Understanding and managing cascading and systemic risks: lessons from COVID-19
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Acknowledgements

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As we continue to grapple with the impacts of COVID-19, it is critical that we learn lessons related to risk management, to be better able to prevent, prepare for and respond to future events. The COVID-19 crisis holds the potential to transform how disaster risk reduction is governed and practised across different scales and systems. DRR needs to shift from a narrow focus on a set of hazards and single risks for specific assets, sectors or systems, to a multi-hazard, multi-sector approach. The rolling out of multi-agency and cross-sectoral responses in many countries, to manage the pandemic, presents a much needed paradigm shift to address the systemic nature of risks.

The COVID-19 pandemic has significantly affected our physical and mental health, human security and the global economy. Existing policies and systems (including health, financing and education), and decisions and priorities, all contribute to either making communities more vulnerable or more resilient. With more uncertainty inevitable, understanding the interrelationship between these factors will enable us to provide guidance on how to better recover and better plan to mitigate risks in the future.

Based on expert consultations, desk review and research in five countries, this report presents a conceptual model that identifies systemic risks that were observed and analysed during the COVID-19 crisis. It assesses the possible cascading interactions between a select number of risks relevant to the achievement of the Sustainable Development Goals (SDGs), and evaluates the extent of compounding impacts on the most vulnerable segments of society.

A set of key recommendations have emerged from this study. They include the need to understand the complex nature of crises in an interconnected world, and to design responsive and timely risk-reduction strategies; the need to co-create comprehensive risk-management pathways that enable the reduction of future risks, backed with iterative learning and adaptation; the importance of understanding gendered risks in unearthing the existing disparities across systems; the need to better explore the co-benefits that emerge from the SDGs’ interactions as an impetus for renewed commitment towards achieving the SDGs; and emphasis on issues of human security, adaptive social protection and enhanced systems thinking are critical in addressing systemic risks associated with COVID-19.

Implementing the key recommendations from this study would help countries better understand and manage the systemic nature of risks – not only in relation to future pandemics, but also the interconnected risks associated with climate change. COVID-19 has demonstrated that the responsibility for disaster risk management must be shared across systems and sectors. To that end, we hope this publication will contribute towards promoting an enhanced understanding and mitigation of the risks that threaten our lives and livelihoods.

Ms Mami Mizutori
Special Representative of the UN Secretary-General for Disaster Risk Reduction
United Nations Office for Disaster Risk Reduction (UNDRR)
# Table of contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imprint</td>
<td>2</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>3</td>
</tr>
<tr>
<td>Executive summary</td>
<td>8</td>
</tr>
<tr>
<td>Key messages</td>
<td>11</td>
</tr>
<tr>
<td>1. Introduction</td>
<td>14</td>
</tr>
<tr>
<td>Guide for the reader</td>
<td>16</td>
</tr>
<tr>
<td>2. Approach</td>
<td>17</td>
</tr>
<tr>
<td>2.1 Literature review</td>
<td>17</td>
</tr>
<tr>
<td>2.2 Expert consultations</td>
<td>18</td>
</tr>
<tr>
<td>2.3 Case studies</td>
<td>18</td>
</tr>
<tr>
<td>2.3.1 Rationale for case study selection</td>
<td>18</td>
</tr>
<tr>
<td>2.3.2 Desk review</td>
<td>21</td>
</tr>
<tr>
<td>2.3.3 Development of impact webs</td>
<td>22</td>
</tr>
<tr>
<td>2.3.4 Workshops</td>
<td>23</td>
</tr>
<tr>
<td>2.4 Development of a conceptual model</td>
<td>23</td>
</tr>
<tr>
<td>3. Findings from the case studies</td>
<td>24</td>
</tr>
<tr>
<td>3.1 Cascading and systemic COVID-19 risks in the case studies</td>
<td>24</td>
</tr>
<tr>
<td>3.1.1 Maritime Region, Togo</td>
<td>24</td>
</tr>
<tr>
<td>3.1.2 Guayaquil, Ecuador</td>
<td>27</td>
</tr>
<tr>
<td>3.1.3 Sundarbans, India</td>
<td>29</td>
</tr>
<tr>
<td>3.1.4 Cox’s Bazar, Bangladesh</td>
<td>31</td>
</tr>
<tr>
<td>3.1.5 Indonesia</td>
<td>34</td>
</tr>
<tr>
<td>3.2 Case study synthesis: distinctive and cross-cutting findings</td>
<td>36</td>
</tr>
<tr>
<td>3.2.1 Distinctive findings from the individual case studies</td>
<td>36</td>
</tr>
<tr>
<td>3.2.2 Cross-cutting findings across the case studies</td>
<td>41</td>
</tr>
<tr>
<td>3.3 COVID-19 and the Sustainable Development Goals</td>
<td>50</td>
</tr>
<tr>
<td>3.4 COVID-19 and social protection</td>
<td>58</td>
</tr>
<tr>
<td>4. Conceptual model of the systemic nature of COVID-19 risks and impacts</td>
<td>63</td>
</tr>
<tr>
<td>5. Lessons from COVID-19 for understanding and managing risk</td>
<td>70</td>
</tr>
<tr>
<td>5.1 Implications for understanding risk and its conceptualization</td>
<td>70</td>
</tr>
<tr>
<td>5.2 Lessons for risk management</td>
<td>77</td>
</tr>
<tr>
<td>6. Recommendations</td>
<td>80</td>
</tr>
<tr>
<td>References</td>
<td>85</td>
</tr>
</tbody>
</table>
Figures

Fig. 1: Overall approach to reach the objectives
Fig. 2: Location of the five case studies
Fig. 3: Development of daily new confirmed COVID-19 cases per million people
Fig. 4: Summary of the cross-cutting findings for all five case studies
Fig. 5: Conceptual model of the systemic nature of COVID-19 risks (Part I)
Fig. 6: Conceptual model of the systemic nature of COVID-19 risks (Part II)
Fig. 7: Conceptual model of the systemic nature of COVID-19 risks (Part III)
Fig. 8: Conceptual model of the systemic nature of COVID-19 risks (Part IV)
Fig. 9: Conceptual model of the systemic nature of COVID-19 risks (Part V)
Fig. 10: Conceptual model of the systemic nature of COVID-19 risks (Full)
Fig. 11: Lessons for understanding and conceptualizing cascading and systemic risk

Tables

Table 1: Key COVID-19 figures in the five case study countries
Table 2: Key system components identified through the impact webs approach
Table 3: Interventions observed in the cases, grouped by the risk factor that they address
Table 4: Extreme weather events overlapping with COVID-19 up to 15 August 2021
Table 5: Hazard profiles and actual events that occurred during the pandemic
Table 6: Possible threats to human security
Table 7: Overview of social protection measures introduced in the countries of the case studies discussed in this report

Boxes

BOX 1: COVID-19 and cascading effects - lessons from education in Germany
BOX 2: COVID-19, gender equity, diversity and women’s leadership
BOX 3: COVID-19 in a multi-hazard context
BOX 4: Positive impacts on the achievement of the SDGs
BOX 5: COVID-19 from a human-security lens
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>APBD</td>
<td>Regional Revenue and Expenditure Budget (Indonesia)</td>
</tr>
<tr>
<td>APBN</td>
<td>State Budget (Indonesia)</td>
</tr>
<tr>
<td>AR6</td>
<td>Sixth Assessment Report of the IPCC</td>
</tr>
<tr>
<td>ASP</td>
<td>Adaptive Social Protection</td>
</tr>
<tr>
<td>BAPPENAS</td>
<td>Indonesian Ministry of National Development Planning</td>
</tr>
<tr>
<td>BPNT</td>
<td>Non-cash Transfer Program (Indonesia)</td>
</tr>
<tr>
<td>CARICO</td>
<td>Understanding Systemic and Cascading Risks: Learning From COVID-19</td>
</tr>
<tr>
<td>COVID-19</td>
<td>Coronavirus disease 2019</td>
</tr>
<tr>
<td>GAR</td>
<td>Global Assessment Report on Disaster Risk Reduction</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse gas emission</td>
</tr>
<tr>
<td>GIZ</td>
<td>Gesellschaft für Internationale Zusammenarbeit GmbH</td>
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<td>GNI</td>
<td>Gross National Income</td>
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<tr>
<td>GoB</td>
<td>Government of Bangladesh (Bangladesh)</td>
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<tr>
<td>IFRC</td>
<td>International Federation of Red Cross</td>
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<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
</tr>
<tr>
<td>NaTech</td>
<td>Natural Hazards Triggered Technological Disaster</td>
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<tr>
<td>NGO</td>
<td>Non-governmental organisation</td>
</tr>
<tr>
<td>NTT</td>
<td>East Nusa Tenggara (Indonesia)</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
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<tr>
<td>PEN</td>
<td>National Economy Recovery program (Indonesia)</td>
</tr>
<tr>
<td>PKH</td>
<td>Program Kluarga Harpan/Family Hope Program (Indonesia)</td>
</tr>
<tr>
<td>RRRC</td>
<td>Refugee Relief and Repatriation Commission (Bangladesh)</td>
</tr>
<tr>
<td>SDG</td>
<td>Sustainable Development Goal</td>
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<td>SME</td>
<td>Small and medium enterprise</td>
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<td>UNDP</td>
<td>UN Human Development Agency</td>
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<td>United Nations Office for Disaster Risk Reduction</td>
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<td>UNICEF</td>
<td>United Nations Children's Fund</td>
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<td>UNU-EHS</td>
<td>United Nations University, Institute for Environment and Human Security</td>
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<tr>
<td>WaSH</td>
<td>Water supply, sanitation and hygiene services</td>
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<td>WHO</td>
<td>World Health Organization</td>
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</tbody>
</table>
Executive Summary

COVID-19: A shock to global societal systems

In an increasingly interconnected and globalized world, COVID-19 is a dramatic reminder of the ever more complex and systemic nature of risks. The direct and indirect impacts of the pandemic have revealed and reinforced inherent vulnerabilities across societal systems, borders and scales. They have seen the closure of borders, economic disruptions and failures, strained and overwhelmed health systems, and failure of supply chains, all of which are contributing to ripple effects and human and national security issues.

As of 30 November 2021, more than 261 million cases and at least 5.2 million deaths have been confirmed according to WHO, making the pandemic one of the deadliest in human history. However, the pandemic has been far more than a health crisis, and has affected societies and entire economies to their core. The impacts have revealed inherent vulnerabilities across societies and have unveiled major deficiencies in pandemic prevention, preparedness, and response initiatives locally, regionally and globally. In addition to the direct health effects, COVID-19 and the interventions taken to contain the spread of the disease and protect at-risk groups, such as school and business closures, stay-home orders or travel restrictions, have led to grave cascading impacts on interconnected sectors and systems. Thereby, effects of the pandemic have not only been felt locally but, as a result of global interconnectivities and interdependencies of systems, have led to cascading effects in other parts of the world. For example, the interruption of international commercial and touristic flows have had major consequences for countries that have either experienced very limited infection rates (e.g. Togo which is featured as a case study in this report) or even the complete absence of COVID-19 cases until very recently (e.g. small island states such as the Cook Islands and Tonga).

Systemic nature of risks

While research on the systemic nature of risks is not new, existing work has largely focused on financial systems and crises and only more recently on climate change and natural hazards. Systemic risk emerges from the interconnectedness of systems and agents (i.e. actors within the system) and results from the interactions of individual risks resulting in cascades of failures. Based on the research conducted in this study, key characteristics that determine the risks associated with COVID-19 have been identified: (i) interdependence, interconnectedness and cascading effects, (ii) non-linear relationships, (iii) feedback loops, (iv) tipping points, (v) being unnoticed, (vi) uncertainty, and (vii) dynamic. Combined, these characteristics confirm the systemic nature of risks associated with the disease. Understanding risks in the context of COVID-19 hence requires a systems perspective. The findings from this report illustrate how the COVID-19 crisis has caused ripple effects that transgress from the domain of health risks and extend into economic, social, and political domains causing complex impacts and new risks.
Cross-cutting findings from five case studies

Research was conducted in five case studies. Individually, the case studies have distinctive traits that are important for understanding characteristics of cascading and systemic risks in a specific context: e.g. (i) rural-urban and national-international interlinkages in Maritime Region, Togo, (ii) a densely populated, urban setting in Guayaquil, Ecuador, (iii) a multi-hazard perspective in the Sundarbans, India, (iv) a fragile setting in Cox’s Bazar, and (v) challenges on all fronts at national scale in Indonesia. Numerous distinctive findings arose from each of these case studies. However, when taken together, the case studies are emblematic in understanding and managing cascading and systemic risks across a range of scales and systems. Six cross-cutting findings are highlighted from the case studies in this report: (i) COVID-19 interventions had clear cascading effects throughout nearly all of society; (ii) COVID-19 and accompanying interventions reinforce pre-existing vulnerabilities; (iii) COVID-19 has demonstrated that the dependence on global networks has impacts at the local level; (iv) COVID-19 and accompanying interventions have distinct impacts on women and girls; (v) COVID-19 and accompanying interventions have severe effects on the education system that will only become apparent over time; and (vi) COVID-19 risk communication and coordination has been a significant challenge for state and non-state actors across all scales. Further, all of the case study regions have been confronted with natural hazards amidst the pandemic, which has led to compounding effects, interconnected risks and, in turn, additional challenges for risk management. Hence, this report also underscores the relevance of moving from hazard-by-hazard approaches to more holistic and comprehensive ways of understanding and managing risks based on all-hazards and multi-risk approaches.

Conceptual model of the systemic nature of COVID-19 risks

The analysis of the COVID-19 crisis through multiple case studies unveiled complex and multi-faceted webs of cascading and systemic risks and impacts. Key in the analysis was the characterization of the network and system structure, and network dynamics. Informed by the case studies, expert consultation and literature review, the CARICO conceptual model is a tool to systematize, visualize and explore the most relevant characteristics, connections and cascading effects as they emerged from the case studies analyses (Figure). It provides a generalized understanding of the risks associated with COVID-19 from a systemic perspective.
The model presented here advances existing conceptual models of systemic risks in showing direct and cascading effects of COVID-19 on interconnected systems. It illustrates how these effects, coupled with decision-making processes (e.g. interventions to contain the spread of the disease) and other factors (i.e. pre-existing vulnerabilities, system dependencies, tipping points and feedback loops), have contributed to making vulnerable communities, sectors and systems more at-risk.

Lessons for prevention and risk management

The systemic nature of risk has important consequences for risk management. Firstly, it implies that risk cannot be eliminated from systems, but rather must be managed, monitored and treated regularly. Risk management must engage with questions such as what levels of risk are acceptable for whom, what are trade-offs and what are risk-transfer mechanisms. Secondly, the interconnected nature of risks implies that risk management must engage with network structure and reciprocity. This includes multi-level governance frameworks, which share the responsibility towards risk management across systems and scales. Thirdly, risk management must explicitly address the dynamic aspects of risks, as well as responses. The timing and duration of responses becomes a critical management variable. Focus should be placed on risk management pathways that enable managing future risks, not only from pandemics, but also compounding risks, through a process of iterative learning and adaptation. Comprehensive risk management pathways consist of a portfolio of specific risk management interventions (including specific contingency plans and protocols), systemic measures (targeting system structure and drivers of vulnerability) and governance considerations.
### Key messages

<table>
<thead>
<tr>
<th>Globally networked risks:</th>
<th>Cascading effects and the role of interventions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effects of the pandemic are severely felt in countries and territories that have not been significantly affected by the disease (e.g. small islands which, due to their high dependency on international tourism, are severely affected by international travel restrictions).</td>
<td>Direct impacts of the pandemic are mostly health-related, while cascading effects result mainly from measures put in place to protect at-risk groups and contain the spread of the disease (e.g. closure of schools and businesses, stay-home orders and restrictions of public gatherings, domestic movement and international travel).</td>
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<tr>
<th>Amplifying inequalities and marginalization:</th>
<th>Complex interconnections:</th>
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<tbody>
<tr>
<td>Cascading effects from the pandemic have exacerbated existing societal inequalities and marginalization (e.g. in regards to income, gender, education and disability).</td>
<td>Cascading and systemic risks and impacts associated with COVID-19 are a result of system interdependencies and highly dynamic developments, characterized by non-linear relationships, feedback loops, tipping points and conditions of very high uncertainty.</td>
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<thead>
<tr>
<th>The double burden of COVID-19 and natural hazards:</th>
<th>Understanding risk:</th>
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<tbody>
<tr>
<td>Many countries, including all case studies in this report, have been facing additional challenges due to the concurrence of climate-related extreme events and natural hazards, and associated compounding risks.</td>
<td>COVID-19 has expanded the way we know and understand risks by highlighting that risks emerge, at times undetected, from both exogenous and endogenous triggers, direct as well as indirect exposures, and multiple vulnerabilities of interconnected agents and systems that can reinforce each other.</td>
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<td>Hampering progress towards the achievement of the SDGs:</td>
<td>Human Security:</td>
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<tr>
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</tr>
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<td>COVID-19 has affected all SDGs, notably SDG 1 (No Poverty), SDG 3 (Health &amp; Well-Being), SDG 4 (Quality Education) and SDG 8 (Decent Work &amp; Economic Growth). While some positive effects were observed, the adverse effects significantly outweigh the benefits.</td>
<td>The impact of the COVID-19 pandemic certainly illustrates the multi-faceted nature of today’s security landscape. The threat and risk landscape associated with the impacts of COVID-19 fundamentally challenges human security through threats to health security, economic security, food security, personal security, political security, and community security.</td>
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<table>
<thead>
<tr>
<th>Gaps in preparedness:</th>
<th>Social protection:</th>
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</thead>
<tbody>
<tr>
<td>The pandemic has revealed clear gaps in preparedness for low-probability and unexpected events, including insufficient early warning systems, under-capacitated healthcare systems, lacking international and cross-sectoral collaboration.</td>
<td>COVID-19 has (i) revealed gaps in social protection regarding coverage, comprehensiveness, adequacy and delivery mechanisms, but also (ii) showed the potential of social protection to increase the resilience of the most vulnerable in a shock-responsive manner, triggering a large-scale roll-out of new schemes and adjustments to existing ones. Approaches like Adaptive Social Protection (ASP) should be implemented before the next shock occurs, to maximise the positive impact of social protection.</td>
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<thead>
<tr>
<th>Risk management:</th>
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</thead>
<tbody>
<tr>
<td>Systemic risk management in the context of COVID-19 calls for greater emphasis on risk and intervention dynamics, risk perceptions, risk communication and managing the interconnections of system elements and agents.</td>
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</tbody>
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1. Introduction
1. Introduction

In an increasingly populous, interconnected, and globalized world, the coronavirus disease (COVID-19) is a drastic reminder of the complex and systemic nature of risks. Since the first case was reported in Wuhan, China, in late December 2019, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has been spreading globally, turning COVID-19 into a pandemic. As of 30 November 2021, 261 million confirmed cases and at least 5.2 million deaths have been reported by authorities in 223 countries and territories across all continents. However, the pandemic has been far more than a health crisis, and has affected societies and entire economies to their core. In addition to the direct health effects, non-pharmaceutical interventions that were taken to contain the spread of the disease and protect at-risk groups (e.g. elderly, people with pre-existing conditions) – such as school and business closures, stay-home orders or travel restrictions – have led to further indirect and cascading impacts on social, economic and financial systems across the globe. Adding to this complexity, in many parts of the world these effects have been further exacerbated by the concurrence of extreme climate and weather events, natural hazards, conflicts or ongoing humanitarian crises.

COVID-19 is not the first event in recent history that has clearly demonstrated the complexity of interconnected and globally networked risks in highly interdependent systems. The impacts of the 2001 terrorist attack in New York, the 2008 financial crisis, the 2011 Fukushima earthquake-tsunami-nuclear disaster or the 2014-2016 Ebola outbreak in West Africa, have also clearly shown the cascading and systemic nature of risks, and led to an increase in scientific research and concept development (e.g. Kaufman & Scott, 2003; OECD, 2021, 2003; Goldin & Vogel, 2010; Helbing, 2013; 2010; Centeno and others, 2015; Renn, 2021; 2016; Renn and others, 2020; Renn and others, 2019; Schweizer, 2021) over the past decade.

In the field of disaster-risk science, the notion of ‘cascading risks’ is increasingly well-represented in the literature. Scholars have particularly tackled the existence of cascading effects that can lead from one disastrous event to another, especially in relation to the so-called Natural Hazards Triggering Technological Disasters (NaTECH) events (e.g. the 2011 Fukushima earthquake-tsunami-nuclear disaster) or to other form of multi-hazard interactions (Zschau, 2017; Pescaroli & Alexander, 2018; Girgin and others, 2019). The idea that risks can be connected and therefore cascade into each other helps dismantle the erroneous and often criticized assumption of linearity of cause-effect relationships (Malamud & Turcotte, 1999; Phillips, 2003), which falls short in explaining how very disruptive consequences can emerge from seemingly small initial shocks. In fact, in contexts of high vulnerability and high interconnectedness, even low-level hazards can generate cascading risks that are difficult to predict and to prevent (Peters and others, 2008). The recognition of characteristics such as non-linearity and interconnectedness in disasters and risk has progressively opened a new research paradigm, which merges the epistemological contributions of system science and risk research into the notion of systemic risk. The use of the term ‘systemic risk’ was popularized by the Organisation for Economic Co-operation and Development (OECD, 2003) in the context of extreme threats such as terrorist attacks, large-scale floods.

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1 Based on data provided by the WHO Coronavirus (COVID-19) Dashboard: https://covid19.who.int
and the appearance of previously unknown infectious diseases, which can potentially affect the “the systems on which society depends” (idem, p. 9). The financial crisis of 2008 offered new insights for the understanding of risk propagation and cascading impacts in complex systems. Helbing (2010, p. 11), for example, described that crisis as an event which “shows very clearly how cascading effects can lead to uncontrollable dynamics and a relatively sudden systemic crisis.” In fact, the financial sector has originally spearheaded the use of the term systemic risk. As was publicly demonstrated in 2008, following the amplification of an initial shock, the failure of a single institute led to multiple cascading collapses of the interconnected banking system (Bijlsma and others, 2010). However, this particular type of event also hints at further characteristics, such as uncertainty, amplification and interconnectedness, which transcend the domain of finance, and are applicable even when connected to other initial shocks, e.g. natural hazards or pandemics. As a result, Schweizer and others (2021) suggests that the term systemic risk may be understood as a lens that attempts to bring together traditional risk research with complexity science.

