WHY INFORMATION MATTERS

A FOUNDATION FOR RESILIENCE

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Internews
Center for Innovation & Learning

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CREDITS

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ACRONYMS

AIFDR	Australia Indonesia Facility for Disaster Reduction
BNPB	National Disaster Management Agency (Badan Nasional Penanggulangan Bencana)
BPBD	Provincial Disaster Management Agency (Badan Penanggulangan Bencana Daerah)
DRR	Disaster Risk Reduction
FEMA	The Federal Emergency Management Agency
MPBI	Indonesian Society for Disaster Management (Masyarakat Penanggulangan Bencana Indonesia)
NGO	Non-governmental Organization
PMI	Indonesia Red Cross (Palang Merah Indonesia)
Pusdalops	Central Management and Operations for Floods
RT	"Neighborhood administrator" (Rukun Tetangga)
RW	"Community administrator" (Rukun Warga) Administrators of a larger geographic area and level of responsibility above Rukun Tetangga
SMS	Short Message Service
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs

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EMBRACING CHANGE: THE CRITICAL ROLE OF INFORMATION

PHASE 1

SCOPING & DEFINING

Initial framing and research to explore theoretical and practical underpinnings of information ecosystems.

ACTIVITIES
- Literature review of systems, ecosystems and resilience
- Defining information ecosystems and an analytic framework

OUTPUTS
- Literature Review [Completed April 2014]

PHASE 2

TESTING & UNDERSTANDING

Refining definitions and analyzing the relationship between information ecosystems and resilience.

ACTIVITIES
- Reviewing four Internews case studies in Japan, Pakistan, Indonesia, and Myanmar
- Fieldwork in Jakarta
- Fieldwork in New York City

OUTPUTS
- Resilient Information Ecosystems Tumblr [Ongoing]
- Why Information Matters: A Foundation for Resilience [September 2014]
- Why Information Matters summary deck [September 2014]

PHASE 3

OPERATIONALIZING

Developing and sharing of operational guidelines and tools for policymakers and practitioners.

ACTIVITIES
- Creating materials to capture research findings
- Disseminating materials through events and public launch

OUTPUTS
- Final Presentation Deck [September 2014]
- Final Report [November 2014]
- Outreach Strategy & Dissemination Plan [November 2014]

ABOUT THIS REPORT

Embracing Change: The Critical Role of Information, a research project by the Internews' Center for Innovation & Learning, supported by the Rockefeller Foundation, combines Internews' longstanding effort to highlight the important role of information with Rockefeller's groundbreaking work on resilience. The project focuses on three major aspects:

- Building knowledge around the role of information in empowering communities to understand and adapt to different types of change: slow onset, long-term, and rapid onset / disruptive;

- Identifying strategies and techniques for strengthening information ecosystems to support behavioral adaptation to disruptive change; and

- Disseminating knowledge and principles to individuals, communities, the private sector, policymakers, and other partners so that they can incorporate healthy information ecosystems as a core element of their social resilience strategies.

"Why Information Matters: A Foundation For Resilience" represents the first step towards these aims. Drawing on theoretical literature, case studies, and primary field research, this report:

1. Defines "information ecosystems" and proposes an analytic framework of eight critical dimensions for understanding them, drawing upon the Center's extensive literature review completed in April 2014 and reflecting Internews' three decades of field experience;

2. Analyzes information ecosystems across a spectrum of change and their impact on resilience, referencing four case studies of Internews' previous work;

3. Shares insights from the Jakarta Information Ecosystems pilot, which investigated the relevance of information ecosystems to communities living in chronically flood-prone environments; *and*

4. Reveals the utility of an information ecosystems approach and highlights preliminary conclusions on why information matters for resilience.

This analysis provides consistent evidence that healthy information ecosystems promote resilience, while weak information ecosystems seriously hinder preparedness, response, and recovery from shocks and stressors; underscores that healthy information ecosystems are a vital component of ensuring that resilience strategies engage all individuals and communities within a city or system; and surfaces critical areas of further investigation in the second phase of the Embracing Change project, the New York InfoEco Pilot study.

The final phase of the Embracing Change project (to be completed in November 2014) will lead to the development of practical guidelines and tools for incorporating measures to strengthen the health of information ecosystems into resilience frameworks. Future outcomes will include diagnostic tools for accessing the health of information ecosystems, including additional characteristics, indicators, and variables that inform a holistic picture of healthy information ecosystems. Ultimately, the research is designed to identify critical issues and opportunities that can inform planning and practice, and further identify where action and investment will be most effective.

"Why Information Matters" is designed principally for policymakers, practitioners, and communities concerned with strengthening resilience strategies and practices. The streams of research that inform the analysis and recommendations are described below in Methodology. While the data from this research is summarized in the paper and annexes, the focus of this piece is the learning and recommendations that we have drawn from the data. The paper is not meant to be academic nor fully capture the rigor of the research; it is meant to enable informed action.

METHODOLOGY

LEARNING FROM LITERATURE

Information ecosystems, occasionally referred to as "information ecologies," are an underdeveloped concept in the literature. Most uses of the term assume a common understanding without laying out a definition; it is less so considered with respect to the development and resilience of communities. In April 2014, the Center presented a literature review summarizing explorations of the theoretical and practical underpinnings of information ecosystems to articulate: 1) what information ecosystems are, how they function, and how best to assess them; and 2) how best to strengthen them to support communities' adaptation to change.[1]

LEARNING FROM CASE STUDIES

The review of theoretical literature was a basis for constructing a working definition of information ecosystems, a significant part of which is the "Eight Critical Dimensions of Information Ecosystems." This definition was then used to analyze the relationship between healthy information ecosystems and resilience through four Internews case studies representing different forms of disruption and change: 1) instability and underdevelopment in the tribal regions of northwest Pakistan, 2) Japan after the massive underwater earthquake and tsunami that notoriously damaged the Fukushima nuclear power plant, 3) Myanmar at the cusp of unprecedented political and economic opening, and 4) three environmental disasters in Indonesia, including floods that are a chronic occurrence in Jakarta.

LEARNING FROM RESILIENCE POLICY, IDEAS, AND PRACTICE

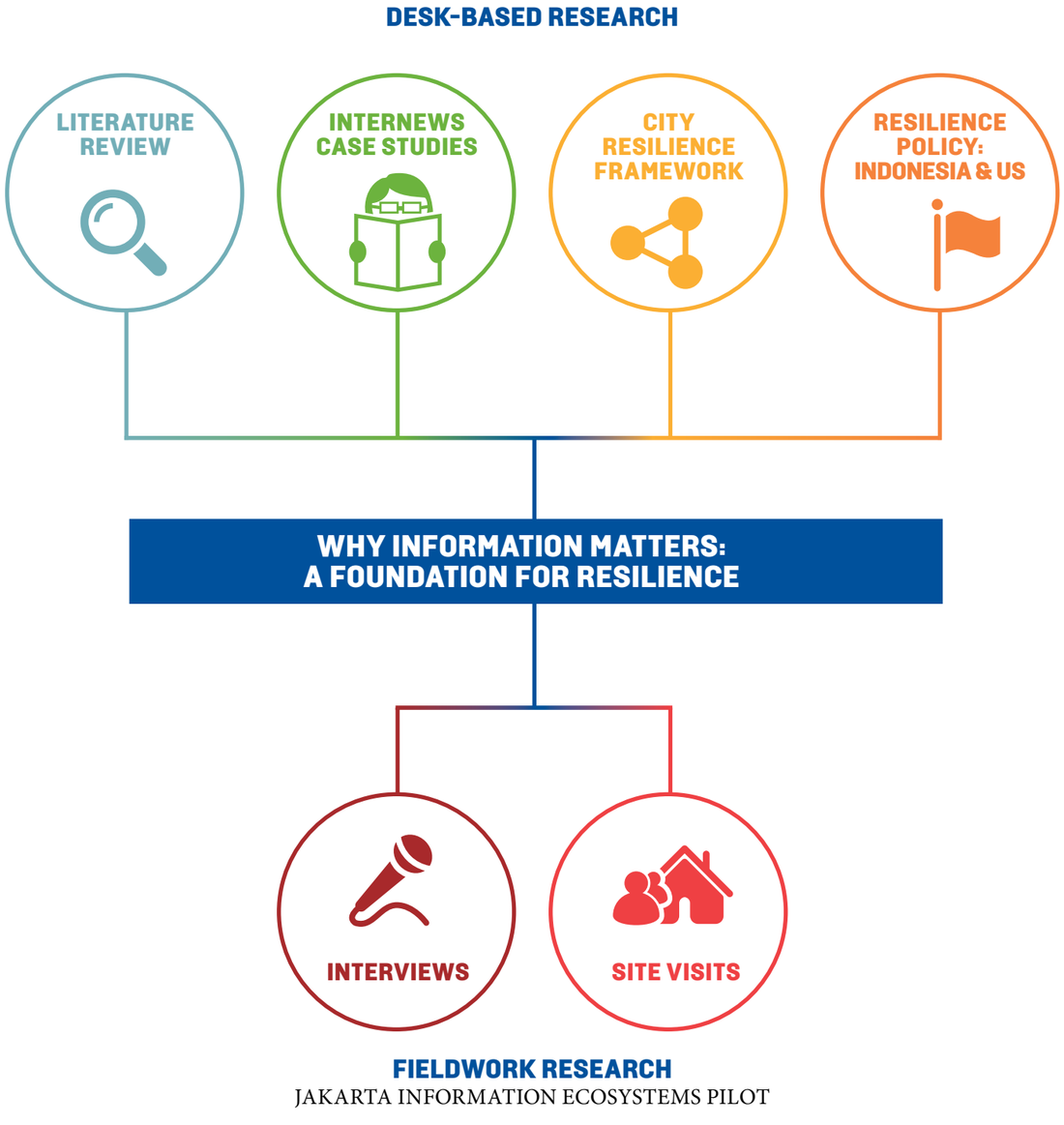
To contextualize the research, the Center examined policy literature on disaster risk reduction and resilience to better understand how information fits into current conversations and thinking in this area. Key to this review was Arup's "City Resilience Framework" (supported by the Rockefeller Foundation) in addition to documents on disaster policy in Indonesia and the United States.

LEARNING FROM FIELDWORK

To further inform the theoretical and retrospective analyses on the relationship between information ecosystems and resilience, this report incorporates fieldwork in Jakarta, Indonesia completed in April 2014. At the time of writing, additional fieldwork in the Brooklyn and Staten Island areas of New York City is ongoing, and will be described in future deliverables. This component of the research is designed to pilot the information ecosystems methodological approach to offer new insight and inform future inquiry for information ecosystem and resilience research and planning.

1 THE FULL LITERATURE REVIEW CAN BE DOWNLOADED ON THE CENTER'S WEBSITE: HTTPS://INNOVATION.INTERNEWS.ORG/RESEARCH/WHAT-INFORMATION-ECOSYSTEM-WHY-DOES-ITMATTER

ABOUT THIS REPORT



PREFACE

WHY DO INFORMATION ECOSYSTEMS MATTER FOR RESILIENCE?

Information is as critical as the air we breathe. Without information, people can neither understand nor effectively respond to the events that shape their world. For over 30 years, Internews has strengthened and supported local media around the world to help ensure that individuals, communities, and governments have the information they need to make critical decisions. This experience with citizens and local media in more than 90 countries has provided plentiful evidence that information not only supports the development and wellbeing of populations around the world, but that people empowered with the information they need are more capable of creating resilient communities.

> "HUMAN WELLBEING IN CITIES RELIES ON A COMPLEX WEB OF INSTITUTIONS, INFRASTRUCTURE AND INFORMATION."
>
> -CITY RESILIENCE FRAMEWORK, ARUP

While information is so fundamental to surviving and thriving within our complex global environment, it is rarely addressed directly, considered strategically, or integrated effectively across policy and planning for resilience. When information does appear in resilience literature, it usually has a minor role, and is often conceived as simple messaging to affected populations, or as a tool in coordinating responders and resources.

Moreover, when information is explicitly recognized as an important element in a system's capacity to adapt and evolve in the face of disruptions, corresponding strategies rarely incorporate analyzing and strengthening information flows as a core pillar – particularly at the hyper local, human-to-human level. The information needs of communities; the context, production, sharing, or impact of information; or social factors such as trust and power dynamics are seldom even mentioned in resilience policy and practice. Most studies to date do not take into account informal information networks, people's perceptions about information in their community, or the impact of information transmitted through word of mouth. Issues of change and adaptation, or the use of information to cope with the events, shocks, and stressors that disrupt the performance of systems and the lives of citizens, has never been systematically analyzed or incorporated into an operational framework.

These elements, which deliberately incorporate an appreciation of social relationships, human context, and dynamic networks of control and influence, are critical to understanding the impact of media, information, communication, and various information technologies on social systems. Information is inherently social and has meaning only in social context. As such, we must leverage a broad and universal framework that emphasizes these dimensions - **information ecosystems** – to truly understand a community's unique information obstacles, challenges, and needs. The use of information ecosystems as a

PREFACE

> "THE CONCEPTUAL LIMITATION OF RESILIENCE IS THAT IT DOES NOT NECESSARILY ACCOUNT FOR THE POWER DYNAMICS THAT ARE INHERENT IN THE WAY CITIES FUNCTION AND COPE WITH DISRUPTIONS."
>
> CITY RESILIENCE FRAMEWORK, ARUP

framework creates the opportunity for a vastly diverse array of frames of analysis, ranging from the sum total of all information points and flows in a community, to a very narrow slice of the system. The framework is also the first to conceive of information needs, information creation, and information distribution as multi-dimensional, dynamic, and fluid systems that adapt and regenerate according to the specific context of a given situation and community.

Information ecosystems are fundamental to resilience. Information is the lifeblood of resilience – it is the foundation for human behavior. Without the ability to access, create, disseminate, and share critical information about the world around them, individuals are incapable of understanding the challenges they confront, adapting to an evolving environment, nor ultimately, improving their lives. As such, a significant element in the understanding, building, and reinforcement of community resilience must be an understanding of how to support the health of information ecosystems. More broadly, understanding how information flows, and how to ensure that information has an impact at all levels of a city or system, is essential for operationalizing resilience strategies and should be a central concern for all planning, practice and investment in this space. How information is interpreted, perceived, and trusted is extremely important in understanding how resilience policies and programs will be transformed in practice.

