, credit, and insurance delivered to them in a responsible and sustainable way. Easy access to financial services supports day-to-day living, helps families and businesses plan for long-term business goals, and builds resilience towards emergencies like COVID-19. People with access to bank accounts are more likely to use financial services, such as credit and insurance, start and expand existing businesses, invest in their own and their family's education and health, and weather financial shocks caused by natural calamities, which can improve the overall quality of their lives.

Significant progress has been made towards financial inclusion. According to the World Bank, 1.2 billion adults worldwide have access to a bank account since 2011. Today, 69% of adults have a bank account.[48] However, close to one-third of adults—1.7 billion—are still unbanked, and about half of the unbanked are women and poor households in rural areas or out of the workforce.[49]

Managing the COVID-19 crisis and enabling effective economic recovery requires extensive financial resources. Apart from dealing with financial concerns at the macro level like debt management, policymakers need to realize the fact that the economic outcome from COVID-19 is most harshly felt by those who already have no or limited access to financial resources. Hence, ensuring easy and fast access to financial services for all, particularly the most vulnerable and disadvantaged people, at affordable and sustainable cost, must be a critical part of governments' policy response to the current crisis.

Digital technologies have enabled access to and delivery of financial services. In particular, the rapid growth in mobile phone uptake has resulted in its innovative use to deliver financial services. In addition, governments should put in place a regulatory framework that promotes cost efficiency and transparency for remittances, and enable enhanced policy coordination between financial services providers, including post offices.

[47] World Economic Forum, "The Global Information Technology Report 2016," 2016, https://www.weforum.org/reports/the-global-information-technology-report-2016.
[48] World Bank, "Financial Inclusion," 2 October 2018, https://www.worldbank.org/en/topic/financialinclusion/overview.
[49] World Bank, "The Global Findex Database 2017," https://globalfindex.worldbank.org/.

7.7.2. INNOVATION AND ENTREPRENEURSHIP

COVID-19 has left few people unaffected, and entrepreneurs are no exception. More than 70% of start-ups have had to terminate full-time employees since the start of the pandemic.[50] Some entrepreneurial businesses have been able to transform to meet new needs for goods or services borne out of the crisis, but the way entrepreneurial businesses have been affected by the pandemic will have an impact on how entrepreneurship is perceived as a career choice in the future.

While a large number of start-ups have suffered at the hands of pandemic, COVID-19 has also led to an increase in entrepreneurial activity. Businesses and individuals around the world have responded in unison to tackle this crisis. During March and April 2020 alone, virtual COVID-19 innovation competitions drew in tens of thousands of participants from 175 countries.[51] From organizers of music festivals overseeing pop-up morgues to automotive companies pivoting their manufacturing plants to build much-needed ventilators, there has been a surge in innovation and creativity. Businesses and individuals have invented new ideas to respond to emerging needs that are inadequately addressed by governments and related institutions.

Government support of businesses has always been critical for businesses to withstand the impacts of any crises. During COVID-19, governments have taken action to support local ecosystems. The UK government launched a £1.25 billion rescue package to help start-ups, emphasizing support for firms driving innovation, the unicorns of tomorrow and the technology success stories of the future.

Entrepreneurs, innovators, and governments should work together to foster innovation and entrepreneurship, not just to fight against the virus, but also to create novel and sustainable ways of living. This should include support for innovative solutions that respond to the needs of vulnerable communities, the scaling up of these solutions, as well as the empowerment of vulnerable communities to realize their own innovative potential.

7.8. DIGITAL AND SOCIAL MEDIA AND NEWS

During crisis situations, access to timely and credible information is critical. Social media is crucial in keeping people informed and connected, especially since it is the only way some people access online content.

During COVID-19, many people experienced firsthand the impact of fake news on public health and safety with false claims about the origins of the virus, its modes of transmission, and methods for treatment and prevention. The sheer volume of ambiguous, misleading, and skewed information online made it very difficult for individuals to understand what was true and what was not. It caused an "infodemic," and undermined trust in digital technologies, as well as traditionally trusted authorities.

[50] World Economic Forum, "Discovering the real impact of COVID-19 on entrepreneurship," 19 June 2020, https://www.weforum.org/agenda/2020/06/how-covid-19-will-change-entrepreneurial-business/.

[51] Dirk G. Schroeder, "Turn Your Covid-19 Solution into a Viable Business," Harvard Business Review, 2 July 2020, https://hbr.org/2020/07/turn-your-covid-19-solution-into-a-viable-business.