Even prior to the COVID-19 pandemic, a variety of alternative definitions, applications and conceptual frameworks for cascading and systemic risk have been proposed, with contributions from multiple scientific domains. A relatively early conceptual contribution, grounded in the financial sector, comes from the European Central Bank (2010), which introduces the conceptual framework known as the ‘systemic risk cube’. In their understanding, three main characteristics define systemic risk: (i) “triggers” (which can be endogenous or exogenous), (ii) “origin” (which can vary between idiosyncratic/limited and systematic/widespread) and (iii) “impacts” (which can be sequential or simultaneous). Helbing (2010) equally built on the financial sector, but attempted to expand towards a general consideration of systemic risk for human systems and globally networked risks (idem, 2013). An example of a different approach can be found in Centeno and others (2015), where systemic risk is analysed from a sociological perspective. Only very recently, studies have started to focus on understanding interconnected, cascading and systemic risks associated with natural hazards and climate change (Pescaroli & Alexander, 2018; O’Connor and others, 2021; OECD, 2021; Li and others, 2021). An important milestone from the same community is the synthesis offered in the 2019 Global Assessment Report on Disaster Risk Reduction (GAR) (UNDRR, 2019), where it is recognized how systemic failure can arise from the effect of multiple types of stressors over a system already burdened by several and diverse types of vulnerabilities at different scales. Parallel to these contributions, a strong impulse and effort to systematize the conceptualization of systemic risk came from the work of Ortwin Renn (e.g. Renn, 2016; Lucas and others, 2018; Renn and others, 2019; Renn and others, 2020; Renn, 2021), which offered useful conceptual categories to analyse systems and systemic risk. From all these perspectives, multiple core features and characteristics of systemic risk can be derived and highlighted in relation to the observed effects of the COVID-19 crisis in this report (see chapter 5.1).

This shift in how we look at and understand risks – from hazard-by-hazard to all-hazards, interconnected and dynamic multi-risk approaches – is also reflected in the Sendai Framework for Disaster Risk Reduction (UNDRR, 2015), which promotes a holistic understanding and management of the dynamic nature of systemic risks.

Yet, understanding complex and interconnected risks and the implications for risk management still remains a field of ongoing scholarship. Against this background, the UN Office for Disaster Risk Reduction (UNDRR) commissioned the United Nations University – Institute for Environment and Human Security (UNU-EHS) in early 2021 to conduct a study on lessons learnt from the COVID-19 pandemic on the cascading and systemic nature of risks (the CARICO project).
More specifically the objectives of this study (CARICO project) are:

1. to develop a conceptual model and identify lessons for understanding cascading and systemic risks observable in the COVID-19 crisis

2. to conduct risk analysis for different cases that shows how the pandemic exacerbates risks, and what actions were taken to avert, minimize and address risks

3. to draft recommendations for prevention and risk management.

In doing so, the project also analysed how far COVID-19 affected progress towards achieving the Sustainable Development Goals (SDGs), and evaluated the role of social protection as a potential risk management approach.

Guide for the reader

The report is structured in six chapters: Chapter A provides an overview of the approach and methodology (incl. literature review, expert consultations, and research in five case study areas). Chapter 3 presents findings from the case studies, including cascading and systemic risks observed in each of the five cases (Chapter 3.1), distinct and cross-cutting findings across the cases (Chapter 3.2) as well as impacts to and risks for the SDGs (Chapter 3.3). Building on the case study findings, Chapter 4 presents a conceptual model to support the understanding of cascading and systemic risks by understanding systems interconnectivity, decision-making processes and other factors that contributed to making vulnerable communities, sectors and systems more at risk to the pandemic. Building on the literature review, expert consultations and case study findings, Chapter 5 synthesizes lessons from COVID-19 for (i) the conceptualization of systemic risk (Chapter 5.1) and (ii) the management of systemic risk (Chapter 5.2). Recommendations emerging from the research conducted in this project are presented in Chapter 6.

Since this report is published while the pandemic is still ongoing – and actually many countries have moved into another wave of rising COVID-19 infections – findings presented here pertain to the period from the beginning of the pandemic to 30 November 2021.
2. Approach

To achieve the objectives of the CARICO project, a multi-method approach was applied. This included (i) literature review, (ii) expert consultation, as well as (iii) desk study and stakeholder workshops for five case studies.

Figure 1 illustrates the overall approach of the CARICO project. The conceptual understanding of the systemic nature of risks associated with COVID-19 is advanced in an iterative process, building on literature review, testing in cases and expert interviews. These steps are treated in more detail in the following chapters.

2.1 Literature review

The literature review for this project was conducted along multiple streams and informed several different stages and multiple activities. A first goal of the review was to get an overview of the state of the art, and to inform concept development. The second overarching objective of the review was to capture the breadth of confirmed impacts and potential risks from the pandemic (in any location) which could highlight cascading and systemic dynamics.

The review was done through both systematic and non-systematic methods. First, the most relevant publications in the field of cascading
and systemic risk were identified through snowball sampling, and reviewed to provide an overview of existing definitions, conceptual models and frameworks of systemic risk. Subsequently, a systematic review was conducted using the Scopus database, which focused on the second overarching objective of gathering information on the most relevant confirmed impacts and potential risks from the pandemic. The database was further expanded through non-systematic additions (especially of reports from international organizations) throughout the duration of the project, as new materials of relevance were being published. Additional non-systematic searches were conducted specifically to further explore the impact of the pandemic on the achievement of the SDGs and on the role of social protection measures in buffering the effects of the pandemic.

### 2.2 Expert consultations

To solicit additional feedback on (i) objective 1 (understanding the systemic nature of risks associated with COVID-19), (ii) objective 3 (recommendations for prevention and risk management) as well on (iii) the draft conceptual model, a series of expert consultations was conducted. This included four bilateral semi-structured online expert interviews held in the period from July to August 2021, and focus group discussions (breakouts) during an online expert workshop held on 18 August 2021, with more than 30 participants (see Annex 4 for more details).

Experts were identified based on their thematic expertise in the field of systemic risk and through snowball sampling (i.e. asking interviewees for recommendations), while ensuring diversity of backgrounds and perspectives on the topic (e.g. food systems, financial systems, security, risk governance). During the bilateral 45-minute interviews and the breakout sessions, experts were asked to critically reflect on (i) key characteristics of cascading and systemic risks, and (ii) a first-draft version of the conceptual model that has been developed in the project. Further, the breakouts were also used to discuss persisting challenges and recommendations for the management of cascading and systemic risks.

### 2.3 Case studies

COVID-19 impacted different parts of the world differently. To get a snapshot of its impacts in different contexts, to inform the development of the conceptual model (Chapter 4), and to tease out lessons for understanding (Chapter 5.1) and managing (Chapter 5.2) the systemic nature of COVID-19 risks, research was undertaken in five different case studies discussed below.

#### 2.3.1 Rationale for case study selection

Individually, the case studies demonstrate a number of important traits and characteristics in the context of the pandemic. Together, the case studies are emblematic of, and present a comprehensive outlook for, better understanding and managing cascading and systemic risks across a range of scales and systems. These cases were selected to ensure the representation of cases from low-income, middle-income and high-income countries. Such a thematically rich and diverse, geographically representative set of cases allowed understanding the interconnected risks and impacts of COVID-19 in different settings.
1. **Maritime Region, Togo**: The Maritime Region, Togo, presents a case study that highlights the rural-urban and national-international interlinkages of COVID-19 in a regional Sub-Saharan context with high levels of poverty.

2. **Guayaquil, Ecuador**: Guayaquil as a case study gives specific insights into how COVID-19 overwhelmed a densely populated, overcrowded urban setting. The case presents characteristics of tipping points and how system dependencies from global to local scales create and reinforce vulnerabilities.

3. **Sundarbans, India**: The Sundarbans encompasses a multi-hazard perspective within the case studies, demonstrating the concurrence of COVID-19 and natural hazards (i.e. tropical cyclone Amphan). The case exhibits the dynamic nature of cascading and systemic risks, exploring the likely delayed cause-effect impacts of the pandemic.

4. **Cox's Bazar, Bangladesh**: Cox's Bazar presents a case of COVID-19 and pre-existing social inequity in a challenging and fragile setting. It highlights characteristics of highly dependent systems.

5. **Indonesia**: As the only case study at a national scale, Indonesia highlights how COVID-19 has led to interconnected challenges on all fronts: i.e. collapsing health systems, grave impacts on the economy and associated ripple effects on debt, poverty and inequalities, as well as on emergency response to other hazards that occurred amidst the pandemic. In addition, the case has a special focus on the role of social protection (see chapter 3.4)

![Location of the five case studies](https://example.com/case-studies.jpg)
Figure 3 provides an overview of the daily new confirmed COVID-19 cases per million people in the five case study countries.

**Fig. 3.** Development of daily new confirmed COVID-19 cases per million people (7-day rolling average) in the five case study countries (1 February 2020 - 30 November 2021). Due to limited testing, the number of confirmed cases is likely to be lower than the true number of infections. Source: Our World in Data (2020) (based on data of the Johns Hopkins Coronavirus Resource Center (2021))

Additional key statistics (incl. confirmed cases, confirmed deaths, vaccination status, date of the first vaccination) are provided in Table 1.
Table 1: Key COVID-19 figures in the five case study countries
* (as of 30 November 2021). Sources: WHO (2021b); Johns Hopkins Coronavirus Resource Center (2021)

<table>
<thead>
<tr>
<th>Country</th>
<th>Cumulative confirmed cases (per 1 million people)</th>
<th>Cumulative confirmed cases (total)</th>
<th>Cumulative confirmed deaths (per 1 million people)*</th>
<th>Cumulative confirmed deaths (total)**</th>
<th>Share of population fully [at least once] vaccinated</th>
<th>1st vaccination start date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>9,478</td>
<td>1.58 million</td>
<td>168.25</td>
<td>27,981</td>
<td>21.5% [34.2 %]</td>
<td>27 Jan 2021</td>
</tr>
<tr>
<td>Ecuador</td>
<td>29,543</td>
<td>526,870</td>
<td>1,858.74</td>
<td>33,250</td>
<td>63.28% [76.9%]</td>
<td>21 Jan 2021</td>
</tr>
<tr>
<td>India</td>
<td>24,828</td>
<td>34.60 million</td>
<td>336.76</td>
<td>469,247</td>
<td>29.9% [55.8%]</td>
<td>16 Jan 2021</td>
</tr>
<tr>
<td>Indonesia</td>
<td>15,401</td>
<td>4.26 million</td>
<td>520.44</td>
<td>143,830</td>
<td>33.1% [49.6%]</td>
<td>13 Jan 2021</td>
</tr>
<tr>
<td>Togo</td>
<td>3,097</td>
<td>26,265</td>
<td>28.66</td>
<td>243</td>
<td>6.9% [13.2%]</td>
<td>10 Mar 2021</td>
</tr>
<tr>
<td>World</td>
<td>33,372</td>
<td>262.81 million</td>
<td>662.30</td>
<td>5.22 million</td>
<td>42.98% [58.09%]</td>
<td>08 Dec 2020***</td>
</tr>
</tbody>
</table>

* The numbers represent country-level statistics while the case studies are located within the countries and numbers might hence differ from the national average (see case study findings in the subsequent chapters).

** Due to limited testing and challenges in the attribution of the cause of death, confirmed deaths can be lower than the true number of deaths.

*** On 08 December 2020 the first person was vaccinated in the United Kingdom.

Each case had a lead coordinator and team from each respective country, and followed a common methodology, involving three main activities, described in the following chapters.

2.3.2 Desk review

To scope each case study with regard to the objectives of this project, a desk review was conducted by each country team. The aim of the desk review was to identify relevant literature and online sources (including related policies and regulations) that inform the development of case-specific conceptual models of cascading and systemic risks from COVID-19, following a novel approach developed in the context of the project, i.e. ‘impact webs’ (see chapter 2.3.3). Both systematic and non-systematic approaches were applied to literature searches, which varied between each case based on (i) how much peer reviewed and grey literature had been published at the time, on relevant topics in the case area, and (ii) what approach coordinators deemed most appropriate for the needs and context of each specific case.
2.3.3 Development of impact webs

To better understand cascading and systemic risks and impacts associated with COVID-19 in the case study areas, a novel approach named impact webs was developed by the CARICO team. The approach draws upon network analysis and builds on the impact chain methodology for climate risk assessment published by the Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) (GIZ, 2014; GIZ & Eurac, 2017; GIZ and others, 2018). The impact webs approach was designed to map and analyse cascading and systemic risks triggered or exacerbated by COVID-19 in each respective case.

Impact webs were designed by the CARICO team as an analytical tool to help in understanding and prioritizing interconnected parts of systems at risk. The impact webs of the respective case studies were developed by case coordinators following an iterative multi-step approach, which was designed to identify and map key system information (see Table 2). Furthermore, the aim of developing impact webs was to visualize how cascading effects influence, propagate and enhance system components through interconnection. The impact webs gave rise to an understanding of the network structure, topology and network dynamics associated with the impact of COVID-19. This provided insights into understanding the systemic nature of risks and informed the development of the conceptual model (see chapter 2.4).

<table>
<thead>
<tr>
<th>Component</th>
<th>Explanation / Guiding questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts (direct and cascading)</td>
<td>What were the positive, negative, direct and indirect impacts resulting from COVID-19 and the interventions to contain the spread of the disease?</td>
</tr>
<tr>
<td>Risks</td>
<td>What were the possible impacts of COVID-19 that did not manifest (e.g. healthcare system reaching a tipping point and collapsing)?</td>
</tr>
<tr>
<td>Interventions</td>
<td>Which actions were taken in response to COVID-19 (e.g. lockdowns, travel restrictions, business or school closures)?</td>
</tr>
<tr>
<td>Drivers of vulnerability</td>
<td>What processes or conditions influenced the negative impacts that occurred as a result of COVID-19 (e.g. a lack of, or insufficient, job protection scheme)?</td>
</tr>
<tr>
<td>Root causes</td>
<td>What are the underlying factors influencing these drivers of vulnerability?</td>
</tr>
<tr>
<td>Agents</td>
<td>What decision making entities influenced risk and impacts (positively and negatively) within the system and how?</td>
</tr>
<tr>
<td>Interlinkages with SDGs</td>
<td>Which SDGs were affected (negatively or positively) or at risk due to COVID-19?</td>
</tr>
</tbody>
</table>

Table 2: Key system components identified through the impact webs approach. Source: authors
2.3.4 Workshops

To contextualize and improve the initial impact webs, at least two workshops were conducted for each case study (in Cox’s Bazar, smaller workshops were conducted with different sets of actors as Bangladesh was going through a very high number of COVID-19 cases during the timeline of this project, and getting all stakeholders in one place was not viable or safe). The first workshop aimed at enhancing the understanding of the systemic nature of COVID-19 risks and impacts, while the second workshop focused on identifying lessons for prevention and risk management. By gathering a representative set of key stakeholders and experts (see Annex 1 and 2 for details on workshop dates and participating institutions in the cases), an extensive set of complementary perspectives on challenges, impacts and opportunities to inform future risk management were gathered. These workshops were tailored to suit the prevailing situation in the case studies and were designed in accordance with then existing COVID-19 protocols (i.e. with adequate safety measures in place). Depending upon the context, in-person as well as digital workshops were held. To ensure the participation of each stakeholder in a conducive environment, certain actors were bilaterally consulted (see Annex 3). This was particularly helpful in reaching out to women groups and religious communities who otherwise would not have participated in a larger gathering. In all the cases, local case study coordinators engaged with multiple stakeholders wherever possible within the permitted safety protocols.

2.4 Development of a conceptual model

One main objective of the study was to develop a conceptual model that supported the understanding of the systemic nature of COVID-19 risks, by showing interconnected systems, decision-making processes and other factors that contributed to making vulnerable groups, sectors and systems more at risk. As shown in Figure 1, first conceptual understanding was built from the literature review (see Chapter 2.1). The resulting draft conceptual model was then discussed with selected experts (c.f. Chapter 2.2) to gather feedback and take forward conceptual model development. At the same time, the conceptual model was tested in the case studies (c.f. Chapter 2.3) and findings from the cases on cascading and systemic COVID-19 risks were used to substantiate the development of the final conceptual model. Results are presented in Chapter 4.
3. Findings from the case studies

Chapter 3 presents the results of the case studies. In chapter 3.1, key findings are presented from each of the case study reports. Following this, in chapter 3.2, a case synthesis is presented that highlights distinctive and cross-cutting thematic findings from each of the cases. Important individual findings that arose in the specific context of each case are discussed, followed by commonalities that arose among multiple or all of the cases. Chapter 3.3 presents how COVID-19 has affected progress towards the SDGs within and across the cases, and discusses lessons for the future of the SDGs in pandemic recovery. Lastly, chapter 3.4 discusses the role of social protection in the context of COVID-19, paying specific attention to the case studies. Taken together, the results from this chapter provide insights into understanding cascading and systemic risks in the context of COVID-19 across each of the cases.

3.1 Cascading and systemic COVID-19 risks in the case studies

In this chapter, we summarize the key results of the individual cases, presenting how COVID-19 unfolded, triggering various different cascading and systemic risks and impacts across the case studies.

3.1.1 Maritime Region, Togo

Togo is a low-income Sub-Saharan country with a large rural population and a significant informal economy. Located in the south of the country is the Maritime region, which encapsulates both ends of Togo’s living conditions: a large rural (and remote) population together with the largest city in the country, Lomé, the capital. The emergence of the COVID-19 crisis prompted the Togolese government to swiftly adopt stringent measures to avoid the diffusion of the virus among the population, a measure aimed at avoiding overwhelming the country’s insufficient health system, which lacks human, infrastructural and technological capacity. While a catastrophic diffusion of the disease was averted in Togo (see Table 2), the consequences of the restriction measures have deeply affected the Maritime region, generating cascading effects on commerce, education, rural livelihoods and other key societal sectors. These effects have further compounded with, and exacerbated, pre-existing vulnerabilities, particularly in relation to the multiple internal and external dynamics and interlinkages which characterize the lives of the residents of the Maritime region.
COVID-19 and rural-urban / national-international interlinkages

From the occurrence of the first case of COVID-19 in Togo in early March 2020, the government immediately enforced restriction measures, including lockdown, closures of cities, and curfews. While the spread of the virus was successfully contained, the disruption of daily activities resulted in a cascade of impacts for the population. These impacts presented different characteristics between rural and urban areas. In the city of Lomé, the lockdown was extremely consequential for both the formal and informal sectors of the economy, having widespread adverse effects on employment and livelihoods. For informal commercial activities in particular, the implementation of a curfew was highly disruptive as much trading activity occurs at night, resulting in a decrease in income. The local experts consulted have indicated how this has led to a generalized increase in poverty conditions all across the region, affecting in particular the most economically vulnerable portions of the population (the ones more dependent on the informal economy). Moreover, the disruption also increased gender disparities in the region, as women are more likely to be employed in high-interaction activities (such as market work, hairdressing, restaurants, etc.), making them both more exposed to the virus and more vulnerable to loss of livelihood opportunities following the restrictions. These cascading impacts highlight the fragility of livelihoods dependent on the informal sector. Additionally, the latter generally suffers from the limited reach of existing social protection mechanisms, which resulted in intensifying negative consequences when regular livelihood activities were forced to a halt.

In rural areas of the region, COVID-19 has been virtually absent (or undetected) for the majority of the pandemic. The effects of the countermeasures have affected the population to a much greater extent. Rural areas suffered from the interruption of the usual demand for market products in the capital, which disrupted the rural economy, presenting characteristics of system dependency and rural-urban linkages in trade networks. Agricultural production was also severely compromised during the crisis. In fact, the enforcement of restriction measures reinforced rural-to-urban migration dynamics. Especially young people increasingly opted to resettle in the capital to avoid being confined in rural areas, resulting in further reduction in workforce availability. The increased labour shortage only added to the existing struggles of agriculture in the region, which suffers in particular from a reduced productivity of the soil, over-exploited in recent decades to sustain the region’s growing population. As emerged from the consultations, this resulted
in a reinforcing feedback loop of decreased agricultural production, in turn leading to a generalized price inflation, ultimately enhancing food insecurity for poor households. Food availability was further compromised by restrictions of commerce with neighbouring countries. This situation of scarcity contributed to an increase in illegal activities, e.g. smuggling activity across the national border, in particular with neighbouring Benin.

Other impacts have been felt across the whole Maritime region. Due to insufficient digital infrastructure and the fact that the majority of the population has difficulties in accessing the internet, there were significant disruptions in education, as online learning was not possible for many students, as stressed by local experts during the consultations. Furthermore, experts highlighted the pandemic is likely to have resulted in decreased attention to other risks in the region, connected both to other health hazards (diseases) and natural hazards (floods). For example, comprehensive approaches to flood risk management from the Mono river have been compromised, which may result in enhanced future losses. Another concern for the region’s population resides in the fact that many families see their income supported by remittances sent by relatives working abroad. For some of them, this important financial contribution has weakened throughout the pandemic, since severe interruptions of working life occurred also in countries where Togolese migrants have settled (e.g. western Europe). Togo’s dependence on external financial mechanisms, whether through remittances or development aid funding, constitutes an example of indirect exposure through global dependency. In fact, the Maritime region of Togo can be characterized as the recipient of cascading effects originating remotely, and triggered by shocks not directly occurring within its formal boundaries (high contagions and subsequent lockdowns in western countries).

Pandemic response efforts in Togo also reported successful experiences. The response to the crisis leveraged pre-existing efforts to mobilize citizens and expand their risk awareness through campaigns, with participation from a variety of local and international actors (Non-governmental Organizations (NGOs), etc.). In particular, organizations of local women established and supported by the Red Cross and active since 2012, the so-called Club de Mères, were mobilized to receive specific campaigns in risk awareness and capacity-building (see Box 2). This served the double purpose of addressing risk in a group highly exposed to the virus (as women are often involved in high-interaction activities) and, on the other hand, ensuring that fundamental countermeasures (in particular, hygiene practices) could reach households otherwise excluded by conventional communication networks. In education, while the digital divide severely undermined the possibility of distance learning in general, most university courses were able to continue. Another positive experience was the expansion of the reach of social protection thanks to the collaboration between the Togolese government, the World Bank and additional partners. A novel platform, called Novissi, was established to deliver emergency cash transfers to the most vulnerable and marginal groups in the country, using innovative approaches to identify those people previously not reached by conventional social protection mechanisms (see chapter 3.4).

The case of the Maritime region in Togo has highlighted multiple risks associated with interlinkages in tightly connected systems, characterized by strong dependencies at both local and global scale. Furthermore, the case has shown the presence of a large variety of agents capable of influencing the system, with a pronounced role of NGOs and citizens’ organizations (such as the Club de Mères) in increasing the effectiveness of risk reduction campaigns.
3.1.2 Guayaquil, Ecuador

Guayaquil is the largest and most densely populated city in Ecuador, with an estimated population of 3 million people. Despite being the country’s most industrious and commercial city, it has the highest rate of poverty (11.2 per cent), largest informal work sector (45.9 per cent) and has the most overcrowded housing of any in Ecuador (Lucero, 2020).