The information ecosystems framework, therefore, offers unique value in understanding the complexities of information so that decision makers can leverage information as a resource for the wellbeing of populations. The approach is applicable at multiple scales and timeframes, from the hyper-local, to the city, to systems within systems. As it enables highly granular human insights grounded in social context, it offers insights for actively engaging communities down to the individual citizen as participants and builders of resilience. For anyone interested in improving information access, flow and uptake in target communities, an understanding of information ecosystems is key not only to the design of appropriate and effective interventions that have impact,

> "EXCHANGE OF INFORMATION BETWEEN SYSTEMS ENABLES THEM TO FUNCTION COLLECTIVELY AND RESPOND RAPIDLY THROUGH SHORTER FEEDBACK LOOPS THROUGHOUT THE CITY."
>
> CITY RESILIENCE FRAMEWORK, ARUP

> "[I]NFORMATION HOLDS SYSTEMS TOGETHER AND... DELAYED, BIASED, SCATTERED, OR MISSING INFORMATION CAN MAKE FEEDBACK LOOPS MALFUNCTION. DECISION MAKERS CAN'T RESPOND TO INFORMATION THEY DON'T HAVE, CAN'T RESPOND ACCURATELY TO INFORMATION THAT IS INACCURATE, AND CAN'T RESPOND IN A TIMELY WAY TO INFORMATION THAT IS LATE. I WOULD GUESS THAT MOST OF WHAT GOES WRONG IN SYSTEMS GOES WRONG BECAUSE OF BIASED, LATE, OR MISSING INFORMATION.
>
> IF I COULD, I WOULD ADD AN ELEVENTH COMMANDMENT TO THE FIRST TEN: THOU SHALT NOT DISTORT, DELAY, OR WITHHOLD INFORMATION. YOU CAN DRIVE A SYSTEM CRAZY BY MUDDYING ITS INFORMATION STREAMS. YOU CAN MAKE A SYSTEM WORK BETTER WITH SURPRISING EASE IF YOU CAN GIVE IT MORE TIMELY, MORE ACCURATE, MORE COMPLETE INFORMATION."
>
> – DONELLA MEADOWS, THINKING IN SYSTEMS

but fostering strategies that empower and build upon a community's existing relationships internally and with external stakeholders.

At the heart of the Internews' work is the vision that *healthy information ecosystems are a root solution to furthering human progress.* Through research in the closed societies of Pakistan and Burma, as well as this current work supported by the Rockefeller Foundation, the Internews Center for Innovation & Learning continues to develop a deeper appreciation for and description of the information dynamics, flows, networks, and communication behaviors that characterize information ecosystems in environments of change and disruption.

It is our belief that applying our expertise in information ecosystems to the context of the Rockefeller Foundation's resilience strategies is not only a fundamental element of strengthening our support for communities around the world, but is a valuable opportunity to bring our expertise to urban planners and others in the resilience space to collaborate and build a body of knowledge around the critical role of information in embracing change. This report is a first step toward demonstrating and building a body of evidence around the importance of healthy information ecosystems in understanding, building, and reinforcing resilience.

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PART I

DEFINING INFORMATION ECOSYSTEMS

A. INFORMATION ECOSYSTEMS: WHY A NEW PARADIGM?

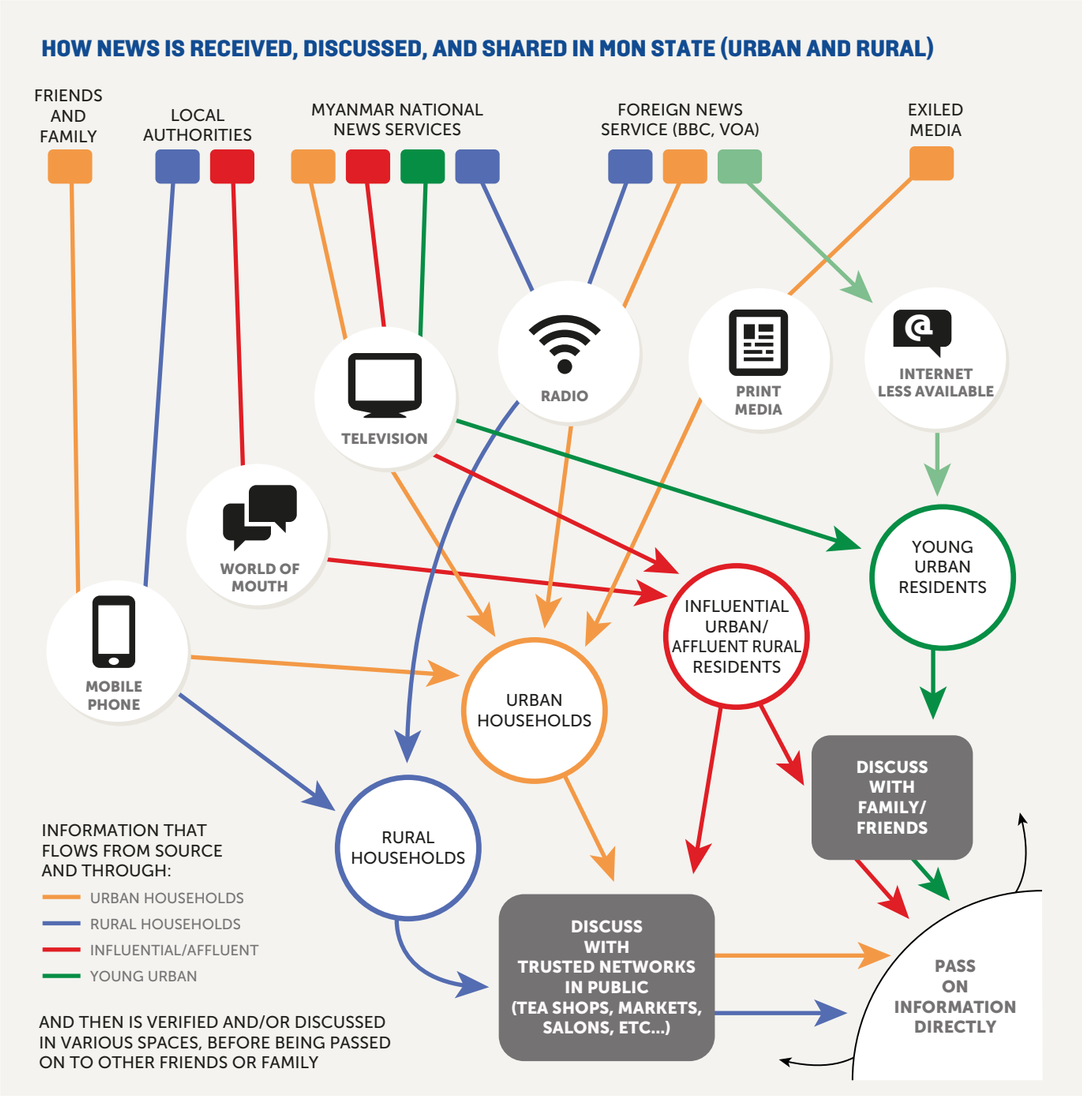
Recent years have seen more changes in the global media and journalism environment than ever before in Internews' 30+ years of history. From the rapid trending of the mobile phone as a primary source of information, to the decline of traditional media in many places around the world, the dramatic evolution in how people access, produce, consume, and share information has challenged our fundamental understanding of how to create quality local news and information.

Recognizing that new information dynamics necessitated a new and forward-looking model of comprehending local information systems, the Internews Center for Innovation & Learning began its investigations into "information ecologies" in 2012. For the first time, this optic conceived of information needs and information creation and distribution as fluid systems that adapt and regenerate according to the obstacles, challenges and needs of a given situation and community. Among other goals, this framework aimed to understand the utility and impact of new tools and technologies within specific contexts, including their unintended consequences on traditional information flows.

Now referred to as "information ecosystems," this approach combining macro-level analysis (i.e. media landscape, information infrastructures, and political/regulatory environments), granular observations (i.e. information availability, needs, and distribution), with human and social insights (i.e. identifying information disseminators and influencers) is believed to be the best methodology for understanding how to deliver information with impact. By understanding information ecosystems, policymakers and practitioners can design the most appropriate and effective strategies that can serve even the most information deprived communities and societies.

This report offers an opportunity to take a systemic and holistic approach in defining information ecosystems and examining how they function across a spectrum of change. In Part I, we present a preliminary definition of information ecosystems and eight critical dimensions for understanding them, based on an

I. DEFINING INFORMATION ECOSYSTEMS

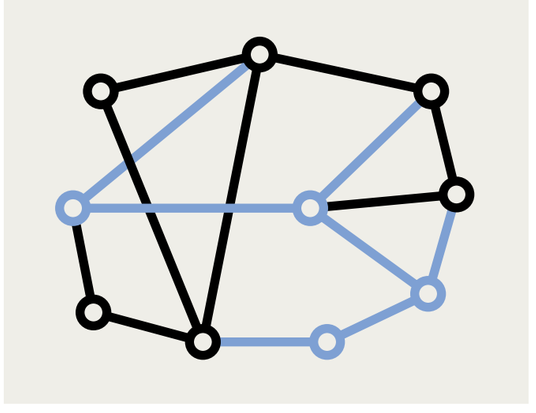


A sample information ecosystem analysis from Mon State, Myanmar examining information sources and flows for different segments of the population. This is just one way of analyzing an information ecosystem; there are many others.

extensive literature review.[2] In order to ground our definitions of information ecosystems, we then look at these concepts "in action" through an examination of Internews' previous research in Japan, Pakistan, Myanmar, and Indonesia in Part II.

B. WHAT IS AN INFORMATION ECOSYSTEM?

Borrowed from environmental studies, the term "information ecosystem" is used to describe how local communities exist and evolve within particular information and communication systems. Within these systems, different types of news and information may be received from outside then passed on to others—through word of mouth, key community members, phone, the Internet, and the like. An examination of an information ecosystem looks at the flow, trust, use and impact of news and information.



2 THE FRAMEWORK PRESENTED HERE SYNTHESIZES AND EXTENDS RELEVANT THEORY ABOUT INFORMATION ECOSYSTEMS AND ITS UNDERPINNING CONCEPTS. THIS SECTION DRAWS ON KEY FINDINGS FROM THE EMBRACING CHANGE LITERATURE REVIEW, FOUND AT https://innovation.internews.org/research/what-information-ecosystem-why-does-it-matter.

An information ecosystem is not a static entity; it is by nature constantly evolving and changing. Nor is it a discrete form; it can be defined at many levels, from global to national to community to interest-based groupings within communities. Any examination of an information ecosystem goes beyond traditional audience research on media access and consumption; it adds considerations of information needs, information creation, and information distribution as dynamic systems that adapt and regenerate according to the broader developmental challenges and needs of a given community.

C. INFORMATION ECOSYSTEMS: A PRELIMINARY DEFINITION

"Information ecosystems" broadly refers to a loose, dynamic configuration of different sources, flows, producers, consumers, and sharers of information interacting within a defined community or space. A resonant and promising idea, information ecosystems are an underdeveloped concept in the literature. Most uses of the term assume a common understanding without laying out a definition. It is not yet a common concept, and even less so with respect to the development and resilience of communities. This under-elaboration and minimal currency offers an opportunity to explore the theoretical and practical groundwork that underlies the term, and to craft the definition that best suits the goals for the Embracing Change project.

The idea of information ecosystems stands on the shoulders of several other families of theory: ecosystems, resilience, and at the very core, systems theory. The systems framework establishes that an information ecosystem is made up of complex sets of relationships. Any systems-driven analysis thus will need to consider the structure of the system, how to understand the relationships among its parts, how to

I. DEFINING INFORMATION ECOSYSTEMS

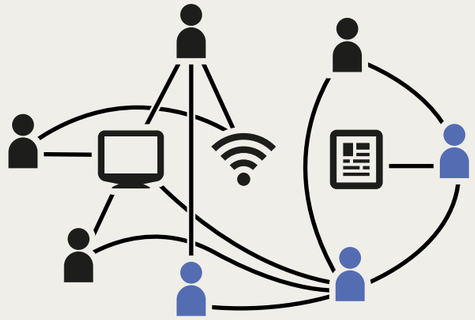
trace and examine the flows of information that are critical to those relationship, and the relationship of the system's structure to its behavior.

To systems thinkers, the world is a collection of feedback processes. Information flows are vital to feedback processes, and thus, information is the lifeblood of any and all systems. Information is inherently social and acquires meaning only in a social context. Information is a relationship; generating and receiving information are both creative acts. Information is an activity, not a thing; it has to move or it ceases to be of value.

To understand information ecosystems, contextual analysis is critical. Information is a defining aspect of human relationships; thus the question of trust is critical to the study of information ecosystems. Information must move or it has no reason to exist; because it moves, it transforms as context and actors shift.

Based on an extensive literature review and Internews' extensive global field experience as an implementer of media and information projects, the Center puts forth the current working definition of information ecosystems:

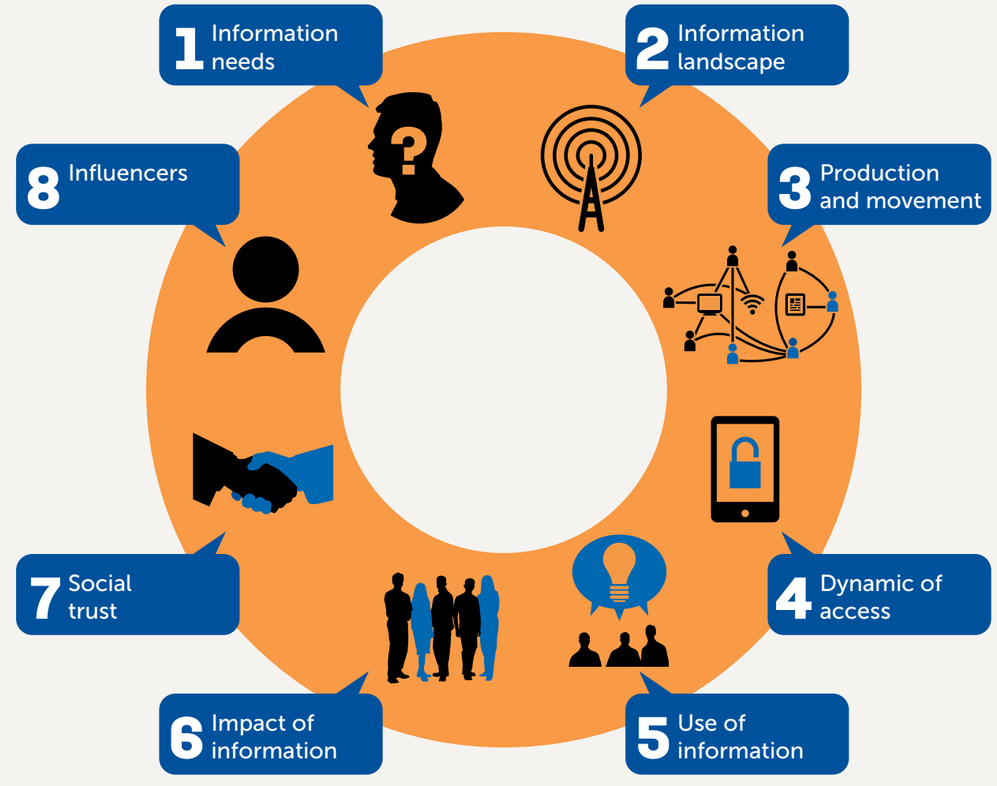
> ***Information ecosystems*** *are complex adaptive systems that include information infrastructure, tools, media, producers, consumers, curators, and sharers. They are complex organizations of dynamic social relationships through which information moves and transforms in flows. Through information ecosystems, information appears as a master resource, like energy, the lack of which makes everything more difficult.*



This definition is intended to be a preliminary one, and will continue to evolve through further research.[3]

D. EIGHT CRITICAL DIMENSIONS OF INFORMATION ECOSYSTEMS

This conceptual framework also includes **Eight Critical Dimensions of Information Ecosystems**, which enable a holistic understanding and analysis of the information ecosystem of any given community or place. These dimensions are dynamic and in constant flux, depending on the specificities of each context at a given moment in time. To illustrate how each would be reflected in a healthy information ecosystem, we provide a few general principles for each dimension. In the next section of this report, the case studies provide concrete examples illuminating these principles. These dimensions, like the definition of information ecosystems, were constructed out of the theoretical literature review and observations from Internews' field experience. The dimensions are interconnected and non-hierarchical, and are provided as a preliminary analytical tool with which to understand resilience from a new perspective.[4]



3 FOR EXAMPLE, COMPLEX ADAPTIVE SYSTEMS BY DEFINITION EXHIBIT EMERGENCE; THEY TRANSFORM IN UNPREDICTABLE WAYS. UNDERSTANDING THIS DYNAMIC IN INFORMATION ECOSYSTEMS IS AN IMPORTANT TOPIC FOR FUTURE RESEARCH.