The general environment of uncertainty and information overload around COVID-19 primed the social media space for more targeted disinformation and propaganda efforts. Some of these appear to be executed by organized groups that scale using bots and trolls, to spread fear and manipulate online narratives.

Fear of the virus aggravated existing prejudices, which led to stigmatization of suspected virus carriers, increased tensions and hate speech between ethnic and religious groups, and instances of violence. The sharing of patients' personal information online, whether by design or through data leaks led to harassment and stigmatization of individuals accused of spreading the virus. Concerns around the pandemic intersected with other fears and conspiracy theories that predate COVID-19, including opposition to vaccines and 5G networks.

Some countries have used the infodemic as an excuse to pass new legislations that grant governments emergency powers to censor online content. Many civil society organizations have raised concerns that governments will take advantage of these emergency powers to remove fundamental freedoms and increase control not only now but in the longer term.[52] Governments, organizations, and individuals play a role in ensuring that the information created and shared is credible and beneficial, but they must also act to curb the spread of false and negative content.[53]

7.9. ENTERTAINMENT

The entertainment media reaches and influences billions each day. The entertainment industry is highly dependent on digitalization and they are stakeholders in the push for holistic digital resilience, particularly in the areas of gaming and eSports.[54] This includes raising awareness, giving voice to vulnerable communities, promoting values of diversity, inclusion, and collaboration, as well as changing social norms and behavior for better development outcomes. For example, UNICEF together with the entertainment industry has explored the use of gaming to challenge misconceptions about refugees and migrant children by casting them as heroes in a short film and a game.[55] The initiative found that games can be a social equalizer, allowing children and youth of diverse backgrounds to focus on what makes them similar, rather than different. Games create a fun and comfortable environment to learn acceptance and other values. Games have also been used to build skills and promote health and wellness.[56]

[52] Nicola Nixon, "Adapting and responding to the pandemic: civic spaces in Southeast Asia," DevPolicyBlog, 28 September 2020, https://devpolicy.org/adapting-and-responding-to-the-pandemic-civic-spaces-in-southeast-asia-20200928/.

[53] World Wide Web Foundation, "COVID-19 Policy Brief: Misinformation & Freedom of Expression," 2020, https://docs.google.com/document/d/1XwcQDtr_aSYbL7mU2biLt9cqwTzZdoDEIia5knO2on0/; and Edda Humprecht et al., "Resilience to Online Disinformation: A Framework for Cross-National Comparative Research," International Journal of Press/Politics, vol. 25, no. 3 (2020), https://journals.sagepub.com/doi/10.1177/1940161219900126.

[54] ITU, "Leveling up the power and potential of eSports for good," 15 July 2020, https://news.itu.int/leveling-up-the-power-and-potential-of-esports-for-good/.

[55] UNICEF, "Press Release: UNICEF uses online gaming to showcase potential, skills and creativity of refugee and migrant children," 15 September 2020, https://www.unicef.org/press-releases/unicef-uses-online-gaming-showcase-potential-skills-and-creativity-refugee-and.

[56] Marigo Raftopoulos, "Gaming for social good is more than an ethical diversion," The Conversation, 22 April 2014, https://theconversation.com/gaming-for-social-good-is-more-than-an-ethical-diversion-24532.

7.9.1. eGAMING

eGaming, also known as online gaming, is one of the world's largest entertainment industries. Lockdowns during COVID-19 have resulted in a 40% increase in time spent on online games on mobile devices.[57] The stress during COVID-19 appears to be pushing people to seek more distractions and virtual entertainment, with eGaming rising in popularity among all age groups.[58] Popular online games such as PUBG, Call of Duty, and Fortnite are also providing a means to socialize, allowing players to team up with others, with the option to chat with each other while gaming. Research in the US shows that online gaming is second only to social media as the most common digital venue for adolescents to meet new friends.[59]

This trend has significant psychological and behavioral influence on children and youth. As more children are exposed to online gaming, there is an urgent need for careful consideration of the risks and opportunities presented by the industry, particularly since gaming platforms have increasingly become targets for cybercriminals, as well as for adults to groom children for sexual abuse or radicalization.[60] Other key concerns include gaming addiction, collection and monetization of children's data, cyberbullying, hate speech, and exposure to inappropriate conduct or content.

The online gaming industry plays a critical role in adopting holistic digital resilience and making the gaming environment a positive, healthy, safe, and inclusive experience for all players, including children and youth. This calls for collaboration with the gaming ecosystem that includes game designers, publishers, distributors and platforms, streaming services, hardware and software developers, industry associations, as well as with policymakers, educators, parents, children, and youth.