The city’s healthcare system was unprepared for the rapid rise in COVID-19 cases early into the pandemic, which was exacerbated by issues of overcrowding. This was further compounded by issues in coordination from both state and international actors, resulting in intensifying underlying societal distrust leading to widespread protests and civil disobedience.

COVID-19 in an overwhelmed, densely populated urban environment

Guayaquil experienced a devastating first wave of COVID-19. Following the first confirmed case on 29 February 2020, the health system reached a tipping point in a matter of weeks, resulting in a high number of corpses being left unattended in hospitals, care homes and on the streets (Alava & Guevara, 2021). The images of bodies accumulating in the streets circulated throughout global media, presented an early example of how COVID-19 rapidly spread in a densely populated urban area, resulting in a near total collapse of the healthcare system, manifesting into a worst case scenario. In March of 2020, the city had an excess mortality rate five times that of the same month in 2019 (Cabrera and Kurmanaev, 2020), and the highest COVID-19 mortality rate of any Latin American city (WHO, 2021a).

In the five years prior to the pandemic, a governmental policy of austerity had led to a reduction in the provision of hospital services, which had dropped between 20-35 per cent in 2019-2020 alone (Organización Internacional del Trabajo, 2021). It was highlighted by healthcare sector workers and healthcare experts from Guayaquil during workshops that the underprepared health system in an overcrowded city was not able to manage the rapid rise in cases. It was reported in workshops that there was a lack of medical supplies, such as ventilators and personal protective equipment, and not enough medically trained staff to treat the sick during emergencies. This lack of personal protective equipment resulted in a high number of cases and deaths among healthcare workers, which put further pressure on the already overburdened healthcare...
system and increased psychological stress for healthcare workers. As well as having an underprepared and insufficient health system capacity, the case of Guayaquil presents an example of how globalized economic, trade and transport networks have resulted in high levels of dependency across scales and social systems (Gordon & Williams, 2020). A novel finding arose from the workshops was that the impacts from disruptions in the flow of global networks have been particularly evident in Guayaquil due to the fact a large part of the city’s economy is dependent on imports and exports from the port. The closing of borders and economic shutdown caused widespread adverse effects on employment and livelihoods. Market and employment informality left a large proportion of vulnerable people, many of whom were living in poverty prior to the pandemic, without income or livelihood opportunities. As well as further increasing destitution, it was noted by experts in the workshops that the pre-existing issue of overcrowded housing throughout much of the city became more of a problem when people lost their jobs. Due to the limited availability of space per person, stay-at-home orders and social distancing were difficult to follow for a large segment of the population, which was not sustainable over longer time periods of weeks and months. These numerous factors occurring together were probably a factor that resulted in sharp increases in domestic and gender-based violence. The desk review and workshop findings further highlighted that there was a lack of an integrated, cross-sectoral and multi-scale response between Guayaquil’s and Ecuador’s public institutions. Issues in state-level coordination resulted in siloed communication, which hindered the effectiveness of local institutions to set up early-detection, warning and monitoring systems such as contact-tracing and testing facilities (Alava & Guevara, 2021). Ecuador has maintained a centralised testing system, whereby provincial samples are sent to a limited number of regional labs, which was found to have contributed to delays in processing (Torres and others, 2021). The limited capacity of data processing at national level further highlights cross-scale dependence as it led to a less comprehensive response at the city level. However, another novel finding stressed by health experts in the workshops concerned the fact that the response of state actors was also influenced by their dependence on the flow of information from global to local scales. As in many low-income and middle-income settings, international collaboration and support are imperative components for comprehensive risk governance, especially in times of disaster. Issues with universal coordination and communication from the WHO resulted in the output of unclear information, which prompted a slower uptake of protocols and ambiguous communication from the Ecuadorian government (The Independent Panel for Pandemic Preparedness and Response, 2021). Workshop participants noted that this was one of the factors that contributed to the spreading of misinformation throughout digital social networks. In response to the economic disruptions, the government of Ecuador brought in further austerity measures. This policy intensified the many cascading impacts for already vulnerable citizens. Furthermore, some city and state-level actors have been allocated in corruption cases for capitalizing on the emergency healthcare situation (Alava & Guevara, 2021; Brown, 2021). These factors saw growing levels of frustration and societal distrust in the government, which was already underlying through policies of austerity. This was made transparent in Guayaquil when a societal tipping point was reached in May of 2020, resulting in widespread protest and civil disobedience. Including Guayaquil as a case study highlights how under-preparedness in the healthcare system, overcrowding, the shutdown of global networks and incomprehensive state and international coordination and response, present characteristics of dependence and tipping points in a densely populated, urban context.
3.1.3 Sundarbans, India

The Sundarban Biosphere Reserve (or Indian Sundarbans) is part of the world’s largest delta, the Ganges-Brahmaputra-Meghna delta. This archipelago of islands constitutes a part of the largest contiguous mangrove forest in the world and is home to approximately 4.4 million people (Census of India, 2011). In this climate hotspot and critical eco-region, 43.5 per cent of households live below the poverty line while more than 87 per cent of households experience food shortages (Ghosh, 2012; HDRCC Development & Planning Department Government of West Bengal, 2009; 2010).

To contain the spread of COVID-19, the central government of India announced a country-wide lockdown as of 24 March 2020 (Ellis-Petersen, 2020). Amidst this, on 20 May 2020, the severe cyclonic storm Amphan made landfall in the region with sustained wind speeds of 170 km/h, gusts of up to 190 km/h and storm surges of up to 5 m. It caused USD 13 billion of damage, thereby becoming the costliest cyclone ever recorded in the north Indian Ocean (State IAG, 2020).

The double burden of COVID-19 and cyclone Amphan

The impact of two hazards occurring simultaneously manifested in the economic distress across sectors, actors and scales as reported in the workshops, media and publications. A significant proportion of the population in this area is dependent on natural resources for livelihood (fishers, crab collectors, honey gatherers, beekeepers, agriculturalists, etc.). Due to COVID-19 containment measures, restrictions were placed on accessing these natural resources, which themselves were directly affected by the cyclone. Seasonal migration to different parts of India, which has gained prominence in recent years, was also affected during the initial months of the pandemic due to movement restrictions and the closure of many industries, mainly disadvantaging those employed in the informal sector. At the same time, disruption in global and national supply chains and networks resulted in a sudden collapse of the tourism-based livelihoods and a lack of market for local products (particularly seafood).

Closing schools as a preventive measure for COVID-19 resulted in the disruption in education, which coupled with the endogenous vulnerabilities of the region. Switching to online
classes was not feasible for many areas, as pointed out by experts. While the existing poverty was one barrier for families to pay for tools to access online education, unstable internet connectivity in the remote regions was another barrier. When these barriers were coupled with the additional economic distress due to the pandemic and the cyclone, the disruption in education became conspicuous (Save the Children, 2020). It was reported in the workshops that not only will this deepen the root cause of vulnerability to climate change (such as poverty and low skill-set), the lack of quality education and skill-building will affect future livelihood opportunities as well. This was further validated by the experts who also pointed out that the disruption in education will “cripple an entire generation”. The cyclone directly caused a loss of study materials, books, etc. which also disrupted education (“Amphan: First Situation Report from Sunderbans – AID”, 2020). It also had long-term impacts, particularly for female students, as a spike in child marriage was reported during the workshops and consultations. Children's mental health is being affected as they are not getting a healthy social environment to grow up in due to the closure of schools and restriction in face-to-face interactions with peers (idem, 2020).

The fear and panic about COVID-19 was amplified by misinformation about the disease. Fear and panic was particularly evident in the early stages of the pandemic due to the unplanned return of migrants from cities, which was triggered by the sudden loss of employment. This was met with difficulties during the evacuation for the cyclone, as individuals were scared to move to cyclone shelters that were being used as quarantine units for returning migrants (Basu, 2020). This caused panic and fear, especially for the children and the elderly as pointed out by the communities. As reported by experts, the existing uncertainty of livelihoods owing to the lockdown, resulting economic distress, and the cyclone's direct and indirect impacts on livelihoods, affected the wellbeing of the people. Residents of Indian Sundarbans mentioned they had a lack of resources to make timely repairs and reconstruct their homes damaged by the cyclone due to the economic stress caused by the lockdown. This had been different from their past experiences of rebuilding after cyclones as they could fund repairs from their active sources of income. This economic distress, when combined with the pressure of rebuilding after the cyclone, affected the wellbeing of the people as they were facing homelessness amidst an ongoing economic crisis.

Experts and residents pointed out the lack of access to healthcare for pre-existing diseases in the early days of the COVID-19 due to lockdowns, which in turn resulted in many residents resorting to impostors in the rural areas. Additionally, the cyclone caused water-borne diseases, skin diseases, and malnutrition, while increasing the chances of snake bites (The Indian Express, 2020; DW News, 2020). The health impacts arising from the cyclone have been similar to experiences of past cyclones, but those arising from the lockdown are new as reported by experts. The remoteness of the region in access to health services, when coupled with the fear of the pandemic and diseases caused by the cyclone, further added stress on health infrastructure that was already anticipating stress due to the pandemic.

Development presented above (economic distress, closure of schools, lockdown, etc.) had a very pronounced gender-differentiated impact. Incidence of forced marriage among underage girls increased during the period of lockdown and in the aftermath of the cyclone in the case study area (Mitra & Bhattacharya, 2020). This was further corroborated by experts and communities who reported the economic distress due to COVID-19 and the cyclone compulsions for the families to sell daughters or marry them off. The schools, which act as primary sources of information, were closed, and this hindered the authorities from getting access to such developments (eadem, 2020). Additionally, due to economic distress and disruption in education, many families engaged their children, especially young boys, as child labour. Many women had to additionally work
in fields on top of their other existing workloads, to do work that was otherwise done by hired workers. Experts asserted that the impacts of such events will fully manifest only in the long term.

Furthermore, the cyclone caused damage to infrastructure and inundation, which resulted in restricted access to safe drinking water, which then further led to cascading impact on women’s workload and safety as they had to travel further and through “neck-deep water” to fetch safe drinking water (Chattopadhyay, 2020). Similar cascading impact on women’s hygiene and safety was reported by residents as restricted access to sanitation services, resulting from infrastructural damage and inundation, compelled some women to resort to open defecation, which was further compounded by movement restrictions imposed due to COVID-19. The restricted sanitation access also led to some women foregoing food and water due to the complexities associated in accessing sanitation services (Banerjee and others, 2021).

The main cascading impact in this region in the near and long term is due to economic distress caused by the lockdown. The COVID-19-induced lockdown disproportionately affected poorer households of this region. One study revealed that 88 per cent of poorer households’ average weekly local income and 63 per cent of average weekly remittance income were lost due to COVID-19 (Gupta and others, 2020). Not only did it increase poverty, it pushed certain people back into it. The reduction in income due to employment loss forced people to reduce meal portions and consume fewer food items, thereby affecting their food security (Gupta and others, 2020). While this was adopted as a coping mechanism by people in the face of economic crisis owing to COVID-19 induced lockdown, women were further disadvantaged in the aftermath of the cyclone, as they tended to sacrifice their nutrition for children and other family members (Banerjee and others, 2021). While aggravating short-term loss of income, it has aggravated child marriage and human trafficking, which can have long-term impacts. The impacts on mental health and wellbeing will also manifest in the long term as opined by the experts.

3.1.4 Cox’s Bazar, Bangladesh

Cox’s Bazar, the southernmost district of Bangladesh, hosts currently the largest refugee camp in the world. It accommodates around 890,276 Rohingya individuals from 189,901 families (UNHCR, 2021). The local community from Cox’s Bazar was the first responder to this migrant crisis; gradually the Government of Bangladesh (GoB) took central control of the camp management and assigned the overall charge of the camps to the Refugee Relief and Repatriation Commission (RRRC). At the same time, several international organizations are working along with the GoB and the local community to support these camps as well.

**COVID-19: Refugee camp and challenges in a fragile setting**

The outbreak of COVID-19 significantly disrupted response to the refugee crisis. To contain the spread of the virus, Bangladesh imposed two rounds of country-wide lockdowns (end of March – June 2020 and April – August 2021). As reported in the workshops, compared to the other parts of the country, the enforcement of lockdowns in refugee camps was stricter; only three sectors i.e. health (all health services), WaSH (water supply, sanitation and hygiene services) and food security (distributing basic foods and rations among the families) were functional in the camps from March 2020 through to August
2021. All other sectors and service, including education, informal employment, non-food-related distribution centres, community-based help groups and NGOs, were fully or partially restricted from functioning. Due to the stringent actions taken by the government and other actors, the spread of COVID-19 in camps has been limited. By 2 September 2021, around 0.3 per cent of the camp population was infected resulting in 32 deaths (WHO, 2021c).

The refugee camp has a unique fragile context that can lead to a much more aggravated crisis than the general population for a multitude of reasons. Refugee communities are often extremely vulnerable due to their dependency on the hosts and the aid agencies. Additionally, in Cox’s Bazar, due to their predisposed location, infrastructure and social circumstances, these camps are highly vulnerable to flash floods, cyclones, slope failure and fire hazards.

The somewhat late occurrence of the pandemic in camps allowed the government to significantly augment the health infrastructure in the camps and the surrounding host communities, which were meant to provide treatment to both the COVID-19-affected as well as other diseases. However, during the spike of COVID-19 infections (May-July 2020 and again April-August 2021), the treatment of other (non-COVID-19) diseases was disturbed in all health facilities which, as reported in workshops, worsened general health conditions. Educational activities served multiple purposes in the camps e.g. providing education, supplementing child nutrition, as well as safety and sense of community. During the pandemic, however, all the centres were closed, which suddenly deprived a significant population of both education and nutrition. As reported in the workshops and community consultations, this seems to have additionally fuelled gender violence, human trafficking, child marriage and illegal trade. The overall mental health and wellbeing of residents was reported to have been significantly affected.

Consultations with the refugee communities revealed that the loss of short-term livelihood opportunities (often informal) and inflation during the pandemic, severely reduced their access to additional nutrition, clothes and basic resources beyond what was being provided to them. One interesting insight from the community consultation revealed the disproportionate impact on the most vulnerable sections of the refugee population. Due to the centralization of services and reduction in frequency to manage the pandemic, food packages were distributed only at specific locations on a monthly basis, which in turn made packages heavier. Due to movement restrictions and economic stress, this disproportionately affected people with disabilities and elderly, who perceived the longer way and heavier packages as an additional burden, but could not afford to...
pay someone else to do it. The pandemic also highlighted the importance of effective and timely communication during disasters. Rumours and misinformation regarding the nature of the virus and sham ways to contain it, severely undermined the scientifically informed official risk containment measures. Consultations underlined the importance of involving community and religious leaders in effective risk communication and reduction.

Measures undertaken to contain the spread of COVID-19 also triggered some positive long-term effects, particularly through the empowerment of the local community and partner organizations. Due to the lockdown, several international NGOs working in Cox’s Bazar were unable to bring their international workforce, and hence enhanced their collaboration with local partners to fulfil these capacity gaps. This helped in augmenting the capacities of the local partners and enhanced their inclusion in the decision-making and implementation processes. In the consultations, it was highlighted that this empowerment of local partners is likely to continue beyond the pandemic, and can help make international assistance more sustainable and collaborative in the long term.

Due to the fragile contexts of Cox’s Bazar, COVID-19 has created multiple and cascading impacts well beyond the health aspects. Consultations carried out during this project highlighted the peculiarities of circumstances and challenges faced by the refugees, particularly their very high level of dependence on the host country. Such experiences in a fragile context can be different from the rest of the country. The pandemic affected the overall societal attitude to health measures and societal trust, both within the refugee, as well as the host, community in Cox’s Bazar.

On the positive side, the government attached special attention to ensuring the containment of COVID-19 in the camps, and to supporting the health infrastructure in camps. It augmented the health infrastructure in Cox’s Bazar, which benefited both the refugee and host communities. Additionally, health measures in the camps (particularly the hygiene measure) improved significantly due to COVID-19. However, in the beginning of the pandemic, the spread of misinformation and rumours in camps created mistrust between different actors as well as within the refugee community. At the same time, COVID-19 containment measures also resulted in the impediment of overall infrastructure and amenities provision in the camps, which further abated the mistrust.

While some of the impacts of the pandemic, such as restricted access to education, nutrition and healthcare, may get addressed in the near term, certain irrevocable damages such as child marriage, rise in criminal activities, low-skilled manpower etc. are likely to manifest over the years. This will particularly affect the more vulnerable groups within the refugees. A generation of refugees that already had very limited access to education has further lost almost two years of education, which compromises their long-term employment and wellbeing prospects as well as the future leadership of the community. Similarly, child marriages and human trafficking will have grave long-term effects across multiple aspects on individuals and the community. The impact of the pandemic on the mental health and wellbeing of the impacted community will only be fully understood in the long term.
3.1.5 Indonesia

With a total population of 270 million people, Indonesia (officially the Republic of Indonesia) is the fourth most populous country. With a Gross National Income (GNI) per capita of 3,870 USD in 2020 it is classified as a lower-middle-income country (World Bank, 2021b) with a rapidly developing economy that is characterized by a large informal sector and labour force. Despite its growing economy, many Indonesians are still trapped in poverty (9.4 per cent in 2020) and face inequalities (idem, 2021a). Due to its geographic location, the country is prone to multiple hazards, such as earthquakes, tsunamis, volcanic eruptions, flooding, tropical cyclones, storm surges, heat waves and sea-level rise (World Bank Group & Asian Development Bank, 2021). The country has experienced multiple of these hazards amidst the pandemic.

COVID-19: challenges on all fronts

Due to the combination of limited knowledge on the novel disease, lack of coordinated response and inconsistent policy messages, the first months of the pandemic were characterized by low willingness of the population to follow the paradigms of testing and tracing. Combined with insufficient preparedness of the healthcare system, Indonesia lost healthcare staff (incl. doctors and nurses) at a much higher rate than other countries in the world. As of mid-September 2020, Indonesia had the fourth-highest fatality rate of healthcare staff globally. During the workshops, experts highlighted this as an example of a vicious circle that has created additional challenges in the fight against the pandemic.

From January 2021 onwards, the Government tried to facilitate economic recovery by relaxing previously established restrictions for selected sectors, such as the tourism sector. In the workshops, experts confirmed that as a consequence of this decision, cases started to increase again (notably on Java and Bali) – a trend that was further exacerbated by the emergency and rapid spread of the Delta variant (officially referred to as B.1.617.2) across the entire country from July 2021 onwards. Combined, these trends have led to a massive increase in confirmed cases and deaths in a very short period of time. This made it difficult for health facilities to treat patients, and led ultimately to a collapse of the healthcare system. With more than 50,000
confirmed cases and over 2,000 deaths a day, mid-July 2021 marked the tragic peak of that development.

During the consultations, experts further highlighted that the health system became increasingly overstretched in the second half of 2021. As a result, the availability of, and access to, reproductive and maternal healthcare has further decreased, which in turn has increased the risk of sexual and reproductive health-related morbidity and mortality.

Next to these direct effects on health and the health system, the restriction measures put in place by the government have led to cascading effects on the economy resulting in a significant drop in economic growth. In 2020, the Indonesian Ministry of National Development Planning (BAPPENAS) estimated that this negative growth may affect the Indonesian economy for at least the upcoming ten years (LPEM FEB UI & BAPPENAS, 2020). In response, the government introduced a massive fiscal stimulus package through the National Economy Recovery (PEN) programme. Financial resources were mobilized through budget cuts in the State Budget (APBN), the Regional Revenue and Expenditure Budget (APBD), and the monetary sector. During the consultations, experts highlighted that, as a result, multiple development projects, especially infrastructure and public facilities, had to be postponed. The need for additional funds to fight the impacts of the pandemic has also led to a further increase in foreign debt. This forced the government to revise development targets in 2020, as well as the target set in the National Mid-Term Development Plan 2020.

Deciphering the impacts on the economy, experts also confirmed that most economic sectors in Indonesia experienced a drastic disruption of value chains and decline in income due to restriction measures installed by the government. Notably, the manufacturing sector, characterized by labour-intensive industries such as garment, leather and shoe factories, trade and service sectors, dominated by small and medium enterprises (SMEs) and low value-add business (micro business), as well as the transportation and tourism sectors, felt the most significant impacts. According to Bappenas (2021), one year after the start of the pandemic, the income generated by SMEs had fallen by more than 50 per cent, and approximately 30 per cent for large companies.

According to the experts consulted in the workshops, this has led to further cascading impacts on livelihoods, employment, and income and in turn poverty and household vulnerability - confirming findings of (Suryahadi and others, 2020). The unemployment rate reached 60 per cent, with higher rates in cities than in rural areas and women compared to men. In Bali, for example, the tourism sector faced a severe economic downturn, further increasing the unemployment rate - also in the informal sector (Yuniti et al, 2020).

Next to these effects, the consultations also confirmed the findings from the desk study that the pandemic has also further exacerbated pre-existing vulnerabilities. For example, a survey from UNICEF and others (2021a) shows that 45 per cent of households reported behavioural changes among their children. The study also showed that women were more likely to take the lead in supporting children with home-schooling (71.5 per cent) and in turn struggling to find a balance between work and additional responsibilities posed by school closures. Experts also highlighted during the consultations that especially students in remote areas and urban poor settlements who were lacking internet connection already before the pandemic, were particularly affected. Further, girls were ten times more at risk of dropping out of school than boys, partly due to a rise in early marriage (eadem, 2021b). The same study also revealed that children and adolescents with disabilities faced three times higher risk of dropout. Combined, the above has hence further aggravated existing inequalities and marginalization.

One point that emerged strongly out of the workshops and that had not been addressed in previous reports or studies, was the effect
of the pandemic on disaster risk management. Officials from the National Agency for Disaster Management highlighted that this was of particular concern for a highly hazard-prone country like Indonesia. Regarding this, the following examples were flagged in the consultations: first, through the implementation of health protocols, emergency response has become not only slower but also more costly, putting additional strains on the national budget. Further, ensuring health protocols during disaster situations is challenging. For example, in the emergency response to the earthquake that affected Mamuju, Mamasa and Majene districts in January 2021, many volunteers and people in the evacuation shelters became infected with COVID-19 (The Sydney Morning Herald, 2021; Oxfam, 2021). Similar observations have been made in the aftermath of the volcanic eruptions in Yogyakarta (August 2021), the floods in West Java (September 2020, February 2021, March 2021, October 2021) and several other provinces in Indonesia (particularly in South Kalimantan), or the tropical cyclone 26S (Seroja) that hit the East Nusa Tenggara (NTT) province (April 2021). Second, it was highlighted that COVID-19 has also caused delays in the relocation of survivors of the 2018 Tsunami in Palu, who still stay in temporary shelters. The temporary shelters have limited facilities as they were planned only for a short period, increasing the challenge to physical distance due to high population densities in these places and in turn leading to a vicious circle of increasing infections.