4 FOR AN EXAMPLE OF EARLY FORAYS INTO APPLYING THE FRAMEWORK, SEE http://resilientinfoeco.tumblr.com/post/91388759035/putting-the-infoeco-framework-into-action. THIS EXAMPLE SHOWCASES SISI NI AMANI, A KENYA-BASED ORGANIZATION THAT USES A COMBINATION OF TRADITIONAL AND INNOVATIVE APPROACHES TO COMMUNICATION AND DIALOGUE TO INCREASE CIVIC ENGAGEMENT AND PREVENT VIOLENCE IN KENYAN COMMUNITIES.

I. DEFINING INFORMATION ECOSYSTEMS

1. INFORMATION NEEDS

• Information needs across different segments of the population, and how they change over time

• The degree that information needs are known to information producers and consumers

GENERAL PRINCIPLES

• Populations' information needs are diverse and changing, and sub-groups within a community will have vastly different information needs. Information and communication needs assessments are a critical first step in designing programs.

• Information must be inclusive and relevant to all segments of the population, including at the hyper-local community level. Policymakers and practitioners must have sufficient channels for listening and adapting to community feedback.

• Information must be unbiased, and should not serve the interests of media organizations, the government, or others. Without locally relevant and actionable information, communities are left disempowered, helpless, and frustrated.

2. INFORMATION LANDSCAPE

• The physical and institutional infrastructures that support information production and flow, including media outlets, distributions systems, production units, etc.

• Intermediary organizations: media, government, private industry, civil society

• The characteristics of information providers and their capacity to verify, filter, sort, and disseminate information

GENERAL PRINCIPLES

• While elements of macro infrastructure (e.g. national radio broadcasting networks, cell phone towers) are often the easiest to identify and support within media and information landscapes, Internews has found that the hyper-local, community level information landscape is the backbone of healthy information ecosystems. Hyper-local information is critical for inspiring action, and its flow depends on capable information providers and local influencers (please see the eighth dimension).

• Different groups access information through different means; understanding the information landscape ensures that information is matched with the most appropriate and resonant way to communicate it for impact.

3. PRODUCTION AND MOVEMENT

• The variety of types of information available (e.g. government services, community news)

• The producers of information and the owners of the means of production and dissemination

• The role of word of mouth, social media, bulletin boards, and other local information hubs

• The role of Internet and mobile media as new, and rapidly expanding sources of information flows

• The variety of types of content available, and to whom

• Impact of information as storytelling

GENERAL PRINCIPLES

• Strengthening information flows is not just about building new tools or technologies; it is also about redundancy and coordination. Healthy information ecosystems are characterized by a diversity of sources capable of providing the same message. In particular, while sophisticated sources of information like SMS and TV are typical of more developed societies, these systems are often the most vulnerable to disruption.

• Strengthening information flows is also about richness of content – not just where and how information flows, but what types of information are available, how compellingly information is conveyed, and whether information is understandable and actionable.

4. DYNAMIC OF ACCESS

• The environment in which information flows (e.g. political, cultural, time, cost, and other factors)

• Ease of accessing, finding, using, sharing, and exchanging different types of information

• Barriers to interaction and participation

• Broader structures that influence access: governance, legal, political, economic, and infrastructural factors

• Social inclusion

GENERAL PRINCIPLES

• Power relationships and other forms of social constraints profoundly shape access to information. Understanding power dynamics is critical to designing for inclusive access.

• Specific, contextual understanding of what access looks like on the ground is also critical.

• Techniques such as design research, combining immersive observation and ethnographic investigative methods, may be the best way to understand the intrinsic constraints and motivations that drive behaviors around information, as well as build a nuanced picture of the dynamics of access.

I. DEFINING INFORMATION ECOSYSTEMS

5. USE

• Factors influencing information's relevance to people: content, medium/ format, source, literacy, habit

• What consumers and audience do with information that is received

• How information is processed, disseminated, and applied

GENERAL PRINCIPLES

• Once information reaches its intended audience, there are many factors that influence whether and how it is actually used. Therefore, it cannot be assumed that an environment with plentiful information is necessarily one with a healthy information ecosystem.

• Before it is used, information is often verified, validated, and triangulated at a hyper-local level through friends and trusted contacts

6. IMPACT OF INFORMATION

• The impact of information on individual and community opportunity, health, and economic development

• Relationship between information, knowledge and behavior change

• Community organization around different types of information

• Effects on community planning and action

• Effects on policy and implementation

• The effect of information on civic engagement

GENERAL PRINCIPLES

• Relevant, compelling, and accessible information has a positive impact on people's lives in terms of their agency and overall well-being.

• However, unless information resonates with people's needs and interests, it will not foster agency and action.

• Information may not always have a positive impact on knowledge and behavior change; in some cases, it may even perpetuate state influence over the architecture of public information and discourse. It may be that information production, distribution, and access are robust in a community; however, if information does not promote empowered decision making (i.e. is primarily entertainment or "managed" news content), it will not actually foster the development of a more empowered or enlightened citizenry.

7. SOCIAL TRUST

• Influence of trust networks on the flow and use of information

• Trust building around information

• Trust in information sources, medium, content

• Disruptions in trust tied to information (or the lack of information)

• Challenges in building trust around information flows

GENERAL PRINCIPLES

• A healthy information ecosystem can only exist when information sources are trusted, and individuals have the ability to verify and validate information through their established trust networks.

• Trust in information is ultimately influenced by a community's social dynamics at the moment, coupled with any historical or cultural factors that may generally color attitudes about government, external intervention, crises, conflict, or other sociopolitical events.

8. INFLUENCERS

• The people, organizations, and institutions that influence how different types of information flow

• Builders of trust in information

• Change in influence over time, especially during disruption

GENERAL PRINCIPLES

• Influence rests on political, religious, economic, and social status. It can also emerge from disruptions of traditional social structures precipitated by specific events, or the advent of new technologies. The democratization of information and communication technologies means that control over information production and flows is more unpredictable than ever before.

• Influencers can act as information bridges, connecting social groups that have weak or nonexistent ties. This is critical for ensuring that information flows are healthy and can adapt to function during change or disruption.

I. DEFINING INFORMATION ECOSYSTEMS

E. INFORMATION ECOSYSTEMS & ADAPTATION TO CHANGE

Internews' experience has revealed consistently and across a myriad of contexts that quality information and communication are critical to anticipating, planning for, and ultimately responding to change. When people are supported by strong information ecosystems that allow them to access and exchange critical information, they can effectively adapt and flourish in response to more frequent and large-scale changes in their environment.

Timely and accurate information for populations, as well as strong and healthy information flows between communities, responders, and local media, allows communities to understand the challenges they confront, self-organize and take on responsibilities in response, participate in recovery and resilience efforts, and reach consensus on how to build back better. As such, information fosters the capabilities and aspirations of individuals and communities: it empowers people to take an active role in their own resilience in a sustained, systemic manner, while reducing dependency on external intervention that is typically only available for traumatic, large-scale events.

> "RESILIENCE IS THE CAPACITY OF INDIVIDUALS, COMMUNITIES, AND SYSTEMS TO SURVIVE, ADAPT, GROW, AND EVEN TRANSFORM IN THE FACE OF CHANGE, STRESS, SHOCKS, AND DISRUPTION."
>
> - ADAPTED FROM THE ROCKEFELLER FOUNDATION

> "RESILIENCE FOCUSES ON ENHANCING THE PERFORMANCE OF A SYSTEM IN THE FACE OF MULTIPLE HAZARDS, RATHER THAN PREVENTING OR MITIGATING THE LOSS OF ASSETS DUE TO SPECIFIC EVENTS."
>
> - CITY RESILIENCE FRAMEWORK, ARUP

While our research demonstrates that information ecosystems are rarely acknowledged within resilience policy and practice, a review of the City Resilience Framework, developed by Arup's International Development team and supported by The Rockefeller Foundation indicates that healthy information ecosystems are already an implicit cornerstone of resilient cities and systems. As the City Resilience Framework is highly aligned with our own conception of resilience (built from the literature review and Internews' experience), Internews is adopting it as our definition of resilience.[5] This framework will help us to precisely analyze the linkages between dimensions of information ecosystems and qualities of resilient systems.[6]

5 THE DEFINITION OF RESILIENCE ARTICULATED IN THE FRAMEWORK DOES NOT REFER TO THE ESSENTIAL CHARACTERISTICS OF THE SYSTEM, OR PUT DIFFERENTLY, FEATURES THAT REMAIN UNCHANGED DESPITE DISRUPTION. WHETHER INFORMATION ECOSYSTEMS SUPPORT A COMMUNITY'S ESSENTIAL CHARACTERISTICS, OR COMMUNITY TRANSFORMATION INSTEAD, IS FERTILE GROUND FOR FUTURE RESEARCH.

6 THE TEXT ON THE FOLLOWING PAGE IS TAKEN DIRECTLY FROM ARUP, "CITY RESILIENCE INDEX: CITY RESILIENCE FRAMEWORK," APRIL 2014, P.5

QUALITIES OF RESILIENT SYSTEMS

REFLECTIVE

Reflective systems are accepting of the inherent and ever-increasing uncertainty and change in today's world. They have mechanisms to continuously evolve, and will modify standards or norms based on emerging evidence, rather than seeking permanent solutions based on the status quo. As a result, people and institutions examine and systematically learn from their past experiences, and leverage this learning to inform future decision-making.

ROBUST

Robust systems include well-conceived, constructed and managed physical assets, so that they can withstand the impacts of hazard events without significant damage or loss of function. Robust design anticipates potential failures in systems, making provision to ensure failure is predictable, safe, and not disproportionate to the cause. Over-reliance on a single asset, cascading failure and design thresholds that might lead to catastrophic collapse if exceeded are actively avoided.

REDUNDANT

Redundancy refers to spare capacity purposely created within systems so that they can accommodate disruption, extreme pressures or surges in demand. It includes diversity: the presence of multiple ways to achieve a given need or fulfill a particular function. Examples include distributed infrastructure networks and resource reserves. Redundancies should be intentional, cost-effective and prioritized at a city-wide scale, and should not be an externality of inefficient design.

FLEXIBLE

Flexibility implies that systems can change, evolve and adapt in response to changing circumstances. This may favor decentralized and modular approaches to infrastructure or ecosystem management. Flexibility can be achieved through the introduction of new knowledge and technologies, as needed. It also means considering and incorporating indigenous or traditional knowledge and practices in new ways.

RESOURCEFUL

Resourcefulness implies that people and institutions are able to rapidly find different ways to achieve their goals or meet their needs during a shock or when under stress. This may include investing in capacity to anticipate future conditions, set priorities, and respond, for example, by mobilizing and coordinating wider human, financial and physical resources. Resourcefulness is instrumental to a city's ability to restore functionality of critical systems, potentially under severely constrained conditions.

INCLUSIVE

Inclusion emphasizes the need for broad consultation and engagement of communities, including the most vulnerable groups. Addressing the shocks or stresses faced by one sector, location, or community in isolation of others is an anathema to the notion of resilience. An inclusive approach contributes to a sense of shared ownership or a joint vision to build city resilience.

INTEGRATED

Integration and alignment between city systems promotes consistency in decision-making and ensures that all investments are mutually supportive to a common outcome. Integration is evident within and between resilient systems, and across different scales of their operation. Exchange of information between systems enables them to function collectively and respond rapidly through shorter feedback loops throughout the city.

I. DEFINING INFORMATION ECOSYSTEMS

While it is implicit from the Qualities of Resilient Systems that healthy information ecosystems are vital to resilience, Internews argues that it is important to make this element explicit and to better understand its dynamics. Without healthy information ecosystems, articulated goals and characteristics of resilience simply cannot be achieved. For example, if governments, donors, investors, policymakers, and the private sector hope to foster resilience by understanding dynamic networks of control, influence and power and ensuring inclusion of all social groups and neighborhoods, it is vital to systematically assess and support the information ecosystem within a given community or place. Similarly, the City Resilience Framework identifies resource coordination, collective action, social cohesion, social networks, and effective communications systems as key features of resilient cities and systems (to name just a few). These ambitions cannot be achieved solely through technology or tools, but must also rely upon strong, redundant, and trusted information flows and relationships that underlie and sustain day-to-day life within a community. Simply put, a community with a strong information ecosystem is a more resilient one.

PART II

INFORMATION ECOSYSTEMS & RESILIENCE

INSIGHTS FROM INTERNEWS CASE STUDIES

In order to move beyond a theoretical understanding of information ecosystems and their relationship with resilience, we now apply the conceptual framework to four real world cases of disruption and change. This section examines four Internews Case Studies that were, to varying degrees, undertaken from different information ecosystems perspectives.[7] While these Case Studies were written before the current information ecosystems framework was constructed, they do provide enough data to test the framework and construct prototype typologies of information ecosystems.

1. "Trust, Influence and Connectivity: Understanding Information Ecosystems in Pakistan's Tribal Areas" by Panthea Lee (2013)
2. "Connecting the Last Mile: The Role of Communication in the Great East Japan Earthquake" by Lois Appleby (2013)
3. "Information Ecosystems in Transition: A Case Study from Myanmar" by Andrew Wasuwongse and Alison Campbell (2014)
4. "Indonesia: Crisis Communication Channels" by Matt Abud (2013)

The case studies provide a diversity of types of information ecosystem, levels of economic development, and types of change––including acute disaster, long-term stresses, and slow-onset crises. They allow us to identify common features of information ecosystems across different contexts and formulate preliminary typologies that can serve as useful analytical and predictive models for policy and planning. The case studies also demonstrate weaknesses in information ecosystems undermine resilience. This presents areas for further investigation through the Jakarta Information Ecosystems (InfoEco) Pilot and the New York InfoEco Pilot.[8]

7 NOTE THAT THESE STUDIES WERE CONDUCTED PRIOR TO OUR CURRENT INFORMATION ECOSYSTEMS FRAMEWORK, AND WHILE THEY REFLECT SOME OF THE VALUES AND CHARACTERISTICS OF THE FRAMEWORK ILLUSTRATED IN PART 1, THEY DO NOT ADHERE TO IT. FOR A MORE DETAILED LOOK AT THE DATA ACROSS THE FOUR CASE STUDIES, SEE THE COMPARATIVE CHARTS IN ANNEX 2.