7.9.2. eGAMBLING

Similar to online gaming, there has been significant growth in the online gambling industry, especially during COVID-19 lockdowns.[61] Frontier technologies such as artificial intelligence, virtual reality and augmented reality are being used by the industry to retain users' attention,[62] fueling gambling addiction and raising mental health concerns. Social gambling where players are able to chat with other players is gaining popularity. Gambling using cryptocurrency is expected to further boost the online gambling industry.[63]

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[57] Global Newswire, "ReportLinker: Global Mobile Gaming Industry," 19 November 2020, https://www.globenewswire.com/news-release/2020/11/19/2129853/0/en/Global-Mobile-Gaming-Industry.html.

[58] UNICEF, "Recommendations for the Online Gaming Industry on Assessing Impact on Children," April 2020, https://www.unicef.org/csr/css/Recommendations_for_Online_Gaming_Industry.pdf.

[59] Amanda Lenhart et al., "Teens, Technology & Friendships," Pew Research Center, 6 August 2015, https://www.pewresearch.org/internet/2015/08/06/teens-technology-and-friendships/.

[60] Nellie Bowles and Michael H. Keller, "Video Games and Online Chats Are 'Hunting Grounds' for Sexual Predators," The New York Times, 7 December 2019, https://www.nytimes.com/interactive/2019/12/07/us/video-games-child-sex-abuse.html.

[61] Anders Hakansson, "Impact of COVID-19 on Online Gambling – A General Population Survey During the Pandemic," Frontiers in Psychology, 25 September 2020, https://www.frontiersin.org/articles/10.3389/fpsyg.2020.568543/full.

[62] The Week, "Online Gaming Industry Showing Impressive Financial Growth Worldwide," 14 November 2020, https://www.theweek.in/news/biz-tech/2020/11/14/Online-Gaming-Industry-Showing-Impressive-Financial-Growth-Worldwide.html.

[63] STICPAY, "Online gambling trends in 2020," Medium, 19 February 2020, https://medium.com/@sticpay/online-gambling-trends-in-2020-915209e06e12.

Studies show evidence of a relationship between anxiety and depression and problematic gambling.[64] Financial hardship, in particular, seems to catalyze problematic gambling. There is also growing concern for gambling-type features in online games and eSports. This includes lootboxes, mystery boxes containing different virtual items (e.g., in-game currency, cosmetic features, tools) that help players gain advantage in the game. Users pay to open a box or spin a wheel to receive one or more randomized virtual items. Another example is skin-betting, which uses in-game virtual items as a form of currency to place bets on outcomes of eSports tournaments, and casino-style games such as roulettes or blackjack. In some cases, adults are making use of in-game currencies and virtual items as rewards to groom children for sexual abuse or radicalization.[65]

Measures need to be in place to protect children from such interactions, as well as from gambling-type activities in general as children may find it more difficult to resist such features, and they may not fully understand the monetary value of their spending.[66] Measures are also needed to ensure the cybersecurity of online gamblers, increase mental health support to prevent and treat gambling addiction, and provide social security support to vulnerable communities facing financial hardship.

7.9.3. eSPORTS

eSports is one of the segments of the online gaming ecosystem that pertains to competitive or professional gaming, and typically allows eSport viewers to comment on or interact with players and other viewers.

It is important that eSports teams and event organizers take into consideration the educational, physical, and mental well-being of both the players and children and youth. Esports players are some of the most visible representatives of the online gaming community and are role models with significant influence on many young people. It is important that eSports teams and event organizers increase diversity in eSports by engaging with women, minorities, persons with disabilities and other groups, and enforce guidelines to promote positive and supportive communities.[67]

8. CONCLUSION

Countries with advanced digital infrastructure and skills have been more successful at keeping their economies and societies running during COVID-19,[68] clearly demonstrating the importance of digital resilience. As the pandemic, disaster events, protests, and conflicts during the pandemic have shown, they have cascading and compounding effects across interconnected systems, which are often not considered. It is therefore important to rethink and reformulate the framework for digital resilience towards current and future threats and crises.

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[64] Alex Price, "Online Gambling in the Midst of COVID-19: A Nexus of Mental Health Concerns, Substance Use and Financial Stress," International Journal of Mental Health Addiction, 13 July 2020, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7357671/.

[65] UNICEF, "Child Rights and Online Gaming: Opportunities and Challenges for Children and the Industry," August 2019, https://www.unicef-irc.org/files/upload/documents/UNICEF_CRBDigitalWorldSeriesOnline_Gaming.pdf.