However, experts who participated in the consultations underscored that the pandemic not only led to negative cascading and systemic impacts, but also triggered some positive developments. Examples include the rise in solidarity, increased innovation and digitalization to establish alternative income generation, a growth in urban farming practices and awareness towards organic farming, increased importance of telemedicine, and the scaling-up and enhancement of social protection schemes.

3.2 Case study synthesis: distinctive and cross-cutting findings

In this chapter, we select and present some of the distinctive findings from the individual case studies and summarize a number of cross-cutting themes and similarities that arose across most or all of the cases. Individually, each of the case studies discussed in Chapter 3.1 give insights into a specific setting, in which a number of distinctive findings emerged for a specific region or context (e.g. in a fragile setting in Cox’s Bazar). However, a combined approach represents a more comprehensive and global picture of the cascading and systemic nature of COVID-19.

3.2.1 Distinctive findings from the individual case studies

A distinctive finding from the case of the Maritime region, Togo, is that it has had a relatively low exposure to the virus in comparison to other cases (see Table 1). In rural regions, the virus has been virtually undetectable (although this should be said with caution due to the limited testing capacity for the health system). However, many restriction measures generated significant societal impacts through both interconnectedness and dependence. Although disruptions in the flow of remittances undoubtedly occurred in other case studies, for the Maritime Region of Togo this element emerged as a cause of widespread
cascading impacts throughout the region. Furthermore, this case presents an interesting dynamic in that the pandemic triggered a **migrational movement towards urban areas** such as Lomé, whereas in many global regions the opposite effect occurred, including in the Sundarbans, India (FAO, 2021). This is likely to be due to the reinforcing feedback loop discussed in the case summary, which was triggered by the interruption of demand for market products.

**Guayaquil, Ecuador,** was the only case study in which state actors implemented strong **policies of austerity** in response to the widespread economic impacts early into pandemic. Furthermore, in comparison to other cases (such as Indonesia), social protection schemes were limited (see Chapter 3.4). These were two of a number of factors identified in the desk review and workshops that resulted in a **societal tipping point** being reached (other compounding factors include allegations of corruption, underlying societal district, widespread misinformation and overall frustration of how the pandemic was being managed). This resulted in widespread **protest, social conflict and rioting** throughout the city, which was unique to this case.

A distinctive finding from the **Sundarbans, India,** case is that interventions that were implemented to mitigate impacts of two concurring hazards counteracted one another. The hazard response protocol for Cyclone Amphan was for communities to evacuate their homes and move to communal cyclone shelters. However, COVID-19 interventions were explicit in directing communities to stay at home, avoid crowds and socially distance. This was further complicated by the fact that cyclone shelters were being used as quarantine units for returning migrant workers, which, as pointed out by communities during workshops, caused further panic and fear.

Six months into the pandemic, as of mid-September 2020, **Indonesia** reported the fourth highest number of **COVID-19 fatalities** in the world for healthcare-sector workers. This distinctive finding from the case study demonstrates that the healthcare system in Indonesia was underprepared due to a combination of factors, including limited knowledge at the time of the novel disease (such as viral loads and peak infection times), shortages of personal protective equipment, the lack of a coordinated response and a low willingness of the population to follow testing and tracing measures. The increase of infections in healthcare workers subsequently resulted in further reducing the capacity of the already overstretched health system to treat the population.

The case of **Cox’s Bazar** is distinctive from the other cases in that Rohingya communities already had very little agency, were highly restricted in their movements and activities, and were **highly dependent on hosts and aid agencies** prior to the pandemic. Although poverty, destitution and vulnerability are apparent in the other cases, the pre-existing vulnerabilities found in Cox’s Bazar were amplified due to the effects of lockdowns. The distinctive learning from this case underlines the importance of the involvement of communities and community leaders (such as religious leaders) for effective risk management and communication in uncertain, novel and dynamic settings, such as that of the COVID-19 pandemic.
BOX 1: COVID-19 and cascading effects - lessons from education in Germany

The education system has been significantly affected by the COVID-19 pandemic. Throughout much of the world, daycares, schools and universities were closed for all but essential services (UNESCO, 2021). This caused cascading effects throughout all of society. This box presents findings from an additional desk study that was focused on COVID-19 impacts on education, and possible cascading effects on other segments of society in Germany.

Germany was chosen as it is characterized as a high-income country and with a GDP of 3,846 USD per capita, it is one of the strongest economies worldwide (World Bank, 2021c). It is therefore expected to be able to better cope with impacts derived from COVID-19 as it has significant financial resources to support e.g. economic development, social protection and health infrastructure. In order to best understand systemic risk in the context of COVID-19, additional insights from a high-income country can reveal characteristics that arise despite this privileged context.

Cascading effects for children

Children’s learning success during the pandemic was found to be largely dependent on their general individual academic performance as well as the socio-economic background of their setting. Children with weaker academic performances showed less motivation, concentration, self-organisation and discipline during home-schooling (Huebener & Schmitz, 2020; Lockl and others, 2021; Wößmann and others, 2021). In addition, lower-performing children are more likely to be in a less advantageous home learning environment (Geis-Thöne, 2020; Huebener & Schmitz, 2020). These results therefore suggest that due to the structural shift to online learning, there is a reinforcing feedback effect for children with lower academic performances, and that performance gaps are likely to widen over time as a result of the pandemic.
An advantageous home-learning environment depends to a large extent on the educational support given by parents, which is linked to the socio-economic background of parents (Wolter and others, 2020). In general, parents with non-academic as well as migrational backgrounds were found to face more difficulties in supporting their children in home-schooling (Wolter and others, 2020; Rude, 2020). In lower-income groups, parents are often less able to work from home and, to avoid financial losses, have consequently been more likely to leave their children unsupervised (Zoch and others, 2020). Beside the educational support, children’s learning success has been dependent on the availability of their own working space, as well as having access to sufficient electronic devices and stable internet connections, which are all connected to family income and demographic factors (Geis-Thöne, 2020; Langmeyer and others, 2020).

In addition, children from families with lower incomes, migrational and non-academic backgrounds experienced fewer joint-learning formats such as video conferences, providing direct contact between teachers and children, which was seen to be important to facilitate the learning-from-home process (Blaeschke & Freitag, 2021; Huebener and others, 2020; Langmeyer and others, 2020). Therefore, the challenges of remote learning faced by children from low-income and migrational backgrounds were not compensated by many schools, but rather exacerbated through the methods of online teaching practices.

If the educational losses experienced by these groups are not compensated for, there is a risk that children who are already disadvantaged because of their socio-economic background have less educational opportunities, and therefore less chances in the labour market in the future (Wößmann and others, 2021). The sudden closure of schools through lockdown measures, is therefore likely to lead to long-term consequences that only become apparent after some delay. The resulting risk is that existing social inequalities in education and income in Germany will persist or even increase over time as a result of COVID-19.

### Cascading effects for parents

The school closure confronted working parents with the sudden challenge of organising childcare or home-schooling and their work at the same time (Destatis and others, 2021; Zoch and others, 2020). However, the capacity to deal with the new situation depended highly on the professional situation, as well as the constellation of the family (Bujard and others, 2020). Couples who had the possibility to divide family responsibilities were less affected than single-parents who experienced both a greater organisational challenge and more of a psychological burden (Bujard and others, 2020). Additionally, the possibility of home office was found to be a critical means to fulfil family and work responsibilities, whereas households with one parent working in a societally essential occupation (such as in healthcare) were particularly confronted with the question of how to divide work and family responsibilities (Bujard and others, 2020).
Kohlrausch & Zucco (2020), as well as Zoch and others (2020), found that regarding these challenges, especially women were affected as they have traditionally been more likely to take over the additional task of child care and support in home-schooling throughout the pandemic. Women are thus more likely to reduce their working hours to compensate for increasing their time on childcare duties (Kohlrausch & Zucco, 2020). This is reinforced by the fact that women are more likely to work in high societally essential and interaction professions that do not offer the possibility of working remotely to facilitate childcare duties (Kohlrausch & Zucco, 2020; Wersig, 2020). Additionally, linked to the gender pay gap in Germany, in the majority of households, the male's salary is higher and consequently, women are more likely to reduce their working hours so as to not compensate more financially (Kohlrausch & Zucco, 2020).

The reduction of working hours for women, in combination with the general slowdown of the economy during the pandemic, additionally enhances the risks that the gender time-and-pay gaps will widen in the long term, as women face the possibility that they cannot automatically return from the reduced working hours to the pre-pandemic state (Zucco & Lott, 2021). Due to the resulting lower incomes from the gender pay gap, women are more likely to receive fewer social benefits in the form of short-time allowances that have been provided by the government of Germany during the pandemic (Kurzarbeitergeld), sickness benefits or unemployment benefits, as well as less pension in the long term (Wersig, 2020; Zucco & Lott, 2021). This leads to the fact that, throughout the pandemic, women have been, and are likely in the future to be, confronted with more financial difficulties.

All in all, it has become apparent that women are much more affected by the impacts of COVID-19 containing interventions than men, which in the long run leads to a reinforcement of gender inequality (see Box 2). The resulting impacts encompass undesirable present and future conditions that are almost impossible to reverse.

**Conclusions**

The COVID-19 pandemic has demonstrated that the education system, which is a key pillar of society, is fragile. The sudden closure of daycares and schools induced cascading impacts throughout all of society. How this will evolve over time is inherently uncertain. However, it is clear that impacts are felt disproportionately, and are likely to reinforce underlying inequalities, as well as demonstrate the delayed cause-and-effect nature that can be seen with systemic risks. The results of this case therefore highlight the importance of protecting the education system in times of crisis.
3.2.2 Cross-cutting findings across the case studies

One of the most apparent cross-cutting themes that can be seen from the case studies is that nearly all interventions that were implemented to mitigate the direct risks and impacts from COVID-19 had clear and observable cascading effects throughout society. All cases exhibit cascading impacts on livelihoods, economy, gender, education, political and social systems through interventions that were implemented. Many of these cascading impacts lead to further cascades. To highlight one example that arose in all the impact webs, stay-at-home orders and social isolation saw sharp increases in mental-health impacts for many people. Another example that can be seen is the lack of acceptance among the population to adhere to interventions, as was demonstrated through widespread protest in Guayaquil, or from the reluctance of people to follow test-and-trace rules in Indonesia and Cox’s Bazar, resulting in higher numbers of cases and further weakening the healthcare system. Although interventions put in place were necessary to protect at-risk groups and avoid health-system tipping points, the cascading effects of interventions such as lockdowns undoubtedly created devastating effects and exacerbated vulnerabilities for large segments of the population.

A second observable cross-cutting theme is that COVID-19 reinforces pre-existing vulnerabilities. This is very likely to result in a widening gap of inequality and injustice throughout societies everywhere. In all cases there are multiple examples of the pandemic increasing and exacerbating vulnerability for those who are already in the most difficult situations. In the Maritime region of Togo, for example, the closure of night markets and the reduction in demand for food products saw a loss of income for those already living in poverty. In Guayaquil, families already living in overcrowded housing suffered more from stay-at-home orders than those in more favourable living situations. In the Sundarbans, lockdown restrictions and the closure of the forests interrupted income-generating activities for those who are dependent on nature for their livelihoods. In Cox’s Bazar, the shutdown of nearly all migrant camp activities resulted in disruption of all short-term livelihood opportunities, severely reducing the population’s access to additional food, clothes and basic resources, and the established emergency WaSH facilities were noted as being non-disability inclusive. In Indonesia, students in urban poor settlements lacked internet connection already prior to the pandemic, reducing online schooling possibilities and in Cox’s Bazar, as internet access was restricted prior to the pandemic, cutting off information from outside the camps, building awareness of the scale and severity of the pandemic was hard to generate. This may have been a factor in the reluctance of communities to follow test-and-trace rules. These demonstrative examples from the cases are only a selective few. However they emphasize the reinforcing nature of COVID-19 on pre-existing vulnerabilities.

All cases further exhibit the dependence of global networks and processes that had significant impacts at the local level. Perhaps the most tangible example of this is demonstrated through the slowdown of the global economic, transport and trade networks, resulting in decreases in national productivity and subsequent widespread job losses. In Guayaquil for example, the slowdown of international trade in the port resulted in economic downturn and job losses throughout much of the city. Each case study further highlights that impacts were felt more strongly by those working in informal settings, for example those employed in the night markets in Lomé, Togo, who generally have less job security.

Another cross-cutting theme that arose from the case studies concerns the exacerbated impacts that have been seen for women and girls. In the Maritime region of Togo and in Indonesia, it was highlighted that women work more frequently in high-interaction jobs, thereby increasing their exposure to the virus and also suffering from more widespread loss of livelihoods. In
Guayaquil, the Sundarbans and Cox’s Bazar, the case experts noted that women and girls have worked more than usual in manual labour throughout the pandemic, to compensate for family financial losses. Furthermore, COVID-19 has increased instances of child marriage in the Sundarbans, Cox’s Bazar and Indonesia, and all cases reported increased instances of domestic and gender-based violence. In Cox’s Bazar and Guayaquil, it was noted in workshops that this is likely to be due to losses in livelihood opportunities and stay-at-home orders. Moreover, the impact webs in all cases highlighted that women were found to take the leading role in supporting home-schooling, increasing the gender pay-and-time gap. It was noted that the focus on COVID-19 reduced provision of maternal healthcare facilities in Indonesia, resulting in increased morbidity and mortality for women. Lastly, the establishment of additional WaSH facilities were noted as being non-gender-inclusive in Cox’s Bazar. These findings reinforce the nature of gendered risks associated with crises. As is often seen, impacts are felt disproportionately and due to the longevity and global scale of the pandemic, these impacts have been felt more widely for women and girls. For further information on COVID-19 and gender (see Box 2).

BOX 2: COVID-19, gender equity, diversity and women’s leadership

The COVID-19 pandemic has transparently presented countless examples of how disasters are inherently connected to, and amplify, pre-existing gender inequality. Women, girls and gender-diverse people have experienced disproportionate indirect health impacts, as well as a multitude of cascading effects (UN Women and others, 2020). Those who face intersectional inequalities due to their income, race, geographic location, age, disability, migration and health status were particularly affected. These impacts have challenged the equitable and effective distribution of health and social care, restricted mobility, deepened inequalities and shifted the priorities of public and private institutions (Freizer and others, 2021).
COVID-19 impacts, gender and inequality

The case studies from CARICO, in line with the literature, present numerous examples of gender inequality connected to the COVID-19 pandemic, as demonstrated in the cross-cutting findings. Indirect health impacts were highlighted in each of the cases. Increases in gender-based and domestic violence were documented in all of the cases, contributing to the growing ‘shadow pandemic’ (UN Women and others, 2020). Furthermore, an overburdened healthcare system in Indonesia has, for example, resulted in a lack of access to maternal and reproductive services. Moreover, the cases show that women have faced increased burdens through impacts on the education system. In Cox’s Bazar, girls’ access to education has decreased due to school closures, contributing to, among other factors, increased incidences of child marriage (UNICEF, 2021). Although not documented in the cases, disproportionate impacts can equally be said to have extended to people based on sexual orientation and gender identity, some of which include increased violence, psychological harm, hate crime, criminalization of sexual orientation and reduced access to medicines (IE SOGI, 2020).

Lastly, also social protection schemes rolled out to buffer against the adverse effect of COVID-19 have been in the majority of all cases implemented insensitively to their gender dimension: only 23 per cent of all social protection measures introduced during COVID-19 target women’s economic security specifically or account for unpaid care (UNDP & UN Women, 2020).

However, throughout the pandemic, there have also been countless instances of exemplary public and private leadership, innovation and mobilization led by women, girls and gender-diverse people (Bruce and others, 2021; UN Women, 2021). These examples reiterate the importance of the role of diversity, equality and social justice in response to, and recovery from the pandemic, and for disaster risk reduction.

Diversity and equality in the context of COVID-19 and systemic risk governance

Women are far more likely to be working in ‘frontline’ sectors. 70 per cent of the global healthcare workforce are women. This figure rises to 90 per cent if social care is included, and women are more likely to work in service-provision industries, such as supermarkets, pharmacies, and cleaning, that have been essential throughout the pandemic (Lotta and others, 2021). Furthermore, many female Heads of Government have been recognized globally for their effectiveness in managing the pandemic. Female leaders in numerous countries and states have implemented rapid-response measures, effectively setting up early-warning systems and containment measures, and employed transparent communication of public-health information. It has been noted that the leadership styles of women have been more collective, collaborative and integrated multiple perspectives (UN Women, 2021), which has been necessary when responding to a highly dynamic and uncertain disaster. This trend can also be seen from female leaders at more local levels (Bruce and others, 2022).
Synthesis of findings from the case studies

Women’s organizations around the world have been mobilizing to combat the direct and indirect threats of COVID-19. Examples from the case studies include; In Cox’s Bazar, female volunteer groups have been providing advice on responsible hygiene, social distancing and medical treatment (UN Women, 2020). In the Maritime region of Togo, the spreading of information about hygiene practices to contain the contagion was supported by the activity and experience of the association of ‘Club des Mères’ (Mothers’ clubs): established and supported by Togolese Red Cross and active since 2012, these groups are constituted of local women (aimed especially at remote areas) who receive training on appropriate hygiene practices, with the mandate to sensitize their communities. In the Sundarbans, women’s self-help groups and female-led cooperatives provided employment and loans that have helped women in repairing their houses that were damaged by the cyclone (Banerjee, Vincent & Ghosh, 2021). Further, frontline workers have also acted as trusted sources of information throughout the pandemic in the Sundarbans, as reported by experts and communities (Banerjee, Vincent & Ghosh, 2021). These groups were among the most resilient support systems during the pandemic.

The systemic risks and cascading impacts associated with the COVID-19 pandemic have revealed inherent vulnerabilities in our societal systems and functions. Gender inequality represents one of these inherent vulnerabilities. Women and girls in communities already reeling from institutionalized poverty, racism and other forms of discrimination are particularly at risk (Azcona and others, 2021). To achieve a posture to support disaster risk reduction and resilience in the face of shocks and disasters, gender-specific measures are needed to offset the widening gender-equality gap that the pandemic has intensified. However, as demonstrated from the above selected examples from the cases and literature, it is evident that diversity is a key mechanism in the role of COVID-19 response and recovery.

Another emergent theme across all the cases regards the impacts of the pandemic on the education system. It was highlighted throughout the cases (and Box 1) that the pandemic’s impacts on the education system are likely to reinforce underlying inequalities and exacerbate pre-existing vulnerabilities. However, many of these impacts will emerge in the future, demonstrating the delayed cause-effect nature of cascading and systemic risks. In particular, the movement to online learning was an issue in the Maritime region of Togo, the Sundarbans, and Cox’s Bazar due to the limited digital infrastructure in the region. Further, it was reported in all cases that there was a digital gap, and that less privileged segments of populations could not access the internet or did not have equipment that was sufficient for online learning. In Cox’s Bazar in particular, due to these factors, there was no alternative to in-person schooling, resulting in a complete shutdown of educational facilities. Furthermore, instances of children dropping out of school increased significantly, as was described in all cases. This resulted in further increased instances of child labour in Guayaquil, the Sundarbans and Cox’s Bazar, which were already driven by losses of livelihoods. Lastly, school drop-outs were higher among girls, which contributed to increases in child marriage. For further insights on COVID-19 and the education system see Box 1.

It was highlighted in all cases that decision makers across all scales, including state actors and international organizations,
exhibited failures in risk communication and coordination in response to the pandemic. This was particularly evident in the early stages of the pandemic, due to the fact that COVID-19 was a novel, highly uncertain and highly dynamic hazard. In Guayaquil, for example, it was noted in workshops that confused messaging from the WHO resulted in slow uptake of protocols from the Ecuadorian government. Consultations with experts in the Cox’s Bazar case underlined the importance of involving religious or community leaders in effective risk communication to prevent the spread of misinformation. Ineffective state communication in Indonesia contributed to a low willingness of the population to test and trace, and in the Sundarbans, governmental protocols resulted in the mass movement of migrant workers from densely populated areas with high case numbers to rural regions.

Fig. 4: Summary of the cross-cutting findings for all five case studies of the CARICO project. Source: authors.

The examples discussed in this case synthesis present only a selective number of cross-cutting findings from the case studies. COVID-19 affected nearly all global systems, therefore it is not possible to discuss all commonalities among the cases, however these six themes emerged strongly from the cases.

Table 3 summarizes interventions in the cases as emerged from the desk study and consultations in each case study, using a classical risk management understanding, in which risk is reduced by addressing one or more of the three risk factors: vulnerability, exposure, and hazard.
Table 3: Interventions observed in the cases, grouped by the risk factor that they address. 
Source: authors.

<table>
<thead>
<tr>
<th>Hazard-oriented interventions</th>
<th>Exposure-oriented interventions</th>
<th>Vulnerability-oriented interventions</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low-trade-off interventions:</strong></td>
<td><strong>Low-trade-off interventions:</strong></td>
<td><strong>Low-trade-off interventions:</strong></td>
<td><strong>Low-trade-off interventions:</strong></td>
</tr>
<tr>
<td>Vaccines</td>
<td>Prioritization of telework</td>
<td>COVID-19 Awareness programmes</td>
<td>Economic-recovery programme</td>
</tr>
<tr>
<td>Masks</td>
<td>Physical distancing</td>
<td>Food-security programmes</td>
<td>Threshold-based intervention schemes</td>
</tr>
<tr>
<td>Hygiene practices:</td>
<td>Track-and-trace programmes</td>
<td>Cash transfer</td>
<td></td>
</tr>
<tr>
<td>Hand washing</td>
<td></td>
<td>Social protection</td>
<td></td>
</tr>
<tr>
<td>Detergent spraying</td>
<td></td>
<td>Wage-subsidy programme</td>
<td></td>
</tr>
<tr>
<td>Cleaning surfaces</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interventions with substantial trade-offs:</th>
<th>Interventions with substantial trade-offs:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Border closures</td>
<td>Lockdown</td>
</tr>
<tr>
<td>Airport closure</td>
<td>School closure</td>
</tr>
<tr>
<td>Self-isolation</td>
<td>Reduction of group size (home, school, events)</td>
</tr>
<tr>
<td>Quarantine</td>
<td>Restrictions of commercial activities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>First-order interventions at initially low COVID-19 numbers</th>
<th>Second-order interventions under rising COVID-19 numbers</th>
<th>Largely responses to recover from other interventions</th>
</tr>
</thead>
</table>

Notably, early interventions, before COVID-19 was recognized as a pandemic, were predominantly hazard-oriented. Examples are hygiene practices, such as hand washing and the cleaning of surfaces, and border and airport closures. On increasing incidence rates and recognizing emergent risk for the collapse of the health system, the interventions became more exposure-oriented. Examples are school closures and telework. These measures became increasingly implemented at a population-wide scale, culminating in hard lockdowns and night curfew. Vulnerability-oriented measures were pursued after the impacts of earlier interventions had exposed underlying vulnerabilities in the system.
BOX 3: COVID-19 in a multi-hazard context

While the focus of this report is on COVID-19, and understanding cascading and systemic risks associated with the pandemic, it is important to emphasize the fact that many countries across the world have continued to face fundamental challenges associated with climate change, and experienced the concurrence of natural and man-made hazards amidst the pandemic. According to a recent study by the International Federation of Red Cross (IFRC) and Red Crescent Societies, and the Red Cross Red Crescent Climate Centre, more than 139 million people have been affected and more than 17,000 have been killed by at least 433 climate-related extreme events (excl. extreme temperatures and drought mortality) in the period from the beginning of the pandemic until August 2021 (Walton and others, 2021).