8 INFORMATION IN THE SUMMARY BOXES WAS ADAPTED FROM THE RESPECTIVE CASE STUDIES.

II. INFORMATION ECOSYSTEMS & RESILIENCE

CHARACTERISTICS OF INTERNEWS CASE STUDIES

	PAKISTAN	JAPAN	MYANMAR	INDONESIA
TYPE OF DISRUPTION	Instability and underdevelopment	Acute crisis event	Political and economic opening; post-conflict recovery	Environmental disasters
SPEED AND SCALE OF DISRUPTION	Long-term, chronic	Sudden-onset, large scale	Sudden, uneven	Chronic, sudden-onset
LEVEL OF DEVELOPMENT	Low	High	Low	Medium
INVESTIGATIVE LENS ON THE INFORMATION ECOSYSTEM	Everyday human impacts of information challenges	Information ecosystems in post-disaster survival and recovery	Information ecosystems within a history of crisis; such as repression and conflict	Crisis communications across contexts (urban and rural, local and national disasters, areas with/without infrastructure and with/without preparedness efforts)

A. OVERVIEW OF CASE STUDIES

CASE STUDY 1: INSTABILITY AND UNDERDEVELOPMENT IN FATA, PAKISTAN

Pakistan's present-day Federally Administered Tribal Areas (FATA) are the homeland for three million Pashtun residents and thousands of Afghan refugees spread across three thousand mostly rural villages and towns. Decades of turbulence and semi-autonomous governance have alienated inhabitants from the rest of Pakistan and kept FATA in a perpetual state of instability, poverty, and isolation. Pakistan's per-capita development spending in FATA is one-third of those in other parts of the country leading to critical gaps in essential services and inadequate infrastructure, including information infrastructure. Compounding these obstacles is the existence in parts of FATA of militant groups that threaten regional security. Since 2004, this threat has led to US intelligence operations, targeting FATA with drone strikes in the attempt to defeat Taliban and Al-Qaeda militants. The political and physical alienation of the region has further contributed to an already-wide gap of understanding between the global community and the people of Pakistan's tribal regions.

CASE STUDY 2: GREAT EAST JAPAN EARTHQUAKE

On March 11, 2011, a massive underwater earthquake measuring 9.0 on the Richter scale struck off the Pacific coast of the Tohoku region in northeast Japan. The earthquake was the most powerful ever recorded in Japanese history and caused a mega-tsunami that toppled seawalls and spread over 500 square kilometers. The tsunami destroyed towns and villages along the coastline and resulted in over 18,000 dead or missing, 6000 injured and 470,000 survivors seeking shelter. The tsunami also damaged the Fukushima nuclear power plant, causing radioactive material to be leaked into the sea. While the damage was catastrophic, it is generally acknowledged that Japan's advanced disaster preparedness measures prevented the number of fatalities and damage from being far greater.

CASE STUDY 3: MYANMAR'S DEMOCRATIZATION AND OPENING

Until recently, few might have predicted the political, social and economic developments now taking place in Myanmar. Rapid removal of restrictions present a unique opportunity to conduct research among the most remote, least developed ethnic minority areas, such as Mon State, that chronically experience conflict. Little has been documented about the way in which information circulates in the ethnic states, what information people need, how they meet these needs through informal networks, and what kinds of information they trust and can access. Internet and mobile phone penetration are minimal.

II. INFORMATION ECOSYSTEMS & RESILIENCE

CASE STUDY 4: THREE ENVIRONMENTAL DISASTERS IN INDONESIA

Flooding has long been a fact of life in the Indonesian capital, Jakarta. Recent decades, however, have seen a significant increase in severity, affecting areas that had not previously been susceptible. Starting January 16, 2013, heavy monsoon rains combined with broken embankments and seasonally high tides led to extreme flooding across Jakarta, causing approximately 41 casualties and some 45,000 displaced. Under a state of emergency, government agencies, civil society organizations, businesses, and citizens all scrambled to meet the sudden humanitarian needs of those affected.

The Rokatenda volcano dominates the isolated Palue Island, home to some 12,000 people. In November 2012, Rokatenda began intense activity and continued to experience repeated tremors with frequent ejections of smoke, ash, and debris. The three villages closest to the volcano, Nitlung, Lidi, and Rokirole were the most affected and account for many of the approximately 4,900 people displaced.

After the catastrophic 2004 tsunami, Aceh, a region on the island of Sumatra, received extensive investment in early warning systems and crisis communications. When two earthquakes struck off the west coast of northern Sumatra on April 11, 2012, measuring 8.6 and 8.2 on the Richter scale, the systems were put to the test. The first quake triggered a tsunami evacuation warning; fortunately, no tsunami materialized. However, the experience exposed significant weaknesses in the disaster response mechanism: thousands were stranded as they tried to heed the evacuation warning.

B. WHY INFORMATION ECOSYSTEMS MATTER FOR RESILIENCE

These four case studies highlight several observations about information ecosystems that are particularly significant in building resiliency:

Firstly, **information ecosystems are shaped and constrained by their context.** The ability for information to foster community resilience depends on broader factors that define the context, including a country's media laws, the presence of conflict, the poverty gap, and the current development status of the entire country. The case studies show that the role information can play in managing change is linked with other features of the system, such as infrastructure and policy. Barriers such as a lack of electricity or community isolation can severely hinder information's movement, the relevance of information produced, and people's usage of that information. Likewise, factors such as demographics can dramatically change the way that people experience and recover from a crisis. To build resilience at the hyper-local level, it is critical to strengthen information ecosystems with an appreciation of contextual constraints.

Second, **trust is absolutely essential for information to have an influence on the lives of communities and individuals**. Naturally, the strongest level of trust is found at the local levels through information shared among friends and families. In all of the case studies, people evaluate information in multiple ways to establish its validity. They consider eyewitness accounts, the medium, and whether there were videos or photographs, and then compare these inputs with other sources of information including friends and family. In all cases, trust in information is difficult to establish, yet central to the way that information is accepted. Information ecosystems with strong trust bonds make for more resilient communities.

Third, the case studies confirm the notion that **information is power**. For example, in Pakistan, where tribal and religious leaders once held the most influence, others have now begun to occupy equal if not more influential positions. For example, educated and tech-savvy citizens have begun to gain influence due to their ability to utilize new media to access and share relevant information and validate official sources of information.

Lastly, one of the most interesting themes central to all case studies was that **technology broadens opportunities for citizens to participate in and shape their lives**. For example, the ability for a community to share information through social media and other Internet platforms allows people to have a voice in setting the agenda and encouraging producers to generate needed information. Additionally, the 24-hour news cycle and the ability for instant updates allows people to get information whenever they want it, and far more quickly than ever before.

C. HOW INFORMATION ECOSYSTEMS MATTER FOR RESILIENCE

The case studies also provide tangible examples of how various dimensions of information ecosystems play into community resilience. Using the **Eight Critical Dimensions of Information Ecosystems** (described in Part I.D) as a framework for analysis, we can identify how strengthening certain dimensions can foster adaptation and recovery from disruption, whereas barriers and weaknesses in other dimensions undermine resilience and lead to breakdown in systems.

1. INFORMATION NEEDS

- ***Inclusive and relevant information is essential.*** Government and major media producers often set an information agenda that is too broad or too sensational, failing to serve the information desires and needs at the community level. In the **Indonesia** case study, media conglomerates provided sensationalized crisis coverage to benefit the media owners. This failed the people directly affected by the disaster. Sensational stories that drive ratings should not take precedence over empowering and informing communities through relevant and unbiased information.

- In **Japan**, mainstream media coverage focused on the nuclear crisis and did not provide the information that people in evacuation centers needed most. This barrier stemmed from a lack of sufficient channels for local information and inquiries to reach policymakers and crisis responders. It also highlights the fact that information providers often have their own agenda. Feeling that their urgent needs for local information are treated as unimportant, people in communities can end up feeling helpless and frustrated.

II. INFORMATION ECOSYSTEMS & RESILIENCE

2. INFORMATION LANDSCAPE

- ***The hyper-local, community-level information ecosystem is the backbone of effective information flows.*** In all the case studies, local influencers are key, as they are best able to discern what information is valuable and capitalize on trusting relationships to disseminate it. In **Indonesia**, while television is the most important source of information for people in Jakarta, electricity-dependent sources of information are unusable during flooding. Instead, residents rely on local administrators or informal community leaders to pass on data, warnings, and other information they acquire from their administrative superiors or other channels. Residents receive notifications either by door knocking or by announcements on local mosque loudspeakers.

- As the case in **Japan** shows, while national preparations can be robust, there remain gaps that only local communities can fill. Even if macro-, city-level systems remain functional, hyper-local information is irreplaceable. In Japan, despite the presence of high-tech national information mechanisms, the main sources of information for many were local initiatives such as community radio stations, community and local newspapers, newsletters and announcements at evacuation centers.

3. PRODUCTION AND MOVEMENT

- In **Japan**, platforms such YouTube, Facebook, and Twitter were used to spread information about individual safety, educate wider audiences about what was happening, map humanitarian relief gaps, and generate funds. However, this highlighted the risk of ***over-reliance on technology*** that could be rendered unusable because of incapacitated networks and blackouts. Further, much of the consumer technology was not designed to function under high load crisis conditions, which could lead to more significant breakdowns.

- The case study in **Myanmar** shows that ***improving information flow is not just about new tools for information sharing, but finding ways to leverage and compound existing information dissemination practices***. For example, since word of mouth is the best way to spread a message in Mon State, at the community level it is important to tailor messages to be easily remembered and repeated. The importance of community in all our case studies, coupled with the fact that information is almost always locally validated through trusted sources, shows that inclusivity and local participation in co-designing any information intervention is central to success.

- ***It is critical to coordinate strategies for information content and dissemination.*** One of the major gaps in fostering resilience through information is the lack of coordination among the different producers and disseminators of information. Without such collaboration, there are inefficiencies and unnecessary overlaps. The creation of the ANY Liaison Council in the **Japan** case study highlights the need for this type of collaboration. The council is the joint venture of three major newspaper groups to ensure better cooperation in any future disaster, allowing these media companies to use one another's facilities in emergencies. This will allow multiple, diverse channels to provide the same basic information. Diversity in source, but redundancy in message, is vital to overcoming infrastructural problems and providing validity.

4. DYNAMIC OF ACCESS

- ***Even in the most sophisticated systems, it is essential to ensure redundancy of access to information***. Although technology-based sources can provide improved access to information, by their very nature they are highly vulnerable to disruption in crises. ***Hence, the more dependent communities become on high-tech tools, the less resilient they become***. Across all case studies it is apparent that with greater infrastructure and economic development, the most commonly used medium for information also becomes more high-tech. For example, in all our countries, newspapers are seen as the medium of historical record, and are no longer a primary source of information. In the developing nation case studies, radio is increasingly being replaced by television as the most used source of information, and in Japan, the most highly developed nation in our case studies, the Internet is beginning to replace television as the primary source of information. All case studies suggest the most resilient form of communication through all crisis situations is radio, yet many countries have built their crisis structures on SMS and television broadcasts, which depend on mobile phone networks and electricity. These infrastructures are usually the first to fail in a crisis.

- New media can support healthy information flow, but must be accessible to all parts of the population. For example, in Japan, where crisis communication was built largely on new media and television, 65.8% of the deaths in the villages of Iwate, Miyagi, and Fukushima were of people over 60 who lacked much access to these technologies. Information access is not homogeneous, and understanding demographic and group patterns is a first step in designing effective information strategies.

5. USE

- ***Information must be trusted and validated before it will inspire action***. For example, in a crisis situation such as occurred in Japan, the presence of one type of information was not enough to make individuals respond to earthquake warnings; people needed to hear the information from the government and the media, and then verify it through friends and families.

6. IMPACT OF INFORMATION

- ***Information must resonate with people's needs and interests in order to foster agency and action***. To foster adaptation and resilience, media must provide relevant and reliable information that addresses hyper-local social and development challenges. Information provided in the FATA area of **Pakistan** focused overwhelmingly on conflict that people felt little ability to change. What communities really wanted was information to help navigate instability, build livelihoods, and achieve aspirations. Media outlets emphasized incidents rather than patterns, challenges rather than solutions, and symptoms rather than causes, fostering a sense of helplessness. Residents therefore felt frustrated and deprived of information that could have helped them access resources to address local and personal challenges.

- ***Information may do nothing to foster the development of an informed citizenry, and may even perpetuate control and influence over public information and discourse***. Our **Myanmar** case study demonstrated that increased media access and "openness" do not automatically lead to positive development outcomes. It is possible that formerly "information dark" ecosystems that prevailed across much of the country under military rule may be seamlessly replaced with "information

lite" ecosystems, in which unsophisticated media audiences consume primarily entertainment and "managed" news content. This sleight of hand would replicate the information ecosystems of the "disciplined democracies" of Singapore, Malaysia and China to which Myanmar's rulers aspire.

7. SOCIAL TRUST

- ***Trust and perceptions around information is key to information use***. In **Pakistan**, the presence of continual conflict and external meddling has worn down trust bases. Overall, the degree that information is trusted appears to be influenced greatly by the community's relationship with the source and the community's perceived notion of who is setting the agenda and why.

- In **Indonesia** and **Myanmar**, where many of the producers of information are linked to politics, citizens tend to perceive the information being disseminated as biased toward politicians' own personal agendas.

8. INFLUENCERS

- In **Pakistan**, tribal and religious leaders are no longer the only influential providers of information. Educated, tech-savvy youth have begun to attract influence through their use of social media to filter relevant information and provide further sources of validation.

- In **Indonesia**, local community members equipped with walkie-talkies acted as "information bridges" between the provincial and local governments, those working at the dam, and the local population. These individuals often also served as informants for the government.

D. AREAS FOR FURTHER RESEARCH

While not exhaustive by any means, this rough analysis illustrates the utility of the Eight Critical Dimensions framework, and already suggests a few areas for further research:

- **Role of information bridges:** These are the people, organizations, or mechanisms that exist as conduits of information from the top to the bottom and vice-versa. They create linkages between the needs at the bottom and the resources available at the top. They enable the community to access relevant and trusted information, and provide feedback to policymakers and decision makers. These bridges are based on two-way symmetrical relationships that are attuned to listening as much as producing information, and link the national, local, and hyper-local information levels.