[66] UNICEF, "Recommendations for the Online Gaming Industry on Assessing Impact on Children," April 2020, https://www.unicef.org/csr/css/Recommendations_for_Online_Gaming_Industry.pdf.

[67] Ibid.

[68] Lisa Schlein, "Countries with Advanced Digital Skills and Safety Nets Doing Better in Pandemic, Report Says," VOA, 16 December 2020, https://www.voanews.com/covid-19-pandemic/countries-advanced-digital-skills-and-safety-nets-doing-better-pandemic-report.

In this new reality brought about by the COVID-19 pandemic with greater digitalization of the economy and society, strategies for digital resilience should holistically address the 25 elements across four interrelated pillars: (1) foundational; (2) human; (3) environmental; and (4) cross-cutting themes outlined previously. They should be designed and implemented through cross-sectoral engagement and collaboration with multiple stakeholders from governments and regulatory authorities, industries and the private sector, United Nations agencies, development banks, universities and research institutions, civil society and non-profit organizations, and most importantly citizens and communities, including those normally underrepresented and excluded.

To help ensure holistic digital resilience, it is necessary to build-up the foundational infrastructure and systems to allow everyone access to high-speed, low-latency, low-cost, and secure digital services. It includes investing in a resilient digital infrastructure made up of the Internet backbone, and middle- and last-mile connectivity; building redundancy and diversity of network routes and equipment in the digital infrastructure; increasing the speed and scale at which resources can be mobilized and accessed for restoration of services when attacked or hit by crises or disasters; and ensuring interoperability and compatibility of digital systems.

"IT IS IMPORTANT THAT GOVERNMENTS PROMOTE STRONG INTER-STATE AND INTER-AGENCY COLLABORATION, DEVELOP INTEROPERABLE DIGITAL CONTENT AND STANDARDS FOR USE BY THE COLLABORATING AGENCIES, AND ENSURE IMPLEMENTATION OF THESE STANDARDS WITHIN EXISTING GOVERNMENT INFRASTRUCTURE, AS WELL AS DEVELOP TOOLS AND RESOURCES TO ASSIST THE PRIVATE SECTOR IN ADOPTING THE STANDARDS."

The foundational pillar also includes the development of digital ID systems with inclusion and trust in mind and a data ecosystem that collects and shares disaggregated data for making data-informed decisions, as well as the incorporation of ethical and inclusive design principles in digital resilience building.

With the foundational infrastructure and systems in place, it is important to strengthen the human-centric elements to enable operational and service delivery transformations. The COVID-19 pandemic has clearly exposed the digital divides between and within countries and demographics that need to be urgently bridged by ensuring universal access and affordability of devices and data plans, and provision of relevant content and skills, particularly among vulnerable communities.

The human-centric pillar promotes the development of frontier technologies for building digital resilience while strengthening skills and knowledge, and safeguarding the safety, security, and privacy of vulnerable communities, particularly women and children. The digital skills and knowledge, as well as empathy, of three groups of people in particular need to be considered and developed—users, providers/creators of digital applications, and governments. Issues related to data ownership and agency, and data sovereignty and trust also need to be addressed.

The environmental pillar focuses on the problems of existing economic and social systems, and the underlying societal and cultural barriers to digital resilience that need to be addressed to uproot inequalities and exclusions. These underlying root causes of vulnerabilities that undermine efforts towards achieving the SDGs need to be understood in order to redesign economic and social systems and identify targeted solutions. They include understanding rural-urban and gender divides, and the effectiveness of policy and regulation in stimulating uptake of digital services.

The thematic areas highlight the cross-sectoral and multidisciplinary nature of digital resilience, and the interconnectedness of the foundational, human-centric, and environmental elements. They call for a new way of working that breaks traditional sector silos and promotes cross-sectoral and multi-stakeholder collaborations to build holistic digital resilience.

The cross-cutting themes include: disaster and crisis management; food security and integrated agriculture value chain; healthcare access and telemedicine, including medical supplies, testing, tracing, tracking and vaccination distribution, and mental wellness and addiction; restoring and recalibrating social security systems; business continuity, telecommunity and teleworking; education, knowledge and tele-learning; people-centric economy, including financial inclusion, innovation and entrepreneurship; digital and social media and news; and entertainment, including eGaming, eGambling, and eSports.

Overall, in order to achieve the SDGs and benefit humanity, a holistic approach to digital resilience is needed that empowers people and communities to use digital technologies to pursue economic and social opportunities in a safe and secure manner. This should not be limited to physical access and skills development, but also strategic transformations that respects the needs and rights of all people, and tackles sociocultural norms, systemic risks, and other complex multidisciplinary challenges.

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