Table 4: Extreme weather events overlapping with COVID-19 up to 15 August 2021.

Source: Walton and others (2021) based on data from EM-DAT.

<table>
<thead>
<tr>
<th>Region</th>
<th>Total affected</th>
<th>Total deaths</th>
<th>Number of events</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Asia and Pacific</td>
<td>24,549,246</td>
<td>2,290</td>
<td>115</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>46,385,202</td>
<td>1,369</td>
<td>91</td>
</tr>
<tr>
<td>Europe &amp; Central Asia</td>
<td>965,047</td>
<td>6,782</td>
<td>48</td>
</tr>
<tr>
<td>Latin America &amp; Caribbean</td>
<td>9,691,101</td>
<td>766</td>
<td>70</td>
</tr>
<tr>
<td>South Asia</td>
<td>42,369,624</td>
<td>4,649</td>
<td>39</td>
</tr>
<tr>
<td>Middle East &amp; North Africa</td>
<td>15,144,498</td>
<td>317</td>
<td>30</td>
</tr>
<tr>
<td>North America</td>
<td>98,915</td>
<td>1,069</td>
<td>48</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>139,203,633</strong></td>
<td><strong>17,242</strong></td>
<td><strong>433</strong></td>
</tr>
</tbody>
</table>

Due to very limited data on deaths due to drought events and people affected by extreme temperatures, estimates are not included for events of this type. Number of events does not sum to total as several events are counted across multiple regions.
Similar findings emerged from our study, given that all countries considered in our analysis are not only prone to climate-related extremes and natural hazards, but have actually been confronted with multiple hazards amidst the pandemic (Table 5).

Table 5: Hazard profiles and actual events that occurred during the pandemic.

<table>
<thead>
<tr>
<th>Case study</th>
<th>Prone to the following hazards</th>
<th>Hazards occurring amidst the pandemic* (* based on expert consultation in the case studies.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cox’s Bazar, Bangladesh</td>
<td>Tropical cyclones, monsoons, strong winds, flash floods, landslides, fire (IOM, 2021)</td>
<td>Fire (May 2020, January 2021, February 2021, March 2021, April 2021)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heavy rainfall (July 2021, August 2021)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flash floods (June 2020, July 2021, August 2021)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Landslides (June 2021, July 2021, August 2021)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lightning strike (September 2021)</td>
</tr>
<tr>
<td>Guayaquil, Ecuador</td>
<td>Earthquakes, volcanic eruptions, ash fall, tsunamis, high-tide floods, pluvial floods, landslides, wildfires, vector-borne diseases, droughts, sea-level rise (World Bank, 2021; Sarmiento, 2009; I Care Environment, 2018)</td>
<td>Urban floods (March 2021)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wildfires Cerro Colorado (September 2021)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ashfall from Sangay volcano (September 2020, March 2021)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dengue (July 2021)</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Earthquakes, tsunamis, volcanic eruptions as well as multiple climate-related extreme events such as flooding, tropical cyclones, storm surges, hot extremes and sea-level rise (World Bank &amp; Asian Development Bank, 2021)</td>
<td>Earthquake (January 2021)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Volcanic eruptions (August 2021)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Floods (September 2020, February 2021, March 2021, October 2021)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tropical cyclone (April 2021)</td>
</tr>
<tr>
<td>Maritime Region, Togo</td>
<td>Floods, drought, strong winds and storms, wildfires, coastal erosion, and disease epidemic (World Bank, 2021)</td>
<td>Flood (September 2020 and September-October 2021)</td>
</tr>
</tbody>
</table>
Sea-level rise, salinity intrusion, tropical cyclones, storm surges, rainfall variability and erratic rainfall, river floods, storms, over-siltation of rivers, soil erosion, and island subsidence (Sahana and others, 2020; Dasgupta and others, 2020; Mandal and others, 2013)

Tropical cyclones (November 2019, May 2020, May 2021)
Cyclones were accompanied by storm surges and saline-water inundation and flooding
Very heavy rainfall resulting in flooding (June-July 2021)

The above figures clearly highlight the double burden (COVID-19 and concurring other hazards) many people, communities and entire countries, societies and economies have faced since the beginning of the pandemic - and are likely to continue to face over the coming months. By destroying homes and critical infrastructure such as healthcare centres and hospitals, hazards such as storms, earthquakes or floods have not only made it difficult to physically distance (e.g. in shelter places) but also reduced the much needed capacity in hazard-affected areas to cope with the pandemic. These additional challenges became very evident in, for example, when tropical cyclone Harold hit Vanuatu, Fiji, the Solomon Islands and Tonga in April 2020, in the aftermath of the explosion in the port of Beirut in August 2020, as well as in multiple of the case study areas considered in this report - notably the Indian Sundarbans and Indonesia (see chapter 3.1 for details).

In a study published in Nature Climate Change, Phillips and others (2020) warn that “these compound risks will exacerbate and be exacerbated by the unfolding economic crisis and long-standing socioeconomic and racial disparities, both within countries and across regions, in ways that will put specific populations at heightened risk and compromise recovery”. It underscores the need to not only move from reactive ways of dealing with crises and shocks to more proactive ways, but also highlights the relevance of moving from hazard-by-hazard to more holistic and comprehensive approaches of understanding, assessing and managing risks based on all hazards and multi-risk approaches.
3.3 COVID-19 and the Sustainable Development Goals

The global crisis caused by the COVID-19 pandemic jeopardizes progress towards the achievement of the 2030 Agenda for Sustainable Development. The direct health impacts of COVID-19 halted or reversed progress towards the achievement of SDG 3 (Good Health and Well-Being) by disrupting essential health services (WHO, 2020) and shortening life expectancy (Pifarré I Arolas and others, 2021). In combination with the indirect impacts of containment measures, the pandemic has affected all SDGs and led to a major setback for sustainable development (UNDP, 2020). Indirect impacts include, for example, that 97 million people, mostly in low-income and middle-income countries, have been pushed into extreme poverty in 2020 alone (Mahler and others, 2021) or that 5 to 7 million children may be stunted, and 570 thousand to 2.8 million more wasted (i.e. low height for their age and low weight for their height) in the year 2030 in low-income and middle-income countries due to impacts of the pandemic (FAO and others, 2021). Depending on the local context, impacts of different severities for each SDG can be observed.

In the technical reports of the five case studies (i.e. Cox’s Bazar, Bangladesh; Guayaquil, Ecuador; Sundarbans, India; Maritime region, Togo; Indonesia), impacts of the pandemic on specific SDGs have been identified. SDG 1 (No Poverty), SDG 3 (Health & Well-Being), SDG 4 (Quality Education), and SDG 8 (Decent work and economic growth) have been in the focus of the case study experts. While SDG 2 (No Hunger), SDG 5 (Gender Equality), SDG 6 (Clean Water and Sanitation) and SDG 10 (Reduction of Inequalities) were also commonly discussed, SDG 11 and 16 were only shortly mentioned in each report.

- **SDG 1**: The amount of people in poverty has increased (Guayaquil; Sundarbans; Indonesia; Maritime region). People in slums and rural areas (Maritime region) as well as informal workers (Guayaquil; Indonesia; Maritime region) are particularly affected.

- **SDG 2**: The restriction of mobility through border closures and lockdown limited food supply (Indonesia, Maritime region). Food prices have increased (Indonesia; Maritime region). The value chains have been disrupted (Indonesia) markets have been closed (Maritime region). This left people with few means to survive, resulting in widespread
food insecurity (*Maritime region*). In the case of Guayaquil, the government of the city of Guayaquil expanded social protection mechanisms and was able to ensure food security (*Guayaquil*)

- **SDG 3**: All case studies have suffered widespread direct health impacts due to COVID-19. In the Maritime region of Togo, while the fear of infections is preventing people from using health services, the scarcity of health workers contributed to the risk of total collapse of the health system. Stress and mental health became a bigger problem due to increased economic uncertainties (*Sundarbans; Guayaquil*), and co-morbidity increased in Indonesia due to reduced availability of, and access to, reproductive and maternal healthcare.

- **SDG 4**: Schools were closed for an extended period leading to school drop-outs (*Cox’s Bazar; Guayaquil; Maritime region*). Poor families were inappropriately affected by the switch to online learning due to lack of adequate infrastructure (*Sundarbans; Indonesia*).

- **SDG 5**: The closure of schools correlated with an increase in forced marriages (*Cox’s Bazar; Sundarbans*) and child labour (*Cox’s Bazar*), and girls were ten times more at risk of dropping out of school than boys, due partly to a rise in early marriage (*Indonesia*).

- **SDG 6**: Water consumption increased (*Indonesia*). Floods and slope failures contributed to water contamination (*Cox’s Bazar; Guayaquil*).

- **SDG 8**: Informal workers lost their jobs and income (*Sundarbans; Indonesia, Maritime region; Guayaquil*). In the Maritime region of Togo, employees in the informal sector, as well as vendors, were forced to close due to curfews (*Maritime region*). The closure of schools contributed to an increase of child labour (*India*) as well as involvement of children in illegal activities (*Cox’s Bazar*).

- **SDG 10**: In India the return of migrants was accompanied by an increase in inequality. Migrants were treated differently (*Sundarbans*). Relief distribution suffered due to corruption (*Sundarbans*) and increased inequalities (*Sundarbans, Cox’s Bazar*).

- **SDG 11**: Urban homelessness has increased (*Indonesia*).

- **SDG 16**: Insufficient governance led to increased corruption and conflict (*Sundarbans, Guayaquil*).
Some authors also found positive impacts of COVID-19 on the achievement of certain SDGs. Shulla and others (2021), for example, highlight that the multi-lateral system is enhanced by the pressures for collaboration (SDG 17) and that insufficient digitalization in social services, especially in the education (SDG 4) and the health sector (SDG 3), has improved. In the case studies, increased digitization led to positive impacts on alternative streams of income (SDG 1), and the availability of telemedicine (SDG 3) in Indonesia. The Indonesia case study further highlighted increased awareness of disaster risks as a positive impact for urban and organic farming (SDG 2), water provision (SDG 6) and unemployment benefits (SDG 8). The Cox's Bazar case showed how new opportunities emerged for local communities and organizations when workers from international organizations and other countries were not able to come. The resulting increased engagement of local actors, in combination with the overall increased awareness of many development issues revealed though COVID-19, could be used to foster progress towards the SDGs.

Some of these positive impacts could benefit the achievement of the SDGs in the long term, while other impacts including, for example, reduced food waste from restaurants (SDG 12) or improved air quality in cities (SDG 11), will only be temporary (Pradhan and others, 2021). Expert consultation in the Sundarbans case study, for example, indicated direct positive impacts in ambient-air and surface-water quality (SDG 15) due to suspension of transport services and closure of industries. Another impact that has been brought up is the overall effect of the COVID-19 pandemic on anthropogenic greenhouse gas (GHG) emissions, and therefore on climate change (SDG 13). Even though the pandemic has been discussed as positive for the reduction of climate change, the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6) considers its impact as “undetectable above natural variability (high confidence)” (IPCC, 2021, p. 30).

The case studies showed that the achievement of the SDGs is not only affected by direct impacts on their progress, but also through a decreased capacity to achieve the SDGs. The attention gets shifted away from certain SDGs, e.g. the Cox's Bazar case study reported that gender mainstreaming and disability inclusion have lost attention due to COVID-19, and the Maritime region case study reported that other risks, including other pathologies are getting shifted to the background. The limited financial resources in the case studies are focused on COVID-19 counter-measures depriving many development projects of their existential basis. This funding issue led to the delay of green development and infrastructure projects in cities. The Indonesia case study, for example, reports a revision of all development targets by the government by at least half a year.
Future of the SDGs in COVID-19 recovery and pandemic risk prevention

To avoid the emergence of future diseases, commitment towards achievement of the SDGs needs to be strengthened. With Target 3.3 "By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases", the SDG framework already included the goal of preventing communicable diseases like COVID-19 from emerging (UN General Assembly, 2015).

Stronger SDG commitment would not just reduce the risk of pandemics on the hazard side but also on the vulnerability and exposure side. With a lower social vulnerability (e.g. SDG 1, 2, 3, 5 or 11), healthier ecosystems (e.g. SDG 13, 14 and 15) and more resilient economies (e.g. SDG 8, 9 and 12) the impacts of COVID-19 would have been less severe (Shulla and others, 2021). Further, more-sustainable city planning (SDG 11), for example, would increase coping capacity to pandemics by providing adequate housing spaces, places for quarantine and spaces to foster social cohesion and trust in local communities (Ng, 2020).

The SDGs offer a holistic frame that fosters resilience against any type of impacts known and unknown (Independent Group of Scientists appointed by the Secretary-General, 2019), by strengthening the system to address underlying risk drivers and compounding factors contributing to future disaster risks (UNISDR, 2015). The pattern of interconnected SDGs revealed in the impact webs of the case studies, but also widely discussed in scientific literature (Zhou and others, 2017; ISCU, 2016) shows clearly the need for a multi-disciplinary systems thinking that highlights the interconnectedness between the SDGs and their embeddedness in the overall socio-ecological system that is creating cascading and systemic risks.

The SDGs are an already-established, globally-applicable framework (UN General Assembly, 2015) that can incorporate an interconnected systemic perspective (Independent Group of Scientists appointed by the Secretary-General, 2019). This makes them a highly suitable framework for a systemic recovery from the COVID-19 impacts, offering a clear way forward (Sachs and others, 2021; UNDP, 2020).
BOX 5: COVID-19 from a human-security lens

‘Recognizing the limitations of prevailing paradigms to effectively manage today’s complex crises, a resurgence of interest in human security as a valuable framework for placing sustained improvements in all dimensions of people’s lives has re-emerged as the foundation for thriving, stable and inclusive societies’.

UN Human Security Newsletter (2020)

As described in Saha & Chakrabarti (2021, p. 112)’COVID-19 has firmly established itself as the single largest security disrupter of this century in the non-traditional sense. It has necessitated a recalibration of securitisation framework...’. The impact of the COVID-19 pandemic certainly illustrates the trans-national nature of today’s security landscape. The threat and risk landscape associated with the impacts of COVID-19 fundamentally challenges human security through threats to health security, economic security, food security, personal security, political security, and community security. The concept of ‘human security’ is a useful framework to support analysis and understanding of the complex and inter-related challenges the pandemic has generated, as it provides a lens to view the interconnections between the SDGs, threats, shocks and various types of security.

Human security

The concept of human security represents a departure from traditional security studies with its state-centric posture, to a framework that is human centric. The notion of human security stems from the Human Development Report by the UNDP in 1994. It represents a multi-dimensional lens through which to understand security through three freedoms: (i) freedom from want, (ii) freedom from fear, and (iii) freedom to live in dignity. Encompassing the human elements of security, rights and development, the concept of human security entails a broadened understanding of threats and includes causes of insecurity relating for instance to economic, food, health, environmental, personal, community and political security (Table 3).

Table 6: Possible threats to human security.
Source: (UNTFHS, 2016).

<table>
<thead>
<tr>
<th>Type of security</th>
<th>Examples of main threats*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic security</td>
<td>Persistent poverty (e.g. Maritime region, Guayaquil, Indonesia), unemployment (e.g. Maritime region, Guayaquil, Indonesia, Sundarbans)</td>
</tr>
<tr>
<td>Food security</td>
<td>Hunger (Maritime region), famine, lack of nutritious food (e.g. Cox’s Bazar, Sundarbans)</td>
</tr>
</tbody>
</table>
### Human Security

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health security</td>
<td>Infectious disease (all cases), unsafe food, malnutrition, lack of access to basic healthcare (e.g. Guayaquil, Indonesia)</td>
</tr>
<tr>
<td>Environmental security</td>
<td>Environmental degradation, resource depletion, natural hazards (all cases), pollution</td>
</tr>
<tr>
<td>Personal security</td>
<td>Physical violence (e.g. Sundarbans), crime, terrorism, domestic violence (all cases), child labour (e.g. Cox's Bazar, Sundarbans)</td>
</tr>
<tr>
<td>Community security</td>
<td>Inter-ethnic (Cox's Bazar), religious and other identity-based tensions (Cox's Bazar)</td>
</tr>
<tr>
<td>Political security</td>
<td>Political repression, human-rights abuses</td>
</tr>
</tbody>
</table>

*Examples are taken directly from UNTFHS (2016) and complemented with illustrative examples from cases where applicable. Elements in light grey were not reported as such in the case studies.*

Human security thereby recognizes the complex interconnectivity across both threats and responses and, as such, embraces the notion of systemic risks. The interdependency across the human security landscape implies that intervention strategies cannot be addressed in isolation but rather require a systems-thinking lens. With this in mind, human security focuses on early prevention to minimize the impacts of insecurity, to engender long-term solutions, and to build human capacities for undertaking prevention. In this regard, human security (UNTFHS, 2016):

- addresses root causes of crises and disasters and their impact on human insecurities
- emphasizes early prevention rather than late intervention, where benefits include greater cost-effectiveness
- encourages strategies concerned with the development of mechanisms for prevention, with the mitigation of harmful effects when downturns occur and, ultimately, with helping communities to cope by becoming more resilient.
Human security lens on case studies

Human security is reflected in the fundamental principles of the 2030 Agenda for SDGs. For example, the Agenda 2030 on Sustainable Development calls for a "world free of poverty, hunger, disease and want … free of fear and violence … with equitable and universal access to quality education, health care and social protection … to safe drinking water and sanitation … where food is sufficient, safe, affordable and nutritious … where habits are safe, resilient and sustainable … and where there is universal access to affordable, reliable and sustainable energy." This analysis of the case studies brings the human-security lens to the various dimensions of security (Masys, 2021) within the context of the COVID-19 pandemic and the SDG impacts.

Health security

Health security encompasses access to health services and living in a safe environment. The emergence of COVID-19 has stress-tested the global public health-security infrastructure. Across the case studies and the literature, both direct impact in illness and deaths, as well as indirect impacts such as overwhelmed or unavailable healthcare and delays in seeking healthcare for other disorders, has emerged. As noted in Di Liddo (2021, p. 14) "the pandemic has driven home the point that health has social determinants that include discrimination and racism, access to adequate healthcare, education and housing, and occupations that put some categories of ‘essential’ but low-paid workers at high risk on the front line."

Economic security

Given the contagion effect of COVID-19 on populations, governments implemented strategies and protocols to limit the spread of the virus and mitigate the negative health outcomes. Such strategies targeted societal functions and included: limited travel, imposed quarantines and lockdowns, and closed businesses and schools. Such measures resulted in a rise in unemployment in both the formal and informal labour markets. Women who were concentrated in highly exposed sectors suffered disproportionately. At the macro level, labour market impacts shrink the economic output, which can have cascading effects as it diffuses through supply chains. As a result of the pandemic, poverty has grown and economic disruption has affected people in many countries.

At the macro level, ‘The COVID-19 shock can be interpreted as a combination of supply and demand shocks…. The supply shock was mainly driven by the restriction of activities due to lockdowns and distancing measures to contain the spread of the virus, causing sectors to struggle to keep up with demand, while the demand shock reflected both the income effect suffered by workers in restricted activities, as well as the diminished mobility and changes in consumption patterns due to contagion concerns (Yeyati & Filippini, 2021)."
Food security

Food security, access to basic nutrition and food supply, and decrease in agricultural production, is closely related to economic security. Many people who lost jobs or experienced reduced work hours lost income and became food-insecure. Lack of social protection further affected people in both rich and poor countries. In developing and fragile countries, the pandemic has eroded incomes, and disrupted markets and supply chains, resulting in shortages of food and price increases.

Personal security

This issue concerns freedom from the threat of physical violence. An increase in intimate partner violence has been seen as a consequence of COVID-19. Gender-based violence is known to be exacerbated in times of crisis, such as conflict, humanitarian crisis, or economic stress. As a result of movement restrictions and stay-at-home orders aimed at containing the virus, victims have faced increased exposure to abusers and, simultaneously, restricted opportunities to seek assistance from formal and informal networks and reduced support services.

Summary

This overview has sought to illustrate how a human-security lens can help to understand the complex, multi-layered reality created by the COVID-19 pandemic, with its interconnected and mutually reinforcing threats to health security, economic security, food security, personal security, political security and community security. The systemic nature of risk and cascading effects across societal functions emerges in the analysis of the human-security dimensions, reflecting the inherent vulnerabilities within the interdependencies, interconnectivity and complexity of systemic risks.

As described by Di Liddo (2021, p. 30) ‘The human-security lens on COVID-19 recognizes the close interdependence between different dimensions of human security, such as healthcare, employment, education and social stability. This means that cooperation between government, civil society, private sector and scientists from multiple disciplines is critical in order to come to a broader understanding of the challenges and, following on from that, to collectively designing solutions which address the interdependencies between these sectors’.
3.4 COVID-19 and social protection

Introduction to social protection

The SDG target 1.3 calls to “implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and vulnerable”. This deserves special attention in the light of systemic risk. Social protection comprises a wide array of policies and interventions aimed at protecting people throughout their life by reducing poverty, inequality, and vulnerability (Aleksandrova, 2019; Bonilla Garcia & Gruat, 2003). These policies can be evaluated in the three dimensions: coverage (who is protected?), comprehensiveness (against what?), and adequacy (and is it sufficient?) (ILO, 2019).

Social protection can be generally broken down into three sub-areas: social insurance, social assistance and labour-market programmes (Sett and others, 2021):

- **Social insurance programmes** are long-term contributory schemes, based on solidarity, transferring the risk from the individual to the general population (Sett and others, 2021). Universal health insurance is an example of a social insurance program of particular relevance during COVID-19 (ILO, 2021c).

- **Social assistance** is all forms of cash or in-kind transfers provided by the state or non-state actors without contribution of the beneficiary. However social assistance can be based on conditionalities like school enrolment (Sett and others, 2021).