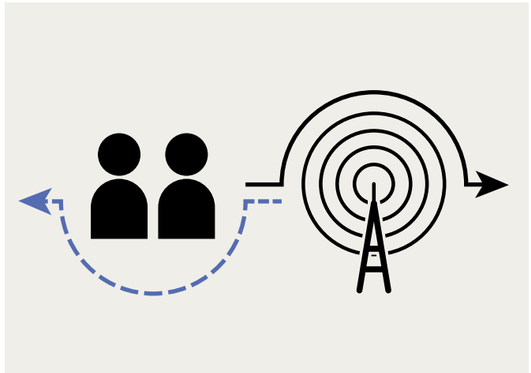
- **The influence of development factors – cultural, social, political, and economic – on the strength of an information ecosystem**: In the case studies, there is little to no reference to the impact that issues such as illiteracy have on the access, use, and landscape of information. Additionally, there is little research on intra-community differences, including power dynamics across sub-groups distinguished by gender, economic status, age, ethnicity and information access. To truly find avenues for expanding and building information ecosystems, these barriers need to be explored and understood.

E. TOWARDS PRELIMINARY TYPOLOGIES: CLASSIFYING INFORMATION ECOSYSTEMS

The Embracing Change project not only aims to build knowledge around the role of information in empowering communities to understand and adapt to change, but also to identify strategies and techniques for individuals, communities, practitioners, and policymakers to leverage certain principles and frameworks produced by this research in their resilience efforts. The Eight Critical Dimensions are one component of this, and we intend to continue refining this framework as our research continues.

In addition, Internews aims to produce typologies for information ecosystems that can serve as a diagnostic tool for assessing information ecosystems, predicting how they may function in different contexts, and anticipating how they may respond to different types of disruption (i.e. technological, physical, or infrastructural). These typologies will enable policymakers and practitioners to design strategies for maximum impact.

Through our analysis of these four Internews case studies, we have created a typology that identifies three types of information ecosystems, each based on the Eight Critical Dimensions of Information Ecosystems framework. At this stage of the project, these are extremely preliminary; we anticipate the emergence of more robust and detailed typologies with further research.[9] The preliminary types identified below highlight that each country's level of economic development substantially affects the health of its information ecosystems. The least economically developed countries arguably have the weakest information ecosystems due to the low levels of infrastructure and other factors. This apparently straightforward relationship is likely to be complicated and questioned with a better understanding of the hyper-local social relationships within communities.

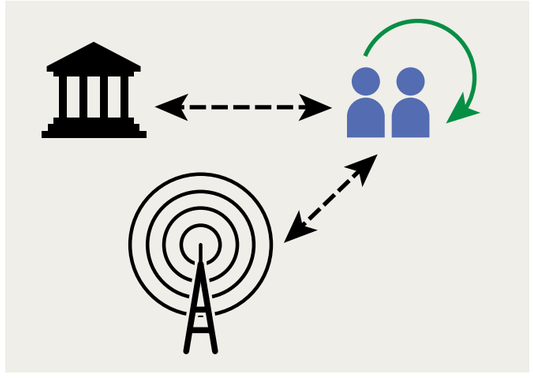


TYPE 1: MISMATCHED

This typology is characterized by low rankings on most dimensions of the information ecosystem, and an overall mismatching of information needs and provision. Low rankings on information landscape, the movement of information, and trust profoundly inhibit the ability of producers and influencers of information to meet or understand the needs of those using and impacted by information. Local relationships with information are weak and there is minimal recognition of the importance of strengthening them at any level. This type of mismatching, exemplified in the **Pakistan** case study, suggests low resiliency and the ability for any shock to the system to lead to a worsening situation.

9 PLEASE SEE THE ANNEX FOR A TABLE SHOWING THE KINDS OF DATA ONE WOULD MEASURE WITHIN EACH OF THE EIGHT DIMENSIONS TO DIAGNOSE AN INFORMATION ECOSYSTEM AND CLASSIFY IT BY TYPE.

II. INFORMATION ECOSYSTEMS & RESILIENCE



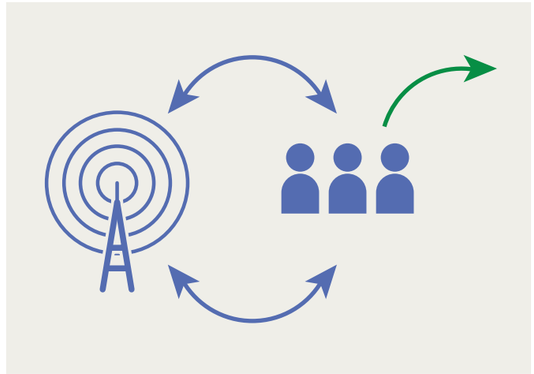
TYPE 2: EMERGING

This typology is characterized by mid-range rankings across most indicators. The mix of various political, physical, and institutional infrastructure factors has led to stronger information flows and rising levels of trust. With a broader range of resources deployed towards understanding and identifying potential stressors, there is an increased ability to meet information needs. This type of emerging information ecosystem, as exemplified in the **Myanmar** and **Indonesia** case studies, suggests engineering resilience: the potential to return to status quo after a shock.

TYPE 3: EVOLVING

This typology is characterized by high rankings across most indicators. The existence of strong infrastructure, information flows, and access creates a system in which influencers and producers are not only aware of the informational needs but are constantly adapting to meet them. Information is plentiful, dynamic, and engaged. This type of active information ecosystem, as exemplified in the Japan case study suggests a complex adaptive resilience and the potential for the impacted community to recover and strengthen after a shock.

Due to the complexity of information ecosystems, these prototypes will continue to be adapted and expanded, and there will certainly be additional typologies added to this list. As a research tool, a typology approach will also be useful for capturing transformations in information ecosystems over time. Examining information ecosystems in the context of disruptive change not only highlights their importance to community and social resilience; it can also illuminate how information ecosystems themselves are adapting in response to stressors and broader shifts in the way people communicate. As information and communication ecosystems are a critical component of preparing citizens, communities, and cities for a future characterized by unpredictable, large-scale disruptions, we must not only understand what they look like now, but what they will look like in the future and how we can help them to adapt and prepare communities to live in a rapidly changing environment.



PART III

THE IMPORTANCE OF INFORMATION ECOSYSTEMS FOR RESILIENCE

PILOTING THE INFOECO FRAMEWORK IN JAKARTA

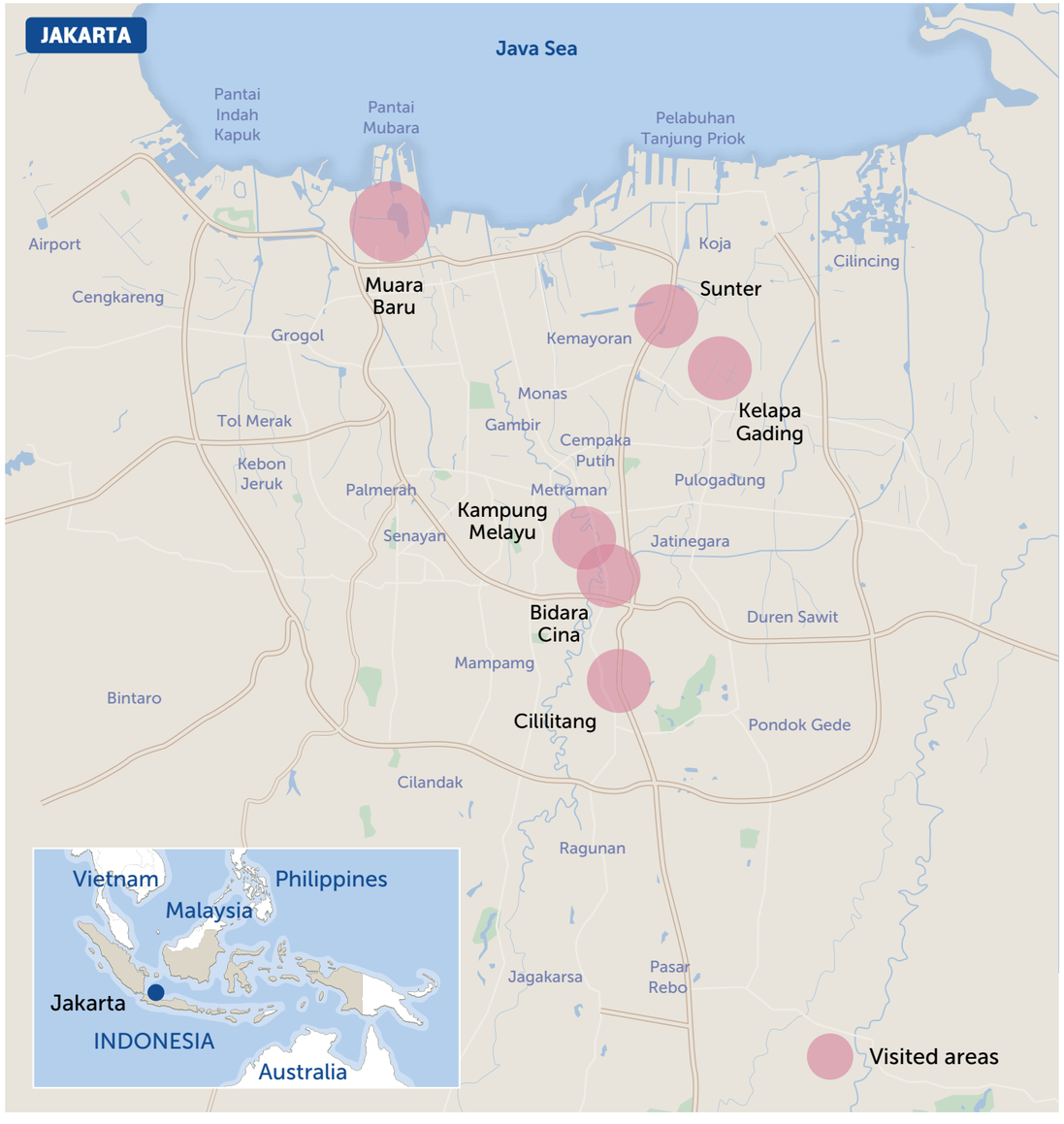
Jakarta, the capital of Indonesia, is highly flood-prone. A convergence of factors contribute: an estimated 40% of the megacity is below sea level; a web of thirteen natural rivers in addition to an extensive canal system constructed by Dutch colonists runs throughout the city; communities have responded to the lack of piped water throughout the city by extracting groundwater; and the city is estimated to be sinking approximately 5 to 10 centimeters per year. Floods have increased notably in the last two decades, due mostly to rapid urbanization and population growth. All of this creates significant environmental, infrastructural, and social strain. Meanwhile, public services and infrastructural improvements have been inadequate.[10] The floods have the most severe and ongoing impact on the poorest and most marginalized communities in the city.[11]

In many years, Jakarta's floods can be classified as acute crises in terms of life lost, land affected, widespread illness, and economic impact. However, they are still highly disruptive even in "less extreme" years. For example, tens of thousands of people were still displaced in 2014; during our fieldwork in April, some residents reported having been flooded 9-15 times over the previous two months, with water levels rising up to four meters. In some communities, people's entire lives seem to revolve around the cycle of floods: preparing, evacuating, and cleaning up, over and over. The floods are in some sense predictable; yet exactly when, where, to what degree, and with what frequency, is not. In a sense, the floods are both a crisis and a normal part of life—a "normalized crisis."

10 ROANNE VAN VOORST, "GET READY FOR THE FLOOD! RISK-HANDLING STYLES IN JAKARTA, INDONESIA," PHD DISSERTATION, UNIVERSITY OF AMSTERDAM, 2014, PP. 12-13.

11 THE GOVERNMENT'S RESPONSE HAS NOT KEPT UP WITH THE ONGOING CRISIS, AND THE LATEST TACTICS, PROMISED WITH GREAT FANFARE, WILL DISRUPT MANY LIVES. A "NORMALIZATION PROCESS," AGREED UPON IN LATE 2013, WILL EXPAND THE WIDTH OF THE CILIWUNG RIVER, DREDGE ALL OF THE JAKARTA RIVERS, TEAR DOWN BUILDINGS AND MOVE COMMUNITIES WITH THE INTENTION OF MITIGATING FLOOD IMPACT. MEDIA REPORTS ESTIMATE THAT THIS PROCESS WILL DISPLACE SOMEWHERE BETWEEN 34,000 PEOPLE AND 70,000 HOUSEHOLDS (THE CITY IS HOME TO 10 MILLION PEOPLE). THE FIGURE OF 34,000 PEOPLE COMES FROM "NORMALISASI KALI CILIWUNG SEGERA DIMULAI," http://www.jakarta.go.id/v2/news/2013/12/normalisasi-kali-ciliwung-segera-dimulai#.U3KiLIGSySo; THE FIGURE OF 70,000 HOUSEHOLDS COMES FROM "RELOKASI WARGA, SYARAT NORMALISASI SUNGAI," http://megapolitan.kompas.com/read/2014/02/03/1340285/Relokasi.Warga.Syarat.Normalisasi.Sungai

III. THE IMPORTANCE OF INFORMATION ECOSYSTEMS FOR RESILIENCE



Given this reality, flooding in Jakarta provides a fertile context in which to study community resilience in response to stress and change across multiple scales. Building upon Internews' previous research described in the 2013 report "Indonesia: Crisis Communications Channels," we piloted the information ecosystem approach through field research in Jakarta in April 2014. This research tested the framework's utility to highlight the role of information in resilience, as well as its ability to identify recommendations for policies and practices that address deficiencies in information ecosystems.

Willy, a second-year college student, stands in his house in the Muara Baru area in North Jakarta. There is a watermark from the most recent flood visible across the photograph of his grandparents.

The following narrative highlights observations from an Information Ecosystems pilot research study investigating the features of Jakarta's flood information ecosystem along the Eight Critical Dimensions of Information Ecosystems. This study builds upon the initial findings of the Crisis Communications Channels Indonesia Case Study, and on the broad findings from all of the Case Studies analyzed in Part II. The methodology for this qualitative research study can be found in Annex 3. The analysis below offers a quick diagnosis of the extent to which each dimension supports or impedes the qualities of resilient systems (for resilience **qualities** as identified in the City Resilience Framework, see Part I.D), and offers recommendations for strengthening the information ecosystem.