- **Labour-market programmes** aim at reducing unemployment and its negative effect on affected people. Well known labour-market programmes are unemployment benefits, but during COVID-19, also job-retention schemes as known from Italy, Germany or Brazil, have been intensively discussed as a solution to reducing the economic impacts of non-pharmaceutical interventions like lockdowns (Gerard and others, 2020).
Gaps in social protection during COVID-19

In our analysis COVID-19 has (i) revealed gaps in social protection, but also (ii) triggered multiple adjustments to existing social protection programmes and a large-scale roll-out of new programmes to buffer against the effect of the pandemic. These findings regarding gaps (Lastunen and others, 2021) and large-scale roll-out (ILO, 2021c) can also be confirmed by literature focusing on other regions and scales: Up until the 10 May 2021, 209 countries had introduced 1,698 formal social protection measures in response to the outbreak of COVID-19 (ILO, 2021b).

Gaps in all three dimensions (coverage, comprehensiveness and adequacy) are reported from the case studies in this report. The return of migrant workers in the Sundarbans in India posed a challenge to the existing social protection programme as they were not covered by any existing scheme. The multi-disaster situation in Sundarbans (COVID-19 and Cyclone Amphan) made this gap acute. Migration patterns caused by the economic disruption of restrictions due to COVID-19 caused similar coverage challenges in multiple nations (Woodall, 2021). Other coverage gaps observable in the case studies during COVID-19, seem to have resulted from informal work arrangements from registries. In Indonesia the social assistance scheme for micro-business actors (Banpres Produktif Usaha Mikro, BPUM) is only accessible for registered businesses, but at the time this report was drafted (autumn 2021), the majority of micro-business actors in Indonesia are still not registered. Smith & Bowen (2020) provide key consideration on how to improve coverage in a shock-responsive manner along the whole delivery chain (i.e. assessment, enrolment and provision) of social protection.

In a pandemic, social insurance granting access to healthcare becomes a vital asset of social protection (ILO, 2021c). Therefore, it is not surprising that measures to increase the access to healthcare have been introduced in all the case studies to increase the comprehensiveness of social protection schemes. At the same time, the health capacities have been overwhelmed, or health facilities lacked access, as observed in the remote areas of the Sundarbans in India. This highlights that, even though the potential to use social protection in a shock-responsive manner is well documented (O’Brien and others, 2018), the benefits of an ad hoc extension of the comprehensiveness of social protection only materialize if the overall institutional capacity to deliver social protection (in this case the health system and transport infrastructure) allows for it. Gaps in adequacy became evident in the fragile setting of Cox’s Bazar: Even though refugees in this camp are fundamentally dependent on social protection, they can usually supplement this with short-term livelihood opportunities. During COVID-19, these have been completely restricted, threatening the food security as well as social safety, and highlighting existing adequacy gaps in the social protection system. In the case of Cox’s Bazar, COVID-19 revealed another challenge in implementing social protection, going beyond the three listed dimensions: Delivery systems to provide social assistance in form of food or cash supplies were previously not designed to meet the infection-control requirements of a pandemic. For example, the regular provision of food supplies had to be limited to once per month from a centralized distribution place, to reduce movement within the camp, which meant heavier packages to carry over a larger distance. It still is a key challenge to minimize the risk of infection while simultaneously ensuring that everyone is reached with essential supplies.
Adjustment of existing social protection schemes in the case studies

Beyond the mere observation of the gaps regarding coverage, comprehensiveness, adequacy, and delivery mechanisms in existing social protection programmes, the case studies also highlighted possibilities to expand social protection in a shock-responsive manner. When possible, countries adjusted existing social protection programmes to respond to the crisis. In India, a majority of all social-protection measures introduced during COVID-19 are adjustments to existing schemes (see Table 7). Existing social insurance and social assistance programmes like Rajya Khadya Suraksha Yojana, midday-meal scheme, Jai Bangla scheme, etc. provided a basic level of social protection that was scaled up by new schemes, like a one-time cash transfer of approximately 14 USD for migrant workers by the West Bengal government for a short period through the Sneher Parash scheme (Government of West Bengal - Department of Disaster Management and Civil Defense, 2020). A similar cash transfer was also undertaken under the Pracheshta scheme to support labourers and daily-wage earners, workers employed in the informal sector who suffered loss of income due to COVID-19, pushing them below the poverty line. Taken together these adjustments increased both coverage and adequacy.

The labour-market programme, Mahatma Gandhi National Rural Employment Guarantee Act, has been set up in a way that coverage can be expanded quickly in times of crisis. This programme guarantees minimum paid work opportunities to everyone in the working age group from rural India. In 2020/2021 the demand for work via this programme increased sharply, but it still managed to provide basic minimum employment opportunities to those in need (Ministry of Rural Development & Harvard Kennedy School - Evidence for Policy Design, 2021). This indicates the adaptability of such programmes designed to augment the rising need for social protection. However, Gerard and others (2020) criticize that conditionalities in this case - that one has to work and risk an infection to receive the benefit - were not adapted to the requirements of this specific hazard (an infectious disease).

In the case study of Indonesia, the existing social assistance programme (Program Keluarga Harapan - PKH) was increased in regards to the amount and pay-out frequency to increase the adequacy in times of COVID-19 (eadem, 2020). The advantage of adjusting an existing programme is that the inclusion criteria are defined, and the delivery systems are already well established. However, considering the magnitude of the economic shock created by COVID-19, upscaling existing programs may fall short of delivering the needed level of social protection, as an unprecedented amount of people are in need of support (Vaziralli & Shahid, 2020). Furthermore, the potential to achieve the desired level of social protection through adjustments depends on the capacities of the social protection system established before the crisis. Indonesia, for example, has a long history of providing social protection benefits to its population. Social insurance was first formally introduced in the 1960s and the concept of employment security established in 1992 (Murphy, 2019).
Table 7: Overview of social protection measures introduced in the countries of the case studies discussed in this report.  
Source: compiled from case study reports

<table>
<thead>
<tr>
<th>Countries of the cases studies&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Share of population covered by at least one social protection benefit in 2020&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Social protection measures introduced between February 2020 and April 2021&lt;sup&gt;c&lt;/sup&gt;</th>
<th>New programme or benefit&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Adjustment to existing programme&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Adjustment to new programme&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecuador</td>
<td>35%</td>
<td>12</td>
<td>10</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>India</td>
<td>24%</td>
<td>42</td>
<td>14</td>
<td>25</td>
<td>3</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>28% (in 2019)</td>
<td>10</td>
<td>7</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Togo</td>
<td>23%</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>28%</td>
<td>19</td>
<td>6</td>
<td>11</td>
<td>2</td>
</tr>
</tbody>
</table>

<sup>a</sup> The numbers represent country-level statistics while the case studies are located within the countries. Hence, numbers might differ from the national average (see case study findings in the subsequent chapters);  
<sup>b</sup> Source: ILO (2021a);  
<sup>c</sup> Source: ILO (2021b)

Implementation of new social protection schemes in the case studies

Gaps in social protection revealed through COVID-19 have not only been addressed by adjusting existing programmes, but also by a large roll-out of entirely new programmes. A majority of these social protection schemes designed in response to COVID-19 are social assistance schemes, most prominently implemented in the form of cash transfers (Gentilini and others, 2020). In Togo, for example, the Novissi emergency social assistance programme is set up jointly by the World Bank, the Government of Togo (led by the Ministry of Digital Economy), the academic institutions (University of California, Berkeley, Innovations for Poverty Action, and Northwestern University), as well as the humanitarian and philanthropic agency GiveDirectly (World Bank, 2021d). Novissi provided cash transfers to 572,852 informal-sector workers in the greater Lomé area, the Tchaoudjo prefecture and the Soudou canton in 2020 to buffer against the adverse effect of COVID-19 on the local economy (62 per cent of all jobs are affected in Togo) (idem, 2021d). According to our case study, the programme was needed to increase the coverage and protect the most vulnerable from the economic impacts of COVID-19, but at the beginning of this crisis, neither data on eligibility criteria nor tested distribution pathways were available. Under high time pressure, the World Bank used deep learning algorithms on anonymized phone metadata to predict consumption, with the aim of minimizing exclusion and inclusion errors (idem, 2021d). This is an emblematic case showing the challenges of covering existing...
gaps in social protection in times of crisis.

Setting up the Novissi emergency social assistance programme addressed two key challenges in implementing new and adjusting existing social protection schemes: informality and scarcity of data. Informality may result in coverage gaps, as discussed in the case of Indonesia above. In the rapidly changing urban setting of Guayaquil, Ecuador, scarcity of data led to an underestimation of the need for social protection. For instance, social protection officials only realized in the enrolment phase that the estimated number of four-member family households was actually between twice or thrice as high as initially estimated.

Another frequently introduced measure in the case studies was social assistance through moratorium on service reduction during the pandemic: In Guayaquil, Ecuador, cuts due to non-payment of residential services such as water, electricity, internet, and telephone were prohibited and the deferral of acquired debts were financially safeguarded. Along the same line also, in Togo, registration fees for the various examinations and school fees for secondary schools as of the start of the 2021-2022 academic year have been dropped.

In the Sundarbans, cash transfers were handed out promptly to react to the multi-disaster situation. However, this had a low level of targeting: household sizes and prior economic conditions of the beneficiaries were not accounted for. This quick handling of cash transfers prevented further system collapse, but the non-differentiated pay out did not lead to an equitable distribution of all resources. While it is generally advisable to upscale social protection quickly to buffer shocks to the system with no strings attached (Vaziralli & Shahid, 2020), the Indian case demonstrated that in the recovery process these social protection schemes should be developed further to increase efficiency and therefore also social acceptance of this tool.

**Benefits of social protection in the case studies**

Despite the various gaps in existing social protection systems, as well as the range of above-listed challenges regarding the adjustment and implementation of new programmes, the positive effect of increased social protection on reducing the impacts of COVID-19 was confirmed by all case studies of the report. Further, the impact of social protection on poverty alleviation is illustrated by the case of Indonesia: the Family Hope Program (PKH) and Non-cash Transfer Program (BPNT) have been implemented by providing cash assistance and essential foods (such as rice, cooking oil, eggs, meat, and instant noodles) to around 10 million households classified as poor and vulnerable to COVID-19. According to research conducted by the National Team for the Acceleration of Poverty Reduction, it is estimated that without these two programmes, the poverty rate would have increased by roughly 1.5 per cent (TNP2K, 2021). Beyond poverty alleviation, the impacts web of the case studied showed that social protection decreased child labour, marginalization, illegal activities, migration and gender disparity. Recommendations on how to maximize the benefits of social protection using the lessons from the cases and the approach of Adaptive Social Protection (ASP), can be found in Chapter 6.
4. Conceptual model of the systemic nature of COVID-19 risks and impacts

One main objective of the CARICO project was to develop a conceptual model that supports the understanding and analysis of the systemic nature of COVID-19 risks, by showing (i) interconnected systems and (ii) decision-making processes (interventions) among (iii) other factors that contributed to making vulnerable groups, sectors and systems more at risk. Drawing on the review of the scientific literature, expert consultations and findings from the case studies (see chapter 2.4 for methodological details), this chapter presents a conceptual model that represents the systemic nature of COVID-19 risks.

To show the logic of the model, in the following paragraphs, individual parts are presented in sections. These are described and explained using examples from the case studies (Cox’s Bazar in Bangladesh, the city of Guayaquil in Ecuador, the Maritime Region of Togo, the Indian Sundarbans, and Indonesia). Following the step-by-step presentation of individual parts of the model, the full conceptual model is shown at the end of this chapter.

Findings from the cases have shown that direct effects of the pandemic were mostly on health and health systems. In order to understand such direct risks and impacts of COVID-19 on health and health systems (Figure 5), it is important to be aware that these are not only a result of the emergence and spread of the disease. Instead, they are also intrinsically linked to direct exposure and pre-existing vulnerabilities of at-risk groups (e.g. the elderly and people with pre-existing conditions) and health systems (e.g. lack of equipment and/or supplies, trained staff due to shortcuts of health budgets in the years before the pandemic, etc.). Risks and impacts on health include, for example, increases in infections/cases, hospitalizations, and COVID-19 related deaths [observed in Cox’s Bazar, Guayaquil and Indonesia2]. In turn, increasing hospitalizations lead to overwhelmed health systems and increase the risk of health-system collapse – a risk that manifested and turned into a tipping point in multiple case studies [e.g. Guayaquil...]

1 https://www.who.int/westernpacific/emergencies/covid-19/information/high-risk-groups
2 SB not included since the increase in cases, hospitalizations and COVID-19 deaths was observed for India as a whole but not for the study area of Indian Sundarbans during the period of study. The same holds true for MR and Togo in general.
and Indonesia]. Overwhelmed health systems can reinforce pre-existing vulnerabilities of health systems by reducing their coping capacity, which in turn might lead to further negative effects on human health (reinforcing loop). Examples include the loss of healthcare staff (including doctors and nurses) in Indonesia, and situations where health systems lacked protective equipment for workers, in turn leading to increased infections [e.g. observed in Guayaquil and the Maritime Region].

If measures (interventions) to contain the further spread of the disease are lacking, and countries are not capable of reducing the number of infections, COVID-19 continues to spread through the population, leading to a reinforcing loop of rising infections within the system (endogenous) [observed in all case studies].

Fig. 5: Conceptual model of the systemic nature of COVID-19 risks based on findings from the case studies [PART I: pre-existing vulnerabilities, direct risks and impacts on health and health systems]. In the figure, selected examples from the case studies are provided (note: this is not a comprehensive list). Source: authors.

Direct risks and impacts can be further exacerbated by the concurrence of other hazards [observed in all cases; c.f. Box 3], such as climate-related extreme events and natural hazards. By destroying homes and critical health infrastructures, these not only lead to increasing cases (e.g. in the aftermath of the Earthquake that affected parts of Indonesia in January 2021) but also affect the capacity of health systems to cope with the pandemic when hospitals or healthcare centres are damaged. Box 3 provides more information on the concurrence of natural hazards and compounding risks observed during the pandemic — both globally and in the case studies.
Fig. 6: Conceptual model of the systemic nature of COVID-19 risks based on findings from the case studies [PART II: concurring hazards]. In the figure, selected examples from the case studies are provided (note: this is not a comprehensive list). Source: authors.

To contain the further spread of the virus, a range of measures (interventions) have been implemented by national and local governments. Interventions aimed to protect at-risk groups (e.g. the elderly, people with pre-existing conditions) and reduce effects on health and health systems [observed in all cases]. Examples of such measures include wearing masks, physical distancing, testing, tracing, and following respiratory-hygiene standards, as well as a wide range of restriction measures (e.g. stay-at-home orders, travel restrictions, international trade restrictions, business and school closures, and border closures).

Fig. 7: Conceptual model of the systemic nature of COVID-19 risks based on findings from the case studies [PART III: interventions to contain the spread of the disease]. In the figure, selected examples from the case studies are provided (note: this is not a comprehensive list). Source: authors.
While some interventions did not lead to known trade-offs (e.g. wearing masks, physical distancing), others – notably restriction measures such as stay-at-home orders, closure of businesses and schools, and national and international travel restrictions, combined with pre-existing vulnerabilities – have led to widespread cascading effects on entire sectors (e.g. hospitality, tourism, trade and commerce) and interconnected systems (e.g. social systems, education systems, economic systems, etc.) and in turn entire societies [observed in all cases]. Examples of pre-existing vulnerabilities in the cases include poverty [observed in all cases], informal economy [observed in all cases] or high dependency on specific sectors that were particularly affected by restrictions [observed in all cases]. Vulnerability (towards interventions) however was also further exacerbated by interconnectedness of sectors and systems that led to ripple effects. Examples of cascading adverse effects on vulnerable people, sectors and systems in the cases include increased unemployment and poverty [observed in all cases], intensifying social distrust leading to widespread protests and civil disobedience [e.g. Guayaquil], increased illegal activities [e.g. Cox’s Bazar, Maritime Region], aggravated child marriage and human trafficking [e.g. Cox’s Bazar, Sundarbans, Indonesia], and effects on education due to the shutdown of programmes [e.g. Cox’s Bazar, Sundarbans] or due to challenges with home-based digital learning [e.g. Indonesia, Maritime Region, Sundarbans, Guayaquil].

Fig. 8: Conceptual model of the systemic nature of COVID-19 risks based on findings from the case studies [PART IV: Cascading effects of restriction measures/interventions]. In the figure, selected examples from the case studies are provided (note: this is not a comprehensive list). Source: authors.
As a further result of systems’ interdependencies and (global) interconnectivities, the negative effects that rippled through the system from COVID-19 also acted as reinforcing feedback loops, by (i) exacerbating pre-existing vulnerabilities and (ii) leading to globally networked risks (see Figure 9). An example of how the pandemic and its cascading effects affect vulnerable people, sectors and systems is the “disruption in education” during the lockdown. This led to an increased need for childcare within households, a responsibility that often disproportionately fell on women, thereby exacerbating pre-existing “gender inequalities” [observed in all cases; c.f. Box 2]. Examples of globally networked risks observable in the COVID-19 pandemic include not only the global spread of COVID-19, but also dependency of (i) households and economies on remittance flows that got disrupted by the pandemic [e.g. Maritime Region], (ii) livelihoods on international supply/value chains that got disrupted [e.g. Guayaquil, Indonesia, Sundarbans], and (iii) refugees depending on international aid that also got disrupted by COVID-19 [e.g. Cox’s Bazar]. Further, Figure 9 also shows how these adverse effects on large segments of the population and entire economies have increased the public pressure on policy to readjust interventions (e.g. public lockdowns) - in turn leading to a further increase in cases and hence another vicious cycle [e.g. Indonesia].

Fig. 9: Conceptual model of the systemic nature of COVID-19 risks based on findings from the case studies [PART V: feedbacks, globally networked risks and reinforced vulnerabilities]. In the figure, selected examples from the case studies are provided (note: this is not a comprehensive list). Source: authors.
Building on the above, the complete conceptual model is shown in Figure 10. The model illuminates the systemic nature of COVID-19 risks and impacts. This is done by presenting a heuristic model that shows how direct and cascading effects of COVID-19 have contributed to making vulnerable communities, sectors and systems more at risk through interconnected systems, decision-making processes, pre-existing vulnerabilities, system dependencies, feedback loops and tipping points. Further, the model also points at important additional characteristics of systemic risk observable in the COVID-19 pandemic, namely that systemic risks can build up gradually over time, are highly dynamic, and subject to very high uncertainty.

**Fig. 10:** Conceptual model of the systemic nature of COVID-19 risks based on findings from the case studies. It shows direct and cascading effects of COVID-19 on interconnected systems. Further, it illustrates how these effects, coupled with decision-making processes (interventions) and other factors (existing vulnerabilities, system dependencies, feedback loops and tipping points), have contributed to making vulnerable communities, sectors and systems more at-risk.

*Source: authors.*
5. Lessons from COVID-19 for understanding and managing risk
5. Lessons from COVID-19 for understanding and managing risk

This chapter provides an overview of lessons from COVID-19 for understanding and conceptualizing risk (chapter 5.1) as well as for risk management (chapter 5.2) as they have emerged from the literature review, the expert consultations and our findings in the case studies.

5.1 Implications for understanding risk and its conceptualization

Based on our research, a number of key characteristics could be identified that reveal and demonstrate the systemic nature of risks associated with COVID-19. In the following, some of the most recurring elements from the desk study and case studies are clustered and explained, including: (i) interdependence, interconnectedness and cascading effects, (ii) non-linear relationships, (iii) feedback loops, (iv) tipping points, (v) being unnoticed, (vi) uncertainty, and (vii) dynamics.

Interdependence, interconnectedness and cascading effects

Interconnectivity of complex systems and agents across borders and scales has been a clear and observable characteristic of the COVID-19 pandemic. For example, COVID-19 has revealed:

- **Global spread of the disease**: Since it was first detected in Wuhan, China, COVID-19 rapidly spread across countries through international travel and domestic mobility, resulting in a sharp rise in infections globally and direct physical health impacts for millions of people.

- **Cascading effects across sectors, systems and scales**: The immediate response of countries to the direct threat of COVID-19 aimed to protect at-risk groups (e.g. the elderly, people with pre-existing conditions) and prevent the collapse of health systems. These responses include interventions such as restrictions of public gatherings, stay-at-home orders, closure of schools and businesses, and restrictions of national and international travel. These interventions – while helping to protect at-risk groups and prevent health systems collapsing by and large – have led to further cascading effects on interconnected
social, economic, financial and governance systems, from global to local scales across all sectors of society.

- **Globally networked risks:** Geographically isolated countries such as Cook Islands, Samoa, Tonga and Tuvalu had not registered any COVID-19 cases until recently, and hence had very little direct exposure to the disease. However, their economies, livelihoods and populations have nonetheless suffered large-scale negative effects – notably as a result of their high economic dependency on tourism and their embeddedness in the global tourism industry, which itself was heavily affected by international travel restrictions (UNCTAD, 2021; 2020).

- **Disruption of food chains:** COVID-19 revealed the fragility of connections between local food producers and national-to-international food systems. Despite these connections being protected through strict international regulation, between May and June 2020, the pandemic triggered disruptions in the production and delivery of fertilizers, as well as reductions in labour forces and increased demand as a result of panic buying – all of which led to food shortages in many regions around the world. These disruptions were disproportionately felt in low and middle-income countries, particularly among small-scale food producers and vendors (Béné, 2020).

These examples also confirm findings from previous studies on the systemic nature of risk, which also emphasized the notion of interdependence as a core component of systemic risk and, in fact, inherent to the definition of a “system” as a connection of elements (Hynes and others, 2020; Helbing, 2013; 2010; Renn and others, 2020). For example, Helbing (2013) argued that disruptions in highly interconnected systems can occur as a cascade of effects along the network, originating so-called globally networked risks (an example of which is provided above). Renn and others (2020) included the characteristic of “ripple effects beyond the source of risk”, akin to cascading effects, as one of the four major components of understanding systemic risks. Adding to this, Hynes and others (2020) argued that increased interconnectivity has, together with growing complexity, made various systems susceptible to widespread, irreversible and cascading failure.

**Non-linear relationships**

The pandemic has displayed abundant characteristics of the non-linearity of relationships and interconnections, meaning that causes and effects are not proportional to each other. Feedback loops and tipping points are a manifestation of non-linear relationships (see further below). For example, COVID-19 has shown:

- **Exponential spread of COVID-19:** The spread of viruses is non-linear. As seen throughout the COVID-19 pandemic (as well as during previous pandemics or regional infectious disease outbreaks), many countries have experienced multiple ‘waves’, during which periods of transmission and infection are high, resulting in tightening of interventions.

- **Number of infections and effects on society:** As of November 30, 2021, Maritime region, Togo has experienced 28.7 cumulative confirmed deaths (per million people), far lower than that of any of the other case studies presented in this report or the global average (see Table

- However, impacts triggered by the relatively low number of infections have cascaded into a series of large-scale negative consequences for large swaths of the population.
This example also confirms findings of Helbing (2010), Centeno and others (2015), who found that network interactions in socio-economic systems show typical non-linear features. They also list non-linear responses to changes as one of three key characteristics of risk at the global scale.

**Feedback loops**

Next to high interconnectivity of systems and non-linear relationships (see above), the pandemic has also revealed feedback loops contributing to the systemic nature of COVID-19 risks and impacts. Notably, reinforcing feedback loops have become transparent throughout the pandemic. As shown in the conceptual model (Chapter 4), feedbacks have reinforced the pandemic, but also reinforced pre-existing vulnerabilities. For example, COVID-19 has shown:

- **Reinforcing the rise of infections**: Increasing hospitalizations led to overwhelmed health systems in all cases and increased the risk of health-system collapse – a risk that manifested and turned into a tipping point in Guayaquil and Indonesia. Once health systems are not capable of reducing the spread of the disease (e.g. as a result of being overwhelmed), COVID-19 continues to spread through the population, leading to rising infections that could be observed in all case studies.

- **Reinforcing migration dynamics**: In the Maritime Region of Togo, the COVID-19 crisis exacerbated economic challenges for the rural population, resulting in increasing levels of poverty. This led to an intensification of a pre-existing migratory trend. For decades, many people, especially young people, have relocated to urban areas to find work, due to the lack of livelihood opportunities in agriculture. The further reduction in agricultural workforce is likely to add to the challenges of rural livelihoods, thereby feeding the migratory loop even further. Moreover, scarcity of food contributed to food-price inflation, which pushed vulnerable households and individuals further into poverty and food insecurity, reinforcing and intensifying their vulnerability.

- **Reinforcing inequalities in education**: Another prominent example of how the cascading effects of COVID-19 have resulted in a reinforcing feedback loop can be seen in the education sector. For example, a desk study has revealed that in Germany, prior to the closure of schools, there was a correlation between children who performed lower at school and their socio-economic background (Geis-Thöne, 2020; Huebener & Schmitz, 2020). Due to numerous factors – such as house and family size, access to electronic devices, and lesson planning of teachers – the structural shift to online learning has been less advantageous for lower-performing children, creating a reinforcing loop, resulting in lower academic performance throughout home-schooling periods. Similar observations have been made in the case studies, where pre-existing digital gaps, such as access to internet/equipment, have resulted in widening educational disparities based on family income.

These findings are again in line with much of the existing literature on systemic risk, which also states that feedback loops are a key characteristic of the systemic nature of risks (e.g. Centeno and others, 2015).
Tipping points

Another element that characterized the COVID-19 pandemic is the discovery – and at times the crossing – of the system’s tipping points, i.e. thresholds past which the system faces critical transitions. For example, COVID-19 has shown:

- **Collapse of health systems:** The collapse of health systems as a result of surges in confirmed cases and hospitalizations in short periods of time (e.g. observed in Guayaquil in March 2020 and Indonesia in July 2021) led to a shift in healthcare priorities: the public system was not able to treat the number of COVID-19 patients, resulting in increased mortality as well as infected persons dying in home isolation. Furthermore, the prioritisation of COVID-19 in overwhelmed healthcare systems resulted in the postponement of treatments of other health-related issues, including, for example, hypertension, diabetes and diabetes-related complications, cancer, and cardiovascular emergencies (WHO, 2020).

- **Large-scale restrictions:** The emergence of COVID-19 triggered a range of interventions (e.g. restriction of movement, lockdowns, school and business closures) that have in turn led to a transformational societal shift in most world regions.

- **Living with COVID-19:** In the early stages of the pandemic, the general societal perception was that, with enough intervention, COVID-19 could be contained. However, through media communication and the length of time that restrictions have been in place, this perception has shifted to a general societal acceptance that COVID-19 is now endemic to the system.

These findings also speak to the characteristics of systemic risks as listed in UNDRR’s recent GAR Special Report on Drought (UNDRR, 2021a), where it is stated that tipping points occur in dynamic systems when an incremental change in a specific variable leads to a sudden, often catastrophic, shift into a new equilibrium state.

Under the radar/unnoticed

A further characteristic of the systemic nature of risks is that these often build up over time in a hidden or unnoticed manner. For example, COVID-19 has shown:

- **Emerging infectious diseases with probable zoonotic origins:** Pathologists have been warning of potential pandemics from the emergence of new diseases for decades. Warning signals can be seen with epidemics such as SARS, Swine flu and Ebola (Hynes and others, 2020). However, despite these warning signals, most countries were highly unprepared and did not invest enough in preventing future outbreaks and pandemics.

- **Unpreparedness of health systems:** In all case studies, health systems were found to be generally unprepared for the task of dealing with the excess pressure caused by the pandemic. While multiple causes may explain this unpreparedness, the tendency to maximize efficiency and optimize performances in the health system (as in other vital sectors of society) has led over the course of time to a reduced buffer against shocks (Hynes and others, 2020).

- **Public distrust:** In the case of Guayaquil, prior to the pandemic, a situation of frustration was growing as a result of increasing levels of poverty and governmental policies of...
austerity (Organización Internacional del Trabajo, 2021). COVID-19 hit all the ‘hot buttons’ for intensifying societal distrust, which resulted in a collapse of the underfunded healthcare system, ambiguous and mixed communication from state actors and an ad hoc policy of further austerity, which significantly impacted already frustrated citizens. These factors triggered a societal tipping point in May of 2020, which resulted in widespread protest, civil disobedience and disregard for interventions. Similarly, in Cox’s Bazar, rumours and misinformation affected people’s reception and trust of official indications, thus gravely undermining the efforts for effective prevention of the contagion.

These examples also confirm findings from UNDRR’s GAR 2019 report (UNDRR, 2019), which states that understanding of systemic risk requires a time-dependent analysis of the interacting elements.

Uncertainty

The COVID-19 pandemic can be characterized as a situation that has been, and continues to be, highly uncertain in nature (as is also evident from the previously mentioned examples of feedback loops and tipping points). This characteristic is inherent to the systemic nature of risks, and has been abundant throughout the case studies. For example:

- **Uncertainty about the spread of the disease**: From the first confirmed case of an ‘unknown pneumonia’ circulating in Chinese media, picked up by the WHO on 31 December 2019, COVID-19 spread rapidly across borders and countries within a number of weeks. As typical for an emerging disease, its diffusion was characterized by very high uncertainty about if, when, where, and how it will spread. The emergence of new variants of the virus has led to increased uncertainty, adding questions on which future variants might arise, their resistance to existing vaccines, and how to best prepare for such scenarios.

- **Knowledge gaps and decision making under high uncertainty**: In response to the above point and the lack of knowledge on the disease and its possible effects (notably in early stages of the pandemic), decisions on how to best contain the spread (which measures, for how long, what will be the effects and trade-offs) of the disease had to be taken in contexts of very high uncertainty.

Again, these findings confirm results of previous studies on systemic risk, which stated that there is a “degree of uncertainty or perturbation that cannot be eliminated” often also referred to as “unknowns” (Helbing, 2013, p. 53). Similarly, Renn and others (2020) and Aven & Zio (2021) include “uncertainty” as one of the major characteristics to understand systemic risk.

Dynamics

Next to illuminating uncertainty as a central characteristic, the pandemic has also revealed the importance of better understanding the interaction of system elements over time, and the resulting potential for delayed, long-term ripple effects. For example, COVID-19 has shown:
• **Dynamic evolution and developments:** Multiple of the previous characteristics (e.g. uncertainty, tipping points, feedback loops, and being under the radar/unnoticed), and the examples thereof, point at the dynamic nature of the pandemic and its associated risks and impacts requiring a dynamic and adaptive approach to managing such crises.

• **Educational gap and uncertain long-term prospects:** Evidence from the cases presents a potential example of the delayed cause-effect nature of cascading and systemic risks. As described above, educational inequality is likely to be exacerbated as a result of the closure of schools. This time-dependent description of interacting elements (UNDRR, 2019) is likely to be seen in how the loss of learning for an entire generation of students will have repercussions for those who were already from disadvantaged situations, as evidenced in multiple case studies (e.g. Sundarbans). Furthermore, evident from the cases is the fact that disruptions in education might further increase gender inequalities over time, examples of which include (i) an increase in child marriages, (ii) decreased opportunities for girls and women due to losses in education, (iii) increasing gender time-and-pay gaps.

**Lessons for understanding hazard, exposure and vulnerability**

It is widely accepted that risk is the potential for loss and damage resulting from the interaction of hazard, exposure and vulnerability (IPCC, 2014; UNDRR, 2021b). Thereby, **hazards** are understood as processes, phenomena or activities that can lead to adverse impacts, and that can be characterized by their location, intensity/magnitude, frequency and probability. Intrinsically linked to hazards, **exposure** is the presence of elements of the system (e.g. people, assets, etc.) in areas and places that are prone to hazards, while **vulnerability** is linked to conditions that increase the susceptibility of individuals, communities, assets and/or systems to the impacts of hazards (IPCC, 2014; UNDRR, 2021b).

COVID-19, and the systemic nature of risks associated with the pandemic, has expanded our understanding of risk by drawing attention also to the fact that (i) **hazards can be both exogenous** (i.e. emerge from outside the system) and **endogenous** (i.e. emerge from within the system), (ii) **exposure can also be indirect** (i.e. effects can be felt in places that are not directly approximated to a hazard) as a result of interconnectedness, and (iii) **vulnerability of one system can also turn into a hazard for other interdependent systems.** In the following, a few examples observed in the COVID-19 pandemic are provided to illustrate these points (see also Fig. 11 for a synthesis).

First, while for many countries COVID-19 initially emerged from the ‘outside’ (i.e. as an exogenous hazard) through international travel, it has quickly also started to spread throughout populations within countries, due to the lack of measures to contain the spread of the disease (i.e. “reinforcing” itself within the system). Further, many of the interventions put in place by governments to protect at-risk groups or the collapse of health systems have led to widespread effects on society (i.e. interconnected sectors, systems and agents), leading to widespread cascading effects due to some of these interventions (i.e. lockdowns, business/ school closures etc.). Hence, the latter can be understood as “secondary hazards” that are socially constructed within the system.

Second, the pandemic has also shown that exposure is not only linked to “being located in a hazard-prone area”, but can also be indirect (i.e. effects of the pandemic can be felt in places that are not affected directly by the virus). An example of such an indirect exposure through interconnectedness is the small islands that were largely COVID-19 free until recently (e.g. the Cook Islands, Samoa, Tonga and Tuvalu) but
nonetheless - as a result of their dependence on international tourism - were severely affected by the global travel restrictions that put a burden on their economies. The Maritime Region of Togo presents a similar trajectory; widespread effects on large segments of society were evident despite very low numbers of cases (direct exposure to COVID-19). As such, this is not a new finding, as similar observations were made, for example, during the 2011 Fukushima Earthquake-Tsunami-Nuclear disaster, where effects from the disaster were felt in regions and countries not directly affected by the incident. However, the scale, diversity and capillarity of effects in the COVID-19 crisis have added additional cogency to this perspective.

Thirdly, the pandemic demonstrated how the vulnerabilities that characterize parts of the system can in themselves be the origin of new “hazards” and related impacts, which cascade into the larger system. This is best exemplified by how governments had to protect the vulnerability of health systems, in order to try and avoid collapse: in so doing, health-system vulnerabilities were the resulting pre-condition for a new shock (societal interventions such as lockdowns) which then triggered hazards in other systems. Further, by revealing characteristics such as non-linearity, tipping points and feedback loops (see above) that point towards the stochastic nature of pandemic-related risks also illustrate the difficulty of representing and modelling risks probabilistically. Lastly, COVID-19 has also emphasized the need to move from hazard-by-hazard and single-risk approaches to more holistic approaches that consider multiple interconnected vulnerabilities and risks in a comprehensive manner - a need that has also been underscored in the Sendai Framework for Disaster Risk Reduction (UNDRR, 2015b). Figure 11 synthesises these findings by showing key characteristics of the systemic nature of risk (red text elements below the risk propeller) and illustrating learnings for the conceptualization of hazard, exposure and vulnerability as outlined above.

Fig. 11: Lessons for understanding and conceptualizing cascading and systemic risk. Source: authors (building on the risk framework of the IPCC 5th Assessment Report; IPCC, 2014).
5.2 Lessons for risk management

This chapter reports on the lessons – from the case studies, expert consultations and literature review – for risk management. We reflect on what we can learn in the broad risk management categories: (i) **risk assessment**, (ii) **risk interventions**, and (iii) **monitoring and evaluation** (after e.g. GIZ, 2020). Our study of systemic risks in the context of COVID-19 reconfirmed lessons for systemic risk management, as elaborated by the IRGC (IRGC, 2018), and for the implementation of the Sendai Framework (UNDRR, 2015b). It places greater emphasis on risk perceptions, risk communication, intervention dynamics and managing the interconnections of system elements and agents. We note that, at the time of writing, it is still too early to evaluate the full consequences of the COVID-19 risk management strategies that are being pursued.

**Risk assessment**

*Explore and map interconnections and critical system components.* The cascading effects originating from COVID-19 have allowed us to observe the interconnections that exist in systems by design or as an emergent quality. Mapping this interconnectivity and critical system components (i.e. those that, if affected, can lead to devastating cascading effects) can help in designing more effective risk management measures. For example, in many of the case studies, the educational system came out as a strongly affected sector, which also triggered multiple cascading impacts that go beyond the disruption of schools itself. Importantly, schools additionally provide access to food security, nutrition, clothes, support systems, safety and a sense of security (e.g. in the Sundarbans and Cox's Bazar). Further, even a short-term disruption in education can have long-term impacts on individuals and groups. Interconnections and network structure deserve more attention in risk assessment.

*Map risk perspectives and perceptions.* Systemic risks have systemic consequences and come with substantial uncertainty for many actors. The sense-making process is critical in shaping individual risk perception and behaviour, which are influenced by the norms and values of individuals, groups, organisations and societies. To guide risk management, risk assessment has to pay attention to trust, risk perceptions and, in particular, to the perceived fairness of the distribution of benefits and losses (c.f. Collins and others, 2020). Joint fact finding is an important tool in this respect. This activity has to be an integral part of, and extend throughout, all risk management activities.

**Risk interventions**

*Identify cascading effects and trade-offs of interventions.* During the COVID-19 pandemic, several interventions (e.g. stay-at-home orders, closure of schools and businesses, travel restrictions) have shown high potential for cascading effects, calling for trade-offs between positive and negative consequences. In all cases, such restricting measures had repercussions and exposed underlying vulnerabilities. For instance, in contexts of high social and economic informality, such as Cox’s Bazar, Indonesia and the Maritime region of Togo, lockdowns and business closures revealed the fragility of many livelihoods. Moreover, informal livelihoods often meant that those most in
need of assistance, for instance through social protection, were invisible to the existing mechanisms, resulting in further exacerbation of existing vulnerabilities. Interventions can be more effective when thoroughly analysed against the interconnected vulnerabilities of the system, so as to anticipate possible cascading effects. Here scenario-based approaches could prove valuable in preparing for future events (c.f. IRGC, 2018). Interventions that address pre-existing vulnerabilities of the system were found to trigger positive-impact cascades and deserve more attention throughout the risk management cycle.

**Foster cross-sectoral and multi-scale (including international) collaboration.** Addressing risks from a systemic perspective hinges on comprehensive and non-isolated knowledge. This requires highly integrated institutions that are able to optimize governance at different levels and scales. For example, local communities are often the first responder during disasters, and COVID-19 has further underlined the need to engage and empower local communities in risk management. The pandemic has also demonstrated that effective management requires institutional collaboration to extend beyond the national sphere: international collaboration (including with supra-national institutions) has motivated management options at the local level – for instance, in setting up new social protection schemes (e.g. the Novissi programme, in a partnership between the World Bank and the Government of Togo), or in the lack of coordination experienced between city-level, national and international health institutions in early phases of the crisis in Guayaquil. In a globally connected ‘risk society’, cross-scale (from local to international) and international collaboration (such as between the WHO and the WMO (UN ESCAP, 2020), and the Resilient Cities Action Package ReCAP21 (GIZ, 2021)) is needed to manage global risks. This has become very evident during the pandemic.

**Comprehensive risk management (all hazards and multi-risk approach).** The COVID-19 pandemic has underlined that managing systemic risks requires risk management approaches that transcend across disciplines, sectors and institutions at all levels. Further, compounding risks induced by the pandemic, climate-related extreme events and natural hazards that have become evident from this research (see also Box 3) call for increased coherence between pandemic risk management, disaster risk management and climate change adaptation. The cases of Indonesia and the Sundarbans, India, are exemplary in this regard: saddled by the overlapping impacts of the pandemic and multiple natural hazards, their experience has shown the challenges but also the necessity of devising risk management practices that tackle multiple types of hazards and risks during prevention, response and preparation, as well as recovery. Additionally, to manage and reduce risks of future outbreaks that could turn into pandemics, societies need to focus on the overlapping interfaces of the human, animal and environmental sector via the One Health approach (Mackenzie and Jeggo, 2019).

**Collective responsibility (whole-of-society approach).** Managing systemic risks is a whole-of-society responsibility, meaning that all societal actors have a role, from government to private businesses to single individuals. This approach increases the chances of identifying and managing vulnerabilities across all sectors and groups. Lessons can be learned from disaster management on the expectations of the general public towards leadership in times of crisis (e.g. Boin and Hart, 2003). Inspiring examples of the involvement of citizens in risk management practices in the context of the pandemic are the Club de Mères in Togo and the female-led self-help groups in the Sundarbans (see Chapter 3.3). These examples also confirm the importance of supporting and strengthening the ability to self-organise and self-control in managing systemic risks (c.f. IRGC, 2018).

**Increase preparedness for low-probability and unexpected events.** The unexpected nature of events, as evidenced in the pandemic, calls for flexible and dynamic regulations: all
actors need to prepare for flexible and dynamic responses to emergencies, and consider large-scale disruptions in their scenario planning (c.f. IRGC, 2018). Having related contingency measures in place can allow them to respond effectively in a time-sensitive environment. Resilience qualities such as diversification, redundancy, learning and adaptive capacity can inspire interventions. Examples are job retraining programmes and pooling hospital resources under the pandemic.

**Actionable communication.** A lack of clear and timely communication can result in the spread of misinformation and distrust in risk reduction measures (c.f. Collins and others 2020). The Cox’s Bazar case showed that inclusion of community leaders from religious organizations in the communication process could raise the credibility and actionability of information. Another example from the Maritime region, Togo, highlights the role of the mothers’ group *Club de Mères*, which was involved in community risk-awareness and capacity-building campaigns, ensuring that counter-measures (in particular, hygiene practices) could reach households excluded by other communication networks. The use of virtual spaces increased under COVID-19, with the lockdowns, working from home, and online schooling. Online communication tools and platforms deserve special attention in risk management as they can also add to polarization (c.f. Renn, 2020).

**From systemic risk to systemic recovery.** The flip side of systemic risk is systemic recovery. The interconnected nature of societal systems presents an opportunity for positive turning points and for the propagation of the success of interventions. In our cases, we observed that positive impacts can serve as a point of (further) intervention, such as the job innovations following financial assistance, and concrete advances in digitalization. Furthermore, with the increase in compounding extreme events, society can be understood to be in a constant recovery mode, entering the stage of a ‘risk society’ (c.f. Beck, 1992). Recovery management thus deserves more attention in risk management.

**Monitoring and evaluation**

**Invest in monitoring and evaluation.** The COVID-19 pandemic revealed the urgency of investment in monitoring and evaluation capacities. For example, managing public healthcare capacity requires strong laboratory capacity for testing, digital monitoring infrastructure for testing-and-tracing applications, active monitoring of hospital capacities, and forecasting of healthcare demand. Health institutions in Guayaquil, for instance, struggled to increase testing capacity at a rate consistent with the rise in COVID-19 cases, and this reflected the strain on public health services early into the pandemic, compared with countries that were noted as having effective track-and-trace systems that minimized outbreaks, such as South Korea (Seung-Ji and others, 2021). Monitoring and evaluation also have an important role in signalling knock-on effects of interventions and cascading risks (c.f. IRGC, 2018).

**Information platforms/data management and assessment.** The dynamic and non-linear nature of systemic risk puts new requirements on data collection and management. Indicator selection critically impacts decision making, as can be seen by the lockdowns in all cases. Close to real-time data collection (cases, intensive-care unit occupation) facilitates evidence-based decision making. It is recommended to regularly evaluate decision-making indicators and strengthen transparent and open-access data sharing. Additionally, involving community-based organizations and frontline workers (as done in the Sundarbans) could help in gathering granular data and building trust.
6. Recommendations

This section reports on the recommendations and lessons learned from the case studies, expert consultations and literature review of cascading and systemic risk. We report recommendations under the following broad categories: (i) understanding the systemic nature of risk; (ii) risk management; (iii) systems thinking; (iv) gendered risks; (v) commitment towards the SDGs; (vi) human security; (vii) social protection, and (viii) future research. These recommendations are a call to Think Differently and point towards informing policy on matters associated with early warning, prevention, preparedness and resilience.

Understanding systemic risk

The unfolding of the COVID-19 pandemic revealed the inherent complexity of crises in our interconnected world. Understanding this complexity is paramount to design effective measures and enhance society’s preparedness and resilience (Linkov and others, 2021). However, traditional approaches to risk, while extremely useful in isolated settings, fall short in providing insights to tackle more complex settings. In the case of the pandemic, for instance, the categories of hazard, exposure and vulnerability (developed especially in the context of risk connected with natural hazards) are ill-equipped to represent what we have seen happening in countries like Togo, where the incidence of the virus (the ‘hazard’) was extremely contained and yet, consequences for the population were still highly disruptive. The understanding of the nature of risk as systemic, rather than isolated, offers a more fitting conceptual toolbox, shedding light on important systemic features such as interconnectedness, dynamics, and global dependencies among others that contribute to cascading effects across sectors, systems, borders and scales.

Risk management

The systemic nature of risk has important consequences for risk management. Firstly, it implies that risk cannot be eliminated from systems, but rather has to be managed, monitored and treated regularly. Risk management has to engage with questions such as what levels of risk are acceptable for whom, what are trade-offs and what are risk transfer mechanisms. Interventions to reduce risks (such as lockdowns) were found to add to new risks. This underlines that the stages of the risk management cycle have to be undertaken in parallel and that comprehensive risk management strategies consist of a portfolio of specific risk management interventions (including specific contingency plans and protocols), systemic measures (targeting system structure and drivers of vulnerability) and governance considerations. Secondly, the interconnected nature of risks implies that risk management has to engage with network structure and reciprocity. This includes multi-
level governance frameworks, that share the responsibility towards risk management across systems and scales. Thirdly, risk management has to explicitly address the dynamic aspects of risks, as well as responses. The timing and duration of responses becomes a critical management variable: this can be seen in the cases where the duration of the lockdown had profound impacts on the proliferation of the disease, the cascading impacts and implications for compliance (e.g. the case of Guayaquil). Opportunities for risk management open up by including incubation and recovery time in risk management strategies. With the systemic nature of risk, as well as the increase in compounding extreme events, society can be understood as in a constant recovery mode: therefore, recovery management deserves more attention in risk governance. Focus should be placed on co-creating risk management pathways that enable reducing future risks not only from pandemics, but also compounding risks associated with climate change, through a process of iterative learning and adaptation.