1. INFORMATION NEEDS

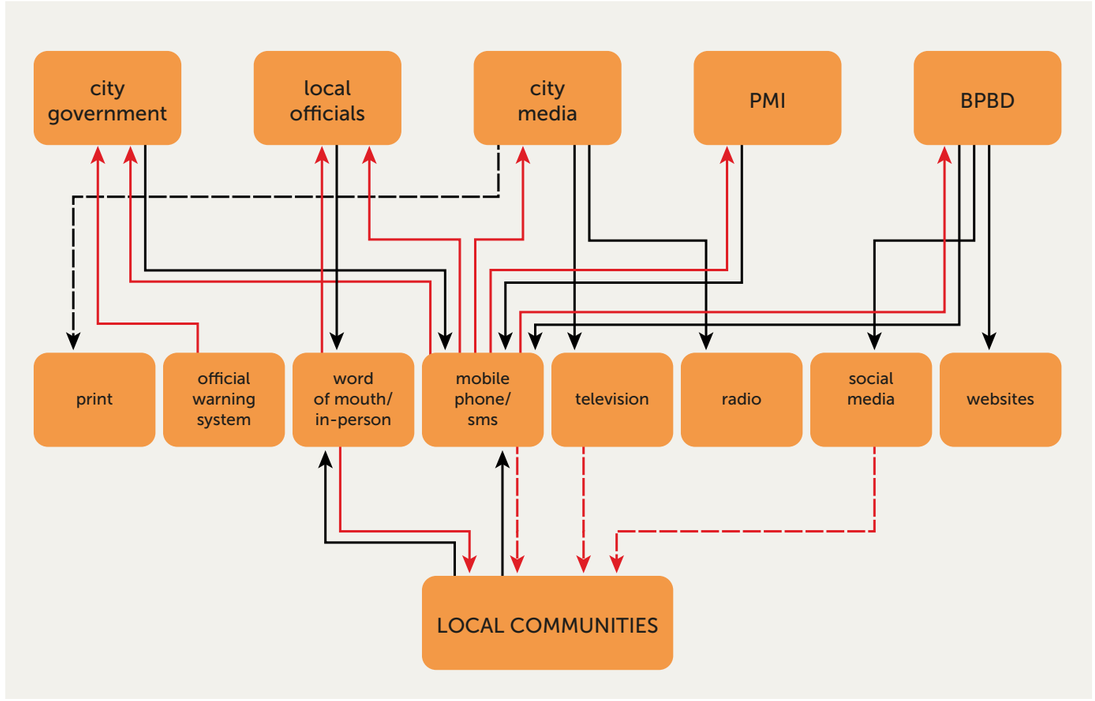
- Do communities have access to the information that they need before, during, and after floods?
- Do responders have accurate and timely information related to the floods?

There are some signs that stakeholders in Indonesia are beginning to seriously consider the role of information in managing disaster. Since the 2013 floods, responder and crisis planning organizations have started to map institutional information flows in the interest of improved information sharing and coordination. However, while many are mapping information flows across responder organizations, no one has conducted any assessments of the information needs of communities.

RAPID DIAGNOSIS: Improvements in planning and attention to information flows show an increased capacity to be **reflective**, evolving and learning from past experiences. Further improvements could be made to make sure the flows are serving community needs.

RECOMMENDATION: As a start, organizations tasked with disseminating flood-related information should coordinate with each other to conduct participatory assessments of community information needs. These should be repeated periodically to adapt to information and communication structures that shift over time.

III. THE IMPORTANCE OF INFORMATION ECOSYSTEMS FOR RESILIENCE



This diagram depicts information flows during the 2013 Jakarta floods, with hierarchical layering of actors and sources of information. The diagram shows that local officials use word of mouth to communicate with local communities in a two-directional manner, while the BPBD sends messaging out through social media, websites, and SMS that is supposed to reach local communities.

2. INFORMATION LANDSCAPE / 3. PRODUCTION AND MOVEMENT

- What infrastructures support information production and flow?
- What capacities do information providers possess to verify, filter, sort and disseminate information?
- How does information flow across different stakeholder groups? What are the factors affecting healthy flows?

At the national level, according to an estimate by Cahyo from the disaster management association MPBI, at least 32 organizations are working on disaster management. Various managing and responding organizations including BNPB (national disaster agency), BPBD (provincial disaster agency), the army, police, fire department, health department, and others, are not yet functioning as an integrated system. There is a notable disjuncture between the top (especially government and news media) and bottom (communities), as well as significant gaps in the information flow across responders, disaster management organizations, NGOs, and media. The biggest challenge is two-way communications between the provincial and community levels. As such, there is a demonstrated need for collaborative information bridges that link people and organizations from the bottom to the top.[12]

Most respondents' descriptions of information flows provide an impression of generalized chaos, and a lack of coordination and clarity on designated authorities, attendant responsibilities, decision making, and ensuing actions. A seemingly simple decision, such as the formal declaration of an emergency, is complicated by information confusion; what information the national government needs in order to declare a state of emergency, and how they would receive this information, is unclear. Complicated channels of authority and communication tend to confuse, delay, and add stress to the decision of when to declare an emergency and how to respond.

Several recent initiatives show promising signs of improving coordination, including designating the BPBD office, Pusdalops, as an information hub, as well as startup initiatives like FloodTags, which maps Twitter-sourced flood information, and scientific research projects like PetaJakarta.org, which crowd-source flood data to support the generation of flood-effected area maps with BPBD. A social network analysis indicated that Pusdalops was perceived by peer organizations to be both the most effective at communicating during disaster and also the most collaborative with other organizations (see Annex 4). At the policy level, a clear articulation (and appropriate dissemination of information) of what government bodies make which decisions, in what sequence, and the budget, planning, and action implications that flow from those decisions, is the most basic and critical first step to strengthening the information ecosystem for resilience.

12 CHART CREATED BY ISOBEL GRAD BASED ON THE INFORMATION IN INDONESIA: CRISIS COMMUNICATIONS CHANNELS, BY MATT ABUD.

Pusdalops control center decision-making tools, including maps, real-time flood data, and live streaming camera pointed on the dam

RAPID DIAGNOSIS: Chaotic information flows and disjunctures in communication across key social groups show a systematic lack of **integration** in the system.

Recommendation: At the policy level, a clear articulation (and appropriate dissemination of information) of what government bodies make which decisions, in what sequence; and the budget, planning, and action implications that flow from those decisions, is the most basic and critical first step. There is also a need to create collaborative information bridges based on trust relationships: people or organizations who operate in the middle are able to analyze the needs at the bottom and the resources (information) from the top, as well as create linkages to inform both the bottom and top.

III. THE IMPORTANCE OF INFORMATION ECOSYSTEMS FOR RESILIENCE

One renter expressed how much she enjoyed living in the Kampung Melayu community and being by the water. This house is built out over the flood-prone river and sits right across from the public toilet that empties out into the river.

4. DYNAMIC OF ACCESS

- What are the intra-community dynamics that impact access and use of information? How uniform are these experiences within communities?
- How do power dynamics impact information access?
- What are the key factors and details impacting access at the hyper-local level?

Flood-prone communities are composed of different sub-groups, and our research revealed that intra-community mistrust is an obstacle to information flows. In a visit to one of the slums, we approached a woman sitting on her doorstep to ask about her life at the edge of the river. As we approached the woman, the local leader informed us that she was a renter (i.e. not a "real" resident of the community), and that there was no need to speak to her. He became visibly annoyed when the interview proceeded. Such tension between long-time residents and renters is apparently consistent across Jakarta's slums; long-term residents generally despise renters, which negatively impacts renters' ability to integrate into neighborhood social networks that are vital to community resilience. More broadly, a few respondents suggested that different groups demonstrate different degrees of integration into the community (i.e. local gangs and militias, political parties, local clinics, and women).

RAPID DIAGNOSIS: Complex power dynamics within communities mean that marginalized groups may lack full access to important information; despite respondents' perceptions, there are negative dynamics affecting community **inclusiveness**.

Recommendation: Participatory assessments of information access can identify key groups that are not getting all the information they need, and how best to address these inequities. Building inclusive information access relies upon the ability to perceive relationships that are distinct from Jakarta's typical patterns of highly structured society.

5. USE

- Is information perceived to be relevant?
- What do people do with information?
- How is information processed, disseminated, and applied?

The dominant narrative from respondents in Jakarta was that during the times that communities were threatened with flooding, the information they needed most was fairly straightforward. Information thought to be the most critical was the height of the water at the Bogar dam in West Java.[13] Weather forecasts and news about evacuation and relief were also important, but the water heights were the first item of concern.[14] This narrative certainly represents an important element of how the flood-affected population uses information. However, it is only part of the story.

Once flood-related information is received, poor, middle-class, and wealthy flood-prone communities behave in a variety of ways that defy generalization. With regard to decisions about whether to leave home, when to go, where to go (i.e. to the second floor, to the roof, out to a designated shelter), and how to go, we heard a variety of approaches with no patterns. These findings align with other research that describes the various decision-making styles in heterogeneous communities. In her doctoral research, anthropologist Roanne van Voorst uncovered four distinct "risk-handling styles" in community members' approach to dealing with floods, which range from cooperative and information-sharing to isolationist. These different approaches led people to make vastly different choices about whether and when to go, from whom to accept help, whom to assist, and what to do once they had left. It is clear that decisions emerge from a web of converging factors: social relations, power relations, past experiences, and values. Starting with information as a basis is simply not enough to predict behavior.

13 UNIVERSALLY, THE MEASURE OF WATER LEVELS AT THIS DAM, WHICH REGULATES THE WATERS OF THE CILIWUNG RIVER, WAS CITED AS THE FIRST LEVEL INDICATORS OF POSSIBLE FLOODING. RESPONDENTS IN NORTH JAKARTA REPORTED THAT THEY THEN WATCHED FOR NEWS OF FLOODING IN EAST JAKARTA, AND KNEW THEY WERE NEXT.

14 SEVERAL RESPONDENTS INTIMATED THAT THE QUESTION OF WATER HEIGHT WAS NOT ACTUALLY SO STRAIGHTFORWARD, AS THE OPENING AND CLOSING OF THE DAM'S SLUICE GATES IMPACTS THE HEIGHT OF THE WATER. THUS, DECISIONS ABOUT OPENING THE GATES MAY BE RELATED AS MUCH TO DESIRES FOR CONTROL AS THEY ARE TO SAFETY AND ENVIRONMENTAL CONCERNS.

The RW (local leader) of Bidara Cina community stands next to the whiteboard where flood data is gathered and posted on the river watch house. To inform their own preparations and actions, watch house volunteers update the monitoring board every three to five minutes by calling the dam when there is a threat of a flood.

RAPID DIAGNOSIS: What information is needed and how communities used it during flood-threatened periods rests on untested assumptions that are only part of the story. Thus, there is insufficient **robustness** in community information systems—information interventions do not anticipate the diversity of decision-making approaches.

Recommendation: At the community level, rather that what seems logical from the perspective of an outsider or any one group in the community, interventions should start by acknowledging the heterogeneity of decision-making, then creating planning and policy out of what exists. This means digging deeper to identify and directly address different decision-making styles.

III. THE IMPORTANCE OF INFORMATION ECOSYSTEMS FOR RESILIENCE

After fleeing their home in the middle of the night during the 2007 floods, these wealthy homeowners in Kelapa Gading, below, bought the home next door, razed both original properties, and built a new home. The new home is elevated a meter and a half above the street, following the advice of a flood expert they consulted. These residents chose to pay for expert information to guide their choices.

Above, impromptu second floors built in the impoverished Muara Baru.

6. IMPACT OF INFORMATION

- What are the short and long term impacts of how people use information?
- How does information inform community members' decision-making?
- How does information inform government, NGO, and other responder agencies' decision-making?

In Jakarta, poor communities adept at adapting to floods through their use of information have ensured their own survival; this is no small feat in the face of poverty. At the same time, becoming locked in a particular web of habits may promote the survival of these communities at the cost of improving their lot overall. Information has historically been used to build strong capacity for survival while reinforcing poverty and low social power in flood-prone areas.

These communities are filled with visible examples of the impact of information on their experience of floods. Ingenious adaptations enable communities to adapt to the ebb and flow of floods on the fly. For example, the most visible and widespread adaptations are residents' raising of their homes, from a few feet to an entire floor level. Given that Jakarta is rapidly sinking, it is clear that these adaptations are short- to middle-term responses. So far, available information has not prompted more substantive, long-term solutions (though this is likely also related to resources, beliefs, values, and capacities, not just information).

RAPID DIAGNOSIS: Different types of information about floods—their cyclical nature, timing, behavior, and risks—have allowed most communities to stay in place and live through the floods. Overall survival is impressive (though community members are still vulnerable to flood-induced illness and death, particularly the young and the elderly). Thus, the communities have shown themselves to be quite **resourceful** in flood management.

This post is one of several throughout the community of Kampung Melayu. People tie rope lines to the loops, then string rope lines throughout the community that people can grab as they wade through the water during evacuations.

Recommendation: Identify ways to help communities not only survive, but thrive. One approach would be to look for examples of positive deviance in flood-prone slums: effective solutions that deviate from the norm but may not be widely adopted. Observing and tracking clever adaptations to understand how they are created, and facilitating their wider adoption by the community, could help make the communities even more resourceful.

Above, residents of middle class neighborhood sometimes raise the first floor above street level.

III. THE IMPORTANCE OF INFORMATION ECOSYSTEMS FOR RESILIENCE

7. SOCIAL TRUST

- What are the dynamics of trust within communities?
- (How) does trust nurture resilience? (How) does the lack of trust impede resilience?
- What are the challenges around trusting flood-related information?

Key relationships that should facilitate bi-directional information flow before, during, and after the floods—between the government and communities and across individuals and groups in each community—suffer from mistrust. Thus, while it is one of the most fundamental dimensions of an information ecosystem, social trust is systematically weak at multiple levels in Jakarta.

> **"INDONESIA IS IN A KIND OF TRUST CRISIS."**
>
> – ARIES NUGROHO, OGILVY PR

Trust is not only an issue between communities and the different government structures, but within flood-prone communities as well. The government pays informants within communities and provides a financial or information quid pro quo. In the community van Voorst lived in, individuals with walkie-talkies that were networked to each other and had access to the most relevant flood information also happened to be government informants, and would warn the city government if someone showed signs of making trouble. Yet this illustrates that citizens may still trust individual government officials with whom they have an established relationship, a holdover from the longtime patronage system.

Jakarta's population, which media researchers describe as credulous when it comes to advertising, is extremely skeptical of news and media messages in a crisis context. There are many reasons for this skepticism. First, the government has not historically been transparent about anything related to city planning, and has actively withheld public health information (e.g. during the avian flu crisis). The larger lack of a social safety net and fairly recent history of government violence against citizens also contributes, in particular, to the urban poor's distrust of government motives. To make matters worse, residents of Jakarta perceive the government as slow to respond to flood emergencies, and many believe that the government may not have the most vulnerable people's best interests at heart. Further adding to the confusion, the well-known possibility that any SMS or tweeted warning might be a hoax (SMS hoaxes are frequent in Jakarta) blunts certain communications channels' effectiveness for delivering messages from the government.

This fraught relationship means that in times of crisis, people verify information from the government with their personal contacts (over the phone or in person) or through pictures. A more serious consequence of this complexity is that information from the government can be completely ignored, or even worse, promote exactly the opposite of the intended reaction. Anthropologist van Voorst, who spent a year living in a flood-prone slum for her research, argues, "A lot of people wouldn't evacuate if the government told them to. They wonder, what if this is just another trick? Maybe the government is trying to bulldoze my house." Given the displacements planned as part of the normalization process, this is not simply paranoia.

RAPID DIAGNOSIS: Fragile trust bonds are yet another factor preventing a truly socially **integrated** and **inclusive** system. Disconnection and mistrust means people are not mutually supportive across the whole social landscape.

Recommendation: Providing redundant, personal or pictorial information flows for community members to verify government information would be one step to building bottom-to-top trust. Participatory, collaborative activities such as mapping and budgeting that sensitively involve members from across the entire community might also build trust while contributing to more robust information flows.

8. INFLUENCERS

- At the very local community context, who is influencing how information flows?
- How does disruption impact these influencers?

Indonesian society is highly structured, with recognized divisions and leadership at the province, district, village, and sub-village levels. This defined organization is present in the slums, which have a rigid, articulated social structure with designated informal leaders at several levels. These locally chosen leaders include the RW (Rukun Warga, or community administrators), and the RT (Rukun Tetangga, or neighborhood administrator. Responder organizations and other research repeatedly pointed to these people as key trust points and influencers in the community. These leaders are always the contact points for outside groups such as the Red Cross.

In interviews, several responder organizations expressed doubts about whether the communal leaders designated by the government and responder organizations were actually trusted by the community. Faizal Thamrin of the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) explains, "We don't know who the focal point is for the local people on the ground, and it's hard to get information from local government officials.... The government says they register the local person that can be trusted and verified, but I think we don't understand what their roles really are in the community.... I always say to the government, you need to dialogue, have meetings at least twice a month to build relations and trust." This is particularly important for building relationships with the groups of people who are marginal to the power structures and may look to different sources for their information. The current communication chaos, however, may include ad hoc communications redundancies that support community adaptation to change.[15] For example, community members might cross-check information from local leaders with information from neighbors who travel frequently across different communities and also with SMS messages from Pusdalops.

RAPID DIAGNOSIS: Community leaders that have been identified as information influencers play a key role in spreading key information about floods. However, not everyone in the community trusts them, and they turn to a variety of other sources. Thus, the community system has created **redundant** trusted sources of information that can back up the influencers if needed, while ensuring **inclusiveness**. This redundancy also illustrates the **flexibility** of the social system, even within such an apparently rigid social structure.

Recommendation: Government and responder organizations must understand the realities of how information flows, beyond assumed hierarchical social structures. This is critical to identify appropriate points of contact and help communities build upon existing redundancies.

15 THIS WAS THE OBSERVATION OF ETIENNE TURPIN, PETAJAKARTA.ORG

III. THE IMPORTANCE OF INFORMATION ECOSYSTEMS FOR RESILIENCE

ONE OF THE PRINCIPAL OBJECTIVES OF THE EMBRACING CHANGE PROJECT IS TO INCREASE UNDERSTANDING AMONG DECISION MAKERS OF INFORMATION ECOSYSTEMS AS A TOOL FOR RISK MANAGEMENT AND RESILIENCE.

PRELIMINARY CONCLUSIONS

The Jakarta InfoEco pilot study provides compelling evidence that weaknesses in information ecosystems can hinder effective preparedness, response, and adaptation to floods at multiple levels, including sub-groups within a community, responder organizations, and provincial and national government bodies. Using the Eight Critical Dimensions as a basis for analyzing the information ecosystem, we can also see precisely where deficiencies hobble the ability of institutions and communities to function resiliently. Building resilience requires extensive coordination and strong information loops across multiple stakeholders, at multiple levels. Approaches to disaster risk reduction and other resilience-related strategies are typically broadly inclusive and engage many different actors, including state and local government, national disaster agencies, non-governmental organizations, and private companies.

Challenges to resilience and information ecosystems do not divide neatly across geographical boundaries or levels of economic and human development. In the next phase of the ***Embracing Change*** project, Internews piloted the InfoEco methodology in New York communities impacted by Hurricane Sandy. In preliminary desk research on New York City, we have observed striking similarities with the case of Jakarta. Both contexts are characterized by problems with disconnected decision-making and communications across agencies and organizations, and unclear roles and decision trees across national and provincial/state agencies. In Indonesia, provincial agencies like BPBD are still fighting for recognition and coordinating capacity within provincial disasters. Because their lines of communication and authority vis-à-vis the national-level BNPB are often unclear, the BPBD's effectiveness is constrained. In the U.S., FEMA confronts a system of regulatory confusion and multiple layers of laws as previously existing agencies with their own priorities and objectives have been consolidated. Both national disaster agencies have widened their scope over time, from weather-related crises to terrorism and other human-caused hazards. Both employ a multi-stakeholder approach to disaster risk reduction, but face challenges in understanding community needs and information systems. In both contexts, rapid adoption of new technologies has increased the reach of communication and created the potential for new spaces of engagement wherein communities can become more informed and self-reliant. This capability enables more bottom-up forms of decision-making and reinforces the need to build the capacity for local response and communication.

Interest and investment in disaster risk reduction and resilience programs have clearly been on the rise. These will only continue to grow as global pressures like climate change, disease pandemics, economic fluctuations, and terrorism challenge the well-being of individuals and communities around the world. Yet, while governments are adjusting their policies and practices to prepare for disruption, manage risks and limit devastation in the face of change, information is a neglected element of policies and practice. It is difficult to imagine how risks, hazards, and vulnerability can be reduced without strengthening information ecosystems. Equally importantly, it is difficult to imagine how principles of resilience can be put into practice effectively unless policymakers and practitioners understand how to leverage information ecosystems to disseminate their strategies and interventions.

Embracing Change is not intended to be a theoretical exercise, but a very practical one. One of the principal objectives of the ***Embracing Change*** project is to increase understanding among decision makers of information ecosystems as a tool for risk management and resilience. Building on the Jakarta InfoEco pilot, our field research in New York City was implemented in June and July 2014. As an extension of the research conducted in Jakarta, the New York study piloted the information ecosystems methodological approach to offer additional insight and inform future inquiry for strengthening information ecosystems within resilience research and planning.[16] The synthesized findings of the Jakarta and New York studies will provide rich preliminary insights into the benefits and challenges of taking an information ecosystems approach. We will also provide carefully considered designs for more robust research on information ecosystems, and a decision tool bringing an information ecosystems approach to policy and implementation of locally appropriate resilience processes and systems. A summary report from the New York InfoEco Pilot, a tool for decision-makers, and a longer research report on the New York fieldwork will be available in December 2014.

16 PLEASE SEE ANNEX 5 FOR AN OVERVIEW OF THE NEW YORK INFOECO PILOT STUDY.

PART IV

WHY INFORMATION MATTERS

WE CONTEND THAT INFORMATION IS A FUNDAMENTAL PIECE OF RESILIENCE: WHILE IT IS NOT SUFFICIENT, IT IS ABSOLUTELY NECESSARY.

Internews' first priority is the communities we serve. As such, in making the case that information matters for resilience, this analysis has focused largely on individuals and communities—many at the margins of society—that are the most vulnerable when it comes to disruptive change, shocks and stressors. However, healthy information ecosystems clearly matter for many different actors, not least the policymakers and practitioners who rely on strong information flows and relationships to implement resilience strategies.

While we have seen ample evidence that timely, accurate, and relevant information is essential, the research cautions against jumping to the conclusion that good information has a straightforward relationship with the health, safety, and security of individuals and communities. The impact of information on decision-making is not easy to anticipate: unpredictable decisions belie the notion that information alone can save lives. In Jakarta, many residents seem to understand the range of choices around flood events, and report that they "know what to do" to protect themselves and their families. So how do we understand people's long-term decision to stay in flood-prone areas, knowing that they will be subject to ongoing stresses and cyclical shocks?

Structural and development constraints are one explanation: in Jakarta, problems around the floods are fundamentally linked with development issues, which serve as a significant constraint on behavior. Several respondents from outside the communities emphasized that the choices framing community members' decisions are limited by their low economic and social status. When asked how information helps people in these communities make decisions, Maha Adi, the director of the Society of Environmental Journalists, observed, "People don't have so many options to make their lives better, so they can't really make decisions. Their decisions don't have impact because of the system." Aside from economic constraints, several respondents referred to a deep sense of place connecting them to where they had been born, and in many cases cited a tribal tie to the land. Other reasons might relate to everyday survival and well-being. "It's about network connectivity; people need access to a lot of different kinds of people to be able to survive in Jakarta," said Etienne Turpin of PetaJakarta.org. Neighborhood social networks in the slums are a key mechanism for survival, so leaving such sources of socio-economic support can represent an even bigger disruption than chronic and severe floods.

Despite these constraints, responder organizations, flood support organizations, researchers, and the government often use the word resilience to describe the most vulnerable and flood-prone communities' capacity for survival in seemingly unlivable conditions. Many of these communities demonstrate impressive adaptation and self-organization in the absence of governmental intervention. For example, it is common for residents to permanently lift their homes a few feet in anticipation of annual floods. The community of Kampung Melayu has built permanent posts for rope lines that can aid evacuations as people wade through water. Others have devised clever means of protecting precious goods by hanging them from the ceilings of buildings. These and other examples in flood-prone slums underscore the ways in which communities are adapting and exhibiting resilience even under significant constraints. While these communities remain vulnerable, they have self-organized and adapted within the social systems and physical places in which they exist. Still, much more is needed for such communities to fully develop the Qualities of Resilient Systems (elaborated in Part I.D).

Resilience depends on various factors, including individuals having the capacity, resources and willingness to act, as well as true freedom of action within a system or structure. Our fieldwork provided ample evidence that these communities exhibit an incredible capacity to survive and adapt to floods. However, much can still be done to strengthen resiliency not just in Jakarta, but also in Pakistan, Japan, Myanmar, and beyond, and our research shows that strengthening information ecosystems is a fundamental part of this effort. Therefore, while information is not a panacea for economic, demographic, or political challenges, it is foundational to the institutions that can act to change such structural inequalities, and it is foundational to empowering people to take charge of their own lives. The absence of information can lead to inaction, just as inaccurate information can lead to counterproductive measures. Thus, we contend that information is a fundamental piece of resilience: while it is not sufficient, it is absolutely necessary.

ANNEX I

TOWARDS TYPOLOGIES

DIAGNOSING AND CLASSIFYING AN INFORMATION ECOSYSTEM

This chart shows examples of data that could be captured, by dimension, in categorizing and diagnosing an information ecosystem. These observations would result in the formulation of typologies of information ecosystems.

CORE ELEMENTS	MACRO ENVIRONMENT		CONTENT DISTRIBUTION/CONSUMPTION			HUMAN/SOCIAL INSIGHTS		
	Key Structures		The Information "market"			Information Flows		
EIGHT DIMENSIONS	**INFORMATION LANDSCAPE**	**DYNAMICS OF ACCESS**	**PRODUCTION AND MOVEMENT**	**INFORMATION NEEDS**	**INFORMATION USE**	**SOCIAL TRUST**	**INFLUENCERS**	**IMPACT**
DATA	• Media environment • Key players in "traditional"/ big media and "new/ social media" • New players • Innovation / new technological developments/ infrastructures	• Political/ regulatory environments: national/local/ community • Economic profiles • Ethnic factors • Security • Vulnerability to emergencies / natural disasters etc. • Access to technology • Access to media	• Type/access to content - distribution • Appropriate content creation and management • Community creation and inputs - Co-designing and implementing • Network dynamics • User-generated content • Sustainability	• Assessments of information needs in different situations • Human-centered approaches to identifying unmet needs and potential strategies to meet them • Security and social audits -Identification and classification of information users: tech-savvy to basic word-of-mouth (secondary audiences etc.)	• Measures of: - Reach - Impact - Engagement - Empowerment - Trust - Reliability • New metrics	• Identification of factors that constitute trust in different societies, communities, groups etc. • What constitutes social trust in different situations? • Who are trusted individuals, institutions etc.? • Location: where are these trust points? • Classifications of trust and effective outcome of engagement • New metrics	• Identification and classification of information networks and key brokers/ conduits • Factors of influence • Sustainability of different types of information/ mechanisms of distribution • New metrics	• Impacts in terms of knowledge, actions, and practices • Factors and pathways that ensure inclusivity

ANNEX II

ANALYZING THE CASE STUDIES

DATA CHARTS

This chart is a summary of the data analysis of the four case studies outlined in Part II. Each of the four studies was originally undertaken with a distinct purpose in mind, though all were guided by the broad idea of investigating information ecosystems. To begin to test our framework and build typologies, we analyzed the research reports with respect to the Eight Critical Dimensions of information ecosystems and several other relevant categories. The data are presented as rough notes to suggest the type of information ecosystems analysis that can be performed on already completed research and to demonstrate how we arrived at our preliminary typology of information ecosystems.

	PAKISTAN	INDONESIA	JAPAN	MYANMAR
INFORMATION NEEDS	• media coverage is mostly government propaganda • media is security focused • outlets emphasize incidents rather than patterns; challenges rather than solution; symptoms rather than causes • US strategic interests are a factor • three-fourths of stories on conflict or terrorism • little to no relevant local information from traditional sources • terrorism is a scapegoat for the region's underdevelopment; used to explain why region lacks infrastructure, education, health services and employment opportunities • externally driven programs may actually stifle the evolution of a market and audience driven information landscape • print news coverage of issues: development issues(6%), education (4%), electricity (2%), local economy (1%)	• media focus on government failures • political agendas of owners shape editorial policies • business side of the media is primary • hoping to shape government action • outlets create narratives in intense situations to generate ratings • coverage by media conglomerates is sensationalized to benefit the owners which leaves the needs of those directly affected by the disaster on the sidelines • media often follow the activities of political leaders and celebrities and less the needs of those directly affected	• evacuation drills are common practice for most coastal towns, • NHK is legally bound to provide disaster-related information in Japan and is the designated public institution for broadcasting disaster warnings and other lifesaving information during natural disasters; NHK's headquarters are designed to be able to continue broadcasting even during a massive earthquake. It is also why the organization has 460 robotic cameras stationed around the country as well as 14 helicopters at its disposal to record footage of natural disasters; Information is offered in 18 languages, and within two weeks of the earthquake, 5.4 million people had visited its website. The NHK homepage was amended for mobile phone access and it also linked to other information sources, donation pages and evacuee registers. The Google Person Finder was embedded directly on the homepage.	• High recognition for DVB and Sky Net: - SkyNet offers a broad array of content, including sports and entertainment 24 hours a day - DVB (a formerly banned exile-based news operation) runs just two hours of programming a day repeating on a 24 hour loop, yet offers extremely rich political and news content. • Focus on news about disaster (including weather forecasts), health news, religion, and ethnic conflict. • 90% or more of radio listeners have heard of the BBC, VOA, and RFA radio stations, but only 60% have listened to programs on them. • 100% of radio listeners have heard of Nay Pyi Daw Myanmar Radio National Service, Myanmar's state-run national radio service. 98% have listened to its programs. • Two other domestic radio stations are highly popular, Padauk Myay and Shwe FM. Each are known by close to 90% of radio listeners and listened to by over 80%.