**Gendered risks**

While impacts from the pandemic have affected the whole of society, in many countries women have borne the brunt of it, either by being particularly exposed due to their livelihoods and occupation (market vendors in the Maritime region, Togo), by seeing their load of household activities increasing manifold due to education disruption (Indonesia and Sundarbans), or even by being the victims of increased gender-based violence (Sundarbans; Guayaquil, Ecuador) or child marriages (Sundarbans, Indonesia; Cox’s Bazar). As part of their efforts to reduce risk, countries should not shy away from addressing, among other societal vulnerabilities, the gender inequalities that are the root of such disparity of outcomes. For example, societal awareness must be increased, through education campaigns and other means, to prevent gender-based violence; similarly, the inequities of unpaid care work should be recognized and tackled to move towards a new, inclusive care economy. In the context of disaster risk reduction, our cases show that women groups can play an important role in disseminating good practices (as in the experience of the Club des Mères in Togo, and of women’s self-help groups in the Sundarbans, see chapter 3.1.1). However, the variety and severity of negative impacts for women highlighted in this report has made it apparent that decision-making in risk and emergency response has to be informed by considerations on gender impacts: in this sense, it is essential to include gender experts in risk and emergency policy bodies.

**Commitment towards the SDGs**

Despite a small number of positive examples, in general the COVID-19 pandemic has been a setback for the achievement of the SDGs, either through direct impact or through a reduction in the capacity to achieve them. In all the case studies, observable impacts on the SDGs are highlighted, with a particular focus from case experts on SDG 1 (No Poverty), SDG 3 (Health & Well-Being), SDG 4 (Quality Education), and SDG 8 (Decent work and economic growth). However, the framework offered by the SDGs can be an important vehicle towards addressing risk from a systemic perspective, as the interconnections and co-benefits between them are a counterforce to the interconnected pre-existing vulnerabilities of the system. In the case studies of this project, multiple SDGs have been found to be potentially affected by the pandemic. The extraordinary toll imposed by the pandemic can be expected to have made countries and societies temporarily falter in their commitment to achieve the SDGs, but at the same time it has also made apparent that the only way to construct societies less
vulnerable and more resilient to the impacts of systemic shocks is to tackle the issues highlighted in the SDGs. In particular, countries should focus on understanding the co-benefits emerging from the SDGs interactions during and after the pandemic, and use this realization to bolster a renewed commitment towards achieving the SDGs.

Human security

Shocks like COVID-19 stress-test our human-security ecosystem, often resulting in failures at various scales thereby posing serious threats nationally, regionally and globally. Complex security challenges within a complex risk-network structure and behaviour (such as the global health-security issues associated with the COVID-19 pandemic) can also reveal latent risks in societal systems, such as the lack of preparation, insufficient vulnerability analysis and response. Due to the interdependencies across the security landscape, it is recognized that changes and intervention strategies applied in one sector may have unintended consequences across others. Hence systemic strategic considerations must include the requisite systems lens for analysis. The realization of this new security calculus recognizes a still broader set of problems as security concerns, among which the most prominent are poverty, political injustice, inequality, institutionalized racism and discrimination, disasters connected to natural hazards, and unemployment. In effect, these items are not merely additions to the list of traditional concerns; rather, they reflect a new security agenda. Thereby, also from a security perspective, a clear requirement emerges for a change in mindset in how we view threats, risks and hazards and their impact on society. Analysis of vulnerabilities associated with non-traditional security requires a shift of mindset, which is well served by the discipline of systems approach.

Social protection

Considering the overall positive impact of social protection observed in the case studies, possibilities to expand the use of this tool to respond to systemic risk should be explored. Also, the ILO (2021c) advocates for building on the lessons learned and scaled up social protection systems during COVID-19 to build a more robust social safety net for the future. To maximize positive effects of social protection in the context of systemic risk, the connection between social protection, disaster risk reduction, and climate change adaptation must be strengthened. A concept developed to achieve this is called Adaptive Social Protection. ASP aims at utilizing synergies of these three areas to increase the capacity to prepare for, cope with, and adapt to shocks (Bowen and others, 2020). From our case studies, recommendations can be derived for each of the four building blocks of ASP as developed by Bowen and others (2020):

Concerning (i) programmes, those which allow for flexibility in expanding the coverage were found of particular value in the case studies. The Mahatma Gandhi National Rural Employment Guarantee Act (India) serves as an example of a social protection programme capable of augmenting the rising need for social protection during COVID-19. Regarding (ii) data and information, the necessity of investing in continuous and rigorous data-gathering to build risk and vulnerability informed social registries has become evident in the roll out of social protection in Guayaquil, Ecuador, and in the design of the Novissi emergency social assistance programme in Togo. Building on the CARICO case studies, a key task for building block (iii) finance, is to secure funding to transition the newly introduced social protection programmes into a long-term social protection system that could support beneficiaries not only in coping with a shock,
but also in general disaster preparedness and adaptation, as for example currently discussed in Indonesia. Lastly, the expansion of health insurance has not yielded the desired benefits in several case studies: this is due to insufficient institutional capacities (e.g. in the healthcare system) and infrastructure (e.g. transportation). This underlines a key recommendation for the building block (iv) institutional arrangements and partnerships: in addition to the necessary investment in social protection, institutional capacity needed to deliver ASP should also be strengthened accordingly.

To realize the full potential of ASP in a shock-responsive manner, the four building blocks mentioned above (including the recommendation derived from the findings of this report) should be implemented and adapted to each context before the next shock occurs.

**Systems thinking**

A shift towards systemic thinking in risk is necessary to be able to identify, understand and manage the criticalities intrinsic to the system, which could manifest in connection to a large variety of threats and in a large variety of sectors and domains, as exemplified by the case studies analysed in this report. Systems-oriented analytical tools like the impact webs developed in this study can, especially when informed by local experts and stakeholders, support the identification of the vulnerabilities inherent within interconnected societal systems, thus promoting a paradigm shift towards systems thinking, i.e. seeing interrelationships rather than linear cause-effect chains and seeing processes of change rather than snapshots (Senge, 1990). Governments, crisis management planners and communities should embrace a systems-thinking mindset to support systemic risk analysis and management.

**Future research**

Opportunities to move towards a better management of the systemic nature of risk as well as solution-oriented approaches require additional research. The following main areas of research are recommended:

- Development of approaches to support the analysis of inherent vulnerabilities within interconnected societal systems and systemic risk propagation across sectors, systems, borders and scales.
- Improve understanding of systemic risks pertaining to the connection between the growing risk of zoonosis and EIDs linked to loss of biodiversity and land-use changes as well (closer animal-human interactions) and the changes in disease vector behaviour linked to climate change.
- Better understanding the role of risk-propagating and risk-mitigating agents in COVID-19 through further in-depth empirical research.
- Better understanding of the compounding risks of climate change, pandemics and other large-scale shocks (e.g. financial crises) and evaluation of the implications for strengthening systems resilience.
• Development of modelling and simulation tools and approaches to support anticipatory future modelling and predictive analytics pertaining to large-scale societal shocks.

• Development of approaches, tools and policies that support local, national, regional and global resilience in the face of shocks.

• Research into risk reduction practices in regions under conditions of conflict and fragility, where national systems are not functioning well.

• Development of early-warning capability to support signal detection, systemic risk awareness and management.

• Research into best practices for crisis leadership under conditions of uncertainty and complexity.

• Improve our understanding of systemic recovery and learning following major system stresses (transformative recovery pathways).
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Contents

Annex 1: Timeline of consultation workshops in case studies 100
Annex 2: List of participating institutions in case study workshops 103
Annex 3: List of bilateral consultations in case study areas (individual and organizations) 110
Annex 4: Expert interviews (outside case study context) 112

Disclaimer: The approaches employed in the case studies were tailored to suit prevailing conditions, stakeholders and the objectives of this work. Therefore, all annexes don't pertain to each and every case.
Annex 1: Timeline of consultation workshops in case studies

This table provides an overview of the consultations that have taken place in the case studies. Detailed information on the participants is provided below in Annexes 2 and 3.

<table>
<thead>
<tr>
<th>Case study</th>
<th>Number of workshops</th>
<th>Workshop dates (chronological)</th>
<th>Format (in-person/hybrid/virtual)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maritime region, Togo</td>
<td>2</td>
<td>Workshop 1: 15 September 2021</td>
<td>Hybrid</td>
<td>Both workshops were held in Lomé, Togo, with the possibility of remote access. Participants provided their inputs in plenary sessions and break-out work groups.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Workshop 2: 22 September 2021</td>
<td>Hybrid</td>
<td></td>
</tr>
<tr>
<td>Guayaquil, Ecuador</td>
<td>2</td>
<td>Workshop 1: Day 1: 7 September 2021 + Day 2: 8 September 2021</td>
<td>Virtual</td>
<td>First workshop was organized in two parts on two days. Second workshop was a one-day event. All workshops were held virtually over Zoom.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Workshop 2: 30 September 2021</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Sundarbans, India

**Workshop 1:** 9 September 2021

Due to the unavailability of experts on a single day, the workshop was split into three bilateral consultations. These made it easier to get nuanced perspectives from different backgrounds, and to accommodate the limitations of participants in attending virtual workshops. The aim for the consultations was to include perspectives and voices mainly from the communities. To help ensure the findings were based on true lived experiences, they were conducted mainly in person.

### Cox's Bazar, Bangladesh

A common workshop could not be arranged, primarily due to prevailing circumstances:

A country-wide lockdown was in place until 11 August 2021, so government agencies could not provide any time to engage in the larger workshops. Instead, bilateral consultation was carried out.

The refugee context in Cox’s Bazar is dynamic as well as sensitive. Many of the participants agreed only to bilateral consultations, which were held extensively.
<table>
<thead>
<tr>
<th>Indonesia</th>
<th>3 workshops (expert group discussions)</th>
<th>Workshop 1: 30 August 2021</th>
<th>Virtual</th>
<th>All expert group discussions were held virtually via Zoom due to COVID-19 related restrictions in Greater Jakarta. The three workshops were split into smaller groups of experts and participants to optimize virtual meeting conditions.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Workshop 2: 8 September 2021</td>
<td>Virtual</td>
<td></td>
<td>An additional, informal consultation was conducted with BNPB (National Disaster Management Agency) to ensure the result of the workshop. There was also an extra discussion with BAPPENAS about the system-thinking approach to understanding systemic and cascading risk.</td>
</tr>
<tr>
<td></td>
<td>Workshop 3: 16 September 2021</td>
<td>Virtual</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Annex 2: List of participating institutions in case study workshops

The tables below show the list of participating institutions in different case study workshops. For privacy reasons, only the affiliation of participants is provided.

A) Maritime region, Togo

**Workshop 1**: (15 September 2021)
**Key agenda** Understanding systemic and cascading risks: Lessons from COVID-19 in the Maritime region, Togo

**Workshop 2** (22 September 2021)
**Key agenda**: Recommendations for prevention and disaster risk management

<table>
<thead>
<tr>
<th>Affiliation</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Agence Nationale de la Protection Civile</td>
</tr>
<tr>
<td>2</td>
<td>Ministère de la sécurité et de la protection civile</td>
</tr>
<tr>
<td>3</td>
<td>Ministère en charge de l’enseignement</td>
</tr>
<tr>
<td>4</td>
<td>Ministère en charge des transports routier, ferroviaire et aérien</td>
</tr>
<tr>
<td>5</td>
<td>Ministère de la santé de la santé Région Grand-Lomé</td>
</tr>
<tr>
<td>6</td>
<td>Ministère en charge du Tourisme</td>
</tr>
<tr>
<td>7</td>
<td>Ministère en charge de l’agriculture</td>
</tr>
<tr>
<td>8</td>
<td>Ministère de la Santé Région maritime</td>
</tr>
<tr>
<td>9</td>
<td>Ministère en charge du commerce</td>
</tr>
<tr>
<td>10</td>
<td>WASCAL-Université de Lomé</td>
</tr>
<tr>
<td>11</td>
<td>Croix-Rouge Togolaise</td>
</tr>
</tbody>
</table>
**B) Guayaquil, Ecuador**

**Workshop 1:** 07 September 2021 and 08 September 2021 (split over two days)

**Key agenda:** Understanding and mapping cascading and systemic risks associated with COVID-19

<table>
<thead>
<tr>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
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<tr>
<td>3</td>
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<td>4</td>
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<td>5</td>
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<td>18</td>
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<tr>
<td>19</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>21</td>
</tr>
</tbody>
</table>
Workshop 2: 30 September 2021

Key agenda: Recommendations for prevention and disaster risk management

Affiliation

1. Escuela Superior Politécnica del Litoral, ESPOL (Academy)
2. Servicio Nacional de Gestión de Riesgos (National Government)
3. GAD Municipal de Guayaquil (Local Government)
<table>
<thead>
<tr>
<th></th>
<th>Institution</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>M.I. Municipalidad de Guayaquil</td>
<td>Local Government</td>
</tr>
<tr>
<td>5</td>
<td>Corporación Registro Civil de Guayaquil</td>
<td>Local Government</td>
</tr>
<tr>
<td>6</td>
<td>CNEL EP</td>
<td>National Government</td>
</tr>
<tr>
<td>7</td>
<td>Corporación Nacional de Electricidad CNEL Guayaquil</td>
<td>National Government</td>
</tr>
<tr>
<td>8</td>
<td>Gobierno Provincial del Guayas</td>
<td>Provincial Government</td>
</tr>
<tr>
<td>9</td>
<td>AEROVÍA</td>
<td>Local Government</td>
</tr>
<tr>
<td>10</td>
<td>Dirección General de Aviación Civil</td>
<td>NGOs</td>
</tr>
<tr>
<td>11</td>
<td>CRUZ ROJA</td>
<td>NGOs</td>
</tr>
<tr>
<td>12</td>
<td>Municipio de Guayaquil</td>
<td>Local Government</td>
</tr>
<tr>
<td>13</td>
<td>CNEL EP</td>
<td>National Government</td>
</tr>
<tr>
<td>14</td>
<td>Policía Nacional</td>
<td>National Government</td>
</tr>
<tr>
<td>15</td>
<td>Servicio Nacional de Gestión de Riesgos y Emergencias (SNGRE)</td>
<td>National Government</td>
</tr>
<tr>
<td>16</td>
<td>M.I. Municipalidad de Guayaquil</td>
<td>Local Government</td>
</tr>
<tr>
<td>17</td>
<td>Consorcio Aerosuspendido Guayaquil POMA SAS y SOFRATESA INC</td>
<td>Local Government</td>
</tr>
<tr>
<td>18</td>
<td>EMPRESA MUNICIPAL DE AGUA POTABLE Y ALCANTARILLADO DE GUAYAQUIL EP</td>
<td>Local Government</td>
</tr>
<tr>
<td>19</td>
<td>Ministerio de Salud Coordinación Zonal 8</td>
<td>Health sector</td>
</tr>
<tr>
<td>20</td>
<td>CNEL EP</td>
<td>National Government</td>
</tr>
<tr>
<td>21</td>
<td>EMAPAG EP</td>
<td>Local Government</td>
</tr>
<tr>
<td>22</td>
<td>Municipio de Guayaquil</td>
<td>Local Government</td>
</tr>
<tr>
<td>23</td>
<td>Servicio Nacional de Gestión de Riesgos y Emergencias</td>
<td>National Government</td>
</tr>
<tr>
<td>24</td>
<td>Empresa Pública de Vivienda del cantón Guayaquil</td>
<td>Local Government</td>
</tr>
<tr>
<td>25</td>
<td>Municipio de Guayaquil</td>
<td>Local Government</td>
</tr>
<tr>
<td>26</td>
<td>Municipalidad de Guayaquil (Dirección de Obras Públicas Municipales)</td>
<td>Local Government</td>
</tr>
</tbody>
</table>
C) Sundarbans, India

**Workshop 1:** 9 September 2021  
**Key agenda:** Seeking feedback on the first order draft of the Impact Web, with particular focus on affected sectors, interventions, drivers of vulnerability, root causes, and agents

**Affiliation**

1. School of Oceanographic Studies, Jadavpur University (academia)  
2. Kulima Integrated Development Solutions (academia)  
3. Retired Joint Director of Sundarban Development Board (government and delta inhabitant)  
4. Save the Children NGO  
6. Sagar Mangal (ground-level NGO)  
7. The Hindu, Media group (Newspaper)  
8. Mongabay India (Online media)

D) Indonesia

**Workshop 1:** 30 August 2021  
**Key Agenda:** Mapping the complexity of the impact of the COVID-19 pandemic on health systems, including the challenges to achieving SDGs

**Affiliation**

1. Ministry of health (Ministry- National Government Organization)  
2. National Task for COVID-19 Pandemic (Consortium of several ministries and experts at the national level)  
3. Eijkman Institute (National Government Organization)  
4. Health Management and Policy Center, University of Gadjah Mada (University)  
5. Faculty of Public Health, University of Indonesia (University)  
6. Faculty of Geography, University of Gadjah Mada (University)  
7. Knowledge Sector Initiatives (a partnership between the governments of Indonesia and Australia. It is funded by the Department of Foreign Affairs and Trade (DFAT) and implemented in cooperation with the National Development Planning Agency (BAPPENAS)
Workshop 2: 8 September 2021
**Key Agenda:** Mapping and understanding the impact of the COVID-19 pandemic on the risk management system in Indonesia, and exploring risk cascading and systemic risks to natural and climate-related hazards that worsen due to the COVID-19 pandemic

**Affiliation**

1. National Agency for Development Planning (BAPPENAS)
2. National Agency for Disaster Management (National Government Organization)
3. Ministry of Environmental and Forestry (National Government Organization)
4. Institute Technology Bandung (ITB) (University)
5. U-Inspire (UN Body)
6. Yayasan Skala (Local NGO working on Disaster Management)
7. Dompet Dhuafa (Local NGO working on Disaster Management and Building community resilience)
8. Bogor Institute of Agriculture (IPB) (University)
9. Thamrin School of Climate Change and Sustainability (NGO - Independent think tank for climate change and sustainability in Indonesia)

Workshop 3: 16 September 2021
**Key Agenda:** Social protection in Indonesia, and its role during the COVID-19 pandemic: what we can learn, and challenges for better social protection

**Affiliation**

1. Director of Social Protection for Workers, Ministry of Manpower (National Government Organization)
<table>
<thead>
<tr>
<th>No</th>
<th>Position and Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Director of Population and Social Protection, National Agency for Development Planning (BAPPENAS)</td>
</tr>
<tr>
<td>3</td>
<td>Research Department of Manpower, Ministry of Manpower (National Government Organization)</td>
</tr>
<tr>
<td>4</td>
<td>Institute of Demography, Economic and Business Faculty, University of Indonesia (University)</td>
</tr>
<tr>
<td>5</td>
<td>Assistant of Deputy for Protection and Facility Small Scale Medium Enterprise (National Government Organization)</td>
</tr>
<tr>
<td>6</td>
<td>BPJS Watch (Non State Government Organization)</td>
</tr>
<tr>
<td>7</td>
<td>Director of Strategies Planning and Information Technology, BPJS of Manpower (National Government Organization)</td>
</tr>
<tr>
<td>8</td>
<td>TNP2K (The National Team for the Acceleration of Poverty Reduction (Tim Nasional Percepatan Penanggulangan Kemiskinan or TNP2K, that was established with Presidential Regulation Number 15 of 2010))</td>
</tr>
</tbody>
</table>
Annex 3: List of bilateral consultations in case study areas (individual and organizations)

The tables below show the list of bilateral consultations, with individuals as well as organizations, held in different case study workshops. For privacy reasons, only the affiliation of participants is provided.

A) Guayaquil, Ecuador

<table>
<thead>
<tr>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Allan Hacay, Director of risk management and cooperation of the municipality, Guayaquil</td>
</tr>
<tr>
<td>2  Mercy Borbor, Health and Risk Management Researcher, ESPOL.</td>
</tr>
</tbody>
</table>

B) Sundarbans, India

<table>
<thead>
<tr>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Zilla Parishad (District Council member) - government</td>
</tr>
<tr>
<td>2  Women’s Co-operative Society</td>
</tr>
<tr>
<td>3  Joygopalpur Gram Vikas Kendra - NGO</td>
</tr>
<tr>
<td>4  Communities from the delta - 14 individuals</td>
</tr>
<tr>
<td>5  School of Oceanographic Studies, Jadavpur University</td>
</tr>
<tr>
<td>6  Kulima Integrated Development Solutions</td>
</tr>
<tr>
<td>7  Independent economic consultant</td>
</tr>
</tbody>
</table>
## C) Cox’s Bazar, Bangladesh

### Stakeholders/Agencies

<table>
<thead>
<tr>
<th></th>
<th>Stakeholder/Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Head Mazi (Rohingya Camp Leaders), Block Mazi (Block Leaders), Community Level Stakeholder</td>
</tr>
<tr>
<td>2</td>
<td>Representative Community People (incl. female, elderly and persons with disabilities)</td>
</tr>
<tr>
<td>3</td>
<td>CARE Bangladesh, Humanitarian Service Provider</td>
</tr>
<tr>
<td>4</td>
<td>Christian Aid, Humanitarian Service Provider</td>
</tr>
<tr>
<td>5</td>
<td>Caritas Bangladesh, Humanitarian Service Provider</td>
</tr>
<tr>
<td>6</td>
<td>UNFPA,</td>
</tr>
<tr>
<td>7</td>
<td>UNHCR</td>
</tr>
<tr>
<td>8</td>
<td>Australian Humanitarian Partnership (AHP) agency</td>
</tr>
<tr>
<td>9-11</td>
<td>Three actors from relevant government agencies (names and affiliations withhold due to privacy reasons)</td>
</tr>
</tbody>
</table>
Annex 4: Expert interviews (outside case study context)

This table provides details of the experts who were consulted outside of the case study context (see chapter 2.2 of main report for more details).

<table>
<thead>
<tr>
<th>Affiliation</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Food Systems Economics Commission (FSEC)</td>
<td>27 July 2021</td>
</tr>
<tr>
<td>2  US Army Engineer Research and Development Center, USA</td>
<td>05 August 2021</td>
</tr>
<tr>
<td>3  University of Oxford, Oxford Sustainable Finance Group, Smith School of Enterprise and the Environment, UK</td>
<td>30 July 2021</td>
</tr>
<tr>
<td>4  United Nations Office for Disaster Risk Reduction (UNDRR), Global Risk Analysis and Reporting Section, Geneva</td>
<td>16 August 2021</td>
</tr>
</tbody>
</table>