ANNEX II: ANALYZING THE CASE STUDIES

	PAKISTAN	INDONESIA	JAPAN	MYANMAR
Consumers	• want information about possible ways to address endemic unemployment, poor public services and lack of electricity • want information to help navigate instability, build livelihoods and achieve aspirations • addressing issues of conflict is outside of respondents' means so they want to focus on more manageable subjects • respondents felt frustrated and removed from information that could help them access resources to address local and personal challenges • no idea on how the decisions of politicians and institutional actors impact them • ranking of acute problems: electricity and gas (55%), lack of employment (38%), lack of food or water (34%), security issues (6%)		• for most disaster-affected communities local initiatives like community radios, community (or hyper-local) newspapers and word of mouth provided the information evacuees wanted most, including information on the safety of friends and family and other essential information	
Producers	• US and Pakistani government	• conglomerate media houses • politicians	• local governments are responsible for disaster preparedness and the standards of this and the levels of engagement vary among towns	
Sources	• Radio stories: - 47% use official spokesperson - 30% use unidentified source - 13% ordinary individual - 10% academic - Newspaper stories: - 52% use official spokesperson - 38% use unidentified source - 9% ordinary individual - 1% academic	• civil society responders noted that coverage of their own efforts was extremely low to nonexistent • media liaison with responders, NGOs, and government		
Gaps	• local information is almost completely absent • limited access to media agenda by local residents • no feedback mechanism; no apparent desire for feedback	• media awareness of the needs of citizens	• NHK failed to provide sufficient info on food, water, gasoline and electricity • mainstream media coverage focused on the nuclear crisis and didn't provide the information that people in evacuation centers needed most	

ANNEX II: ANALYZING THE CASE STUDIES

	PAKISTAN	INDONESIA	JAPAN	MYANMAR
INFORMATION LANDSCAPE (TYPES OF MEDIA AVAILABLE)	• state-owned media • Radio Pakistan: sole radio station legally permitted to broadcast • Pakistan television is the only news channel accessible without satellite • mobile phones, satellite dishes and internet increasing • Radio Khyber: USAID funding with programming in Pashto-language on health education, women's rights, religious programming (risking closure)	• local government provides the most information about getting aid • 10 private national TV stations (2011) • 1 state TV with 100 regional stations (2011) • 2800 radio stations/700 were community stations (2011) • 85% of the country covered		• media choices in Myanmar are growing quickly. • newspapers have been proliferating in the cities while new television programs, driven particularly by satellite TV services, have expanded the range of content and programming available within the country. • satellite TV is now legally bringing content into the country ranging from rich political discussion via DVB-Burmese to a variety of entertainment programming, including popular Burmese and Korean soap operas and even Myanmar Idol, a Burmese version of the popular music competition Face-to-face information flows take place primarily in the home between immediate family and friends. • very little information arrives through the Internet • news and information flows overwhelmingly by word of mouth, after entering a community through radio, TV, or print media.
Intermediary Organizations		• Provincial Disaster Management Agency (BPBD): capture flood and aid response data from range of government departments and share with relevant stakeholders - no common reporting format or platform - utilizes website and social media - no dedicated PR office - no shared media protocol with BNPB - insufficient personnel • National Disaster Management Agency (BNPB): national body overseeing and supporting disaster response strategy - has PR office - head of organization is the main communicator • Jakarta Governor's Office - political profile and lead responsibility of Governor's position is significant		

ANNEX II: ANALYZING THE CASE STUDIES

	PAKISTAN	INDONESIA	JAPAN	MYANMAR
Infrastructure	• Physical (Land) - isolated - tracks that cannot be driven - periodic floods, droughts, earthquakes • Physical (Technology) - Poor electricity supply/enduring blackouts - lack of mobile signal and Internet connectivity - DSL internet networks	• Physical (Technology) • 19 million households lack electricity	• Physical (Technology) - highly sophisticated media and telecommunications infrastructure • 220 terrestrial television • 300 AM/FM radio stations. • high internet and mobile penetration rate; 80 percent of the population are internet users with around 84 percent using mobile phones.	• Physical (Technology) - lack of access to grid-connected electricity by 85% of the rural population—limit key information sources to radio and word of mouth • In 2011, 74% of Myanmar's population lacked access to grid-connected electricity.
PRODUCTION AND MOVEMENT	• poor communication between governing institutions and the communities they serve			
Community Participation	• mullahs influence being affected by local militants, drone strikes, and persistent poverty	• most successful neighborhood social networks were able to integrate with permanent administration or community structures independent of finite funding • Digital volunteers are beginning to have an impact	• local initiatives including community radio stations, community and local newspapers (also known as hyper-local media), newsletters and announcements at evacuation centers - remained the main source of information for many	• Information shared mostly by word of mouth (88% of respondents); 5% by phone, 1% by email or SMS • Monks are sources of religious information

ANNEX II: ANALYZING THE CASE STUDIES

	PAKISTAN	INDONESIA	JAPAN	MYANMAR
Owners	• Pakistani government • US government	• conglomerates are dominated by Kompas Gramedia and Jawa Pos • conglomerates include: TV, radio, print, online and entertainment portals • 11 companies compete in the mobile market • Telkomsel is the most dominant followed by Indosat and XL Axial	• government owns the majority of crisis communication channels • private media	• 3 Internet providers exist in Myanmar: Red Link Communications, Sky Net MPS, and Yatanarpon Teleport. - all three work under the regulation of state-owned Myanmar Posts and Telecommunications (MPT), which controls all aspects of Myanmar's communications sector, including landlines, street phone kiosks, and mobile phones. - Red Link, whose services are limited mostly to Yangon and Mandalay, is owned by the sons of current Union Solidarity and Development Party (USDP) chairman and speaker of Myanmar's lower house of parliament, - business tycoon Shwe Than, an ally of President Thein Sein, owns Sky Net, - Yatanarpon Teleport is state-owned. • the stations with the most extensive reach and popularity remain in the government's hands
Barriers	• women are even less literate and many are not mobile (= less access to info)	• licensing regulations block local access to radio networks; only allowed to transit in a radius of 2.5km • Media Convergence Bill (bring together the country's Broadcasting Act, the Electronic Information and Transaction Law, and Telecommunications Laws; and merges the Broadcasting Commission, the Information Commission and the Indonesian Telecommunications Regulatory Body) • censorship laws: Anti-Pornography Law, Cyber Law, EIT Law • there are no government common reporting platforms or formats	• there was little information sharing between humanitarian agencies • while there were some localized efforts to co-ordinate government and civil society efforts, there was no systematic approach to sharing information, causing inefficiencies and duplication	• it appears that connectivity issues, remoteness, and a focus on meeting basic needs preclude many from the ability to readily share news, or to cultivate an interest in news or information not directly connected to their daily lives.

ANNEX II: ANALYZING THE CASE STUDIES

	PAKISTAN	INDONESIA	JAPAN	MYANMAR
DYNAMIC OF ACCESS	• local journalists barred from accessing government records, including development schemes • international media outlets and human rights organization denied access to report in region • 74% of journalists had been threatened by militants or governments • Pakistan Telecommunication Authority temporary blocks websites including Facebook, YouTube and Wikipedia as blasphemous (2010) • Pakistan Electronic Media Regulatory Authority creates media licensing framework but not extended to FATA • poor infrastructure, militant attacks, and threats to journalists. • two-way radio is an open channel; can be picked up my militants • no secure forums for discussing, vetting and debating first-hand accounts • residents use public spaces to share information but less freely and restricted conversation since rising insecurity • residents fear digital communications might be monitored by intelligence agencies, militants or other actors	• investment in telecommunication only in places where revenue is high; disincentive for investment in more sparsely populated locations • Telecommunication: fixed-line phones are extremely limited	• areas where internet connectivity was available, those with internet-enabled mobile phones could search for news of the dead and missing • The JMA use a Short Message Service Cell Broadcast (SMS-CB) system to send mass alerts to mobile phone users in specific geographical locations • As of 2009, 21 million mobile phones in Japan are capable of receiving earthquake early warning messages and three of Japan's major mobile providers offer it for free • A smartphone application such as Yurekuru Call can be downloaded and it will send warnings before an earthquake with details of potential magnitude and arrival times depending on the location • Live updates were available on a number of newspapers websites whenever there was breaking news or a development in the story. • Most media outlets including newspapers used social media services like Twitter to inform the public • people in survivor centres were able to make one outgoing call a day, for free. • All the public payphones that were still operational in Miyagi, Iwate and Fukushima were able to be used free of charge for one month after the disaster. • Where all telephone networks were down, the International Committee of the Red Cross also provided stations where survivors could make calls via satellite phone to let family members know that they were safe	• At the current time, connecting to the Internet outside of Internet cafes is outside of the financial reach of most of Myanmar's citizens. • use of new media and technology in Mon State still remains very low. Only 25% of respondents owned mobiles phones, while a mere 2% had Internet access at home. • Only 32% reported that their communities had access to grid-connected electricity. Close to three-quarters reported access to electricity by generator (72%), while almost one-quarter reported access to electricity in their communities by solar power (22%). • Radio use has declined in Mon State overall as access to TV and electricity has improved. • over 50% of Mon State urban dwellers have a mobile phone in their household 67% of respondents in Mon State have a TV and DVD/VCD player in their home.
Places	• hujras • mosques • barber shops	• internet cafes (highest usage of internet)		• markets, weddings, public ceremonies local monastery, tea shops

ANNEX II: ANALYZING THE CASE STUDIES

	PAKISTAN	INDONESIA	JAPAN	MYANMAR
Challenges to access	• underdeveloped • characterized by crisis and conflict for decades • Poor, isolated, and unstable • Very low literacy and very high unemployment • Characterized internationally as a training ground for religious extremists • High circulation of drones • Mass population displacement • Tribal system of governance (semi-autonomous) • personal mobility restricted and public conversations endangered	• maintaining networks between individuals and local groups • continuing programming once funding ends • digital access does not mean digital literacy • changes in mobile online access is most prevalent among responders rather than among affected communities • digital divide • squeezing out of local stations • maximizing on tools • Lack of staff: PMI has 100,000 followers on Twitter, 65000 likes on Facebook, website and e-mail subscription but only one person to manage the role	• two years later, around 305,000 people are still in temporary accommodation and need for information is still there • Months of continuous power outages, damage to infrastructure and congestion on landlines and mobile phone networks across northeast Japan. • Phone carriers restricted up to 95% of traffic for emergencies • main media consumption could not be relied upon during the disaster or after it, due to power shortages, problems with the telecommunications networks and other technical failures.	• rural areas face cost and distance barriers; lack the financial means to purchase a television and often must travel to the nearest town to buy a radio or a newspaper; extremely high costs of electricity • Rural/urban divide
Use				
Developmental	• Illiteracy- only 22% literate • 66% below poverty line • 60-80% unemployment		• world's most rapidly aging population, with 24 percent over 65 years old	

ANNEX II: ANALYZING THE CASE STUDIES

	PAKISTAN	INDONESIA	JAPAN	MYANMAR
Consumption	• Satellite: available to the rich • TV: 33% respondents used this to form opinion • Radio: 50% respondents used this to form opinion • Online: 5% of 64 respondents had internet access • Oral Tradition: largely used • Mobile: Bluetooth devices; 64% have access to mobile phones (unreliable signals)	• Print: medium of record (19% of population) - 1076 print media (2011) • TV: largest medium 90% of population as regular viewers • Radio: national audience of 23.5% - 40000 villages without access • Online: 45 million (18.5%) of population - 4th highest number of Facebook users • high in urban/low in rural • Oral Tradition • Mobile: proliferation was 107% in 2012 - 65% of households lack access to any network - mobile data penetration (10%)	• TV was the most used medium in daily life (87.2 percent) followed by the Internet accessed on a personal computer (81.3 percent) and then mobile phones (63.6 percent). • While only 46.6 percent of the respondents used the radio in daily life, during the crisis it became the most used medium (67.5 percent).; mobile phones (37.5 percent), television (33.4 percent), and internet on a computer (19.5 percent). • the extensive network of public address systems using a system of wireless speakers was the most used means of communication. • Social networks such as Twitter, Mixi and Facebook • With approximately 35 million account holders in Japan, Twitter is the most popular social networking site in that country; disaster related hashtags • Facebook is rapidly becoming more popular with over 17 million users	• TV most prevalent media device; 2/3 of respondents owned a TV; 85% in urban, 46% in conflict areas • Nearly half of the total sample said they had never watched TV (46%); 70% in conflict areas, 51% in rural areas; Respondents who had never watched TV were predominantly female (65%), employed (59%), working at least 30 hours per week (68%), lower middle class (76%) and possessing less than a middle school-level education (80%). • Radio is the second most used media device in Mon State. 59% of all respondents have a radio in the home. Radio ownership is more prevalent in rural households compared to urban homes, with 61% of rural respondents owning one, compared to 49% of urban respondents, and also more common in non-conflict areas (60% of respondents) than former conflict areas (48%). Nearly every radio listener (98%) used a battery-powered transistor radio. • In qualitative interviews in Mon State's former conflict areas, respondents reported that radio is the main and preferred source for news and information, including the latest news, weather report, music, talk shows, and Buddhist teachings • Radio only means of accessing immediate information • 9% in 2012 had mobile phones; almost exclusively for making and receiving calls with only 9% of mobile users used their phones to send or receive text messages, while 3% or less used their phones to take photos, record video, record audio, or send photos to other people; Only 2% of mobile phone users in Mon State used their phones to access the Internet • 98% of respondents had never used the Internet; 70% do not know what the Internet is or how to use it • 21% of respondents own a mobile phone. 54% of all urban respondents have a mobile phone in their household, while 47% own one themselves. • Only 2% of mobile phone users use their phones to access the Internet.

ANNEX II: ANALYZING THE CASE STUDIES

	PAKISTAN	INDONESIA	JAPAN	MYANMAR
Relationship	• Willing to risk their lives to use walkie talkies • travel miles to get mobile signal • hiding satellite antenna dishes in house; balancing fear or militants against desire to be connected • excitement for getting online			• Less than one-third of respondents saw themselves as a disseminator of news and information to other members of the community. Most news is passed on to friends and family. • Only 2% of the sample—business owners, professionals, military, and students—strongly viewed themselves as a source of information for others. • Over 26% of respondents in former conflict areas do not share news and information at all.
IMPACT OF INFO	• increasingly recognizing the value of education to access, analyze and use information • test information through social networks and as many trusted sources as they are able to access • reinforced feelings of powerlessness • US/India and international news may signal changes in their environment given the relationship between the governments and theirs		• respectively, wireless public address systems, radio and television broadcasts and word of mouth were the most useful channels • Car and battery-powered radios also proved useful during power cut as people moved to higher ground • Radio and TV effective only if had them on at the time • Japanese national radio, NHK, covered the disaster extensively but this was on a national level; Local radio stations could better address the needs of those seeking shelter, missing persons and relief supplies in their surrounding communities. • Social networks such as Twitter, Mixi and Facebook provided a way for survivors to locate friends and family and let people know that they had survived. • A few hours after the earthquake, Google's Person Finder, a platform to trace and reunite the missing, was launched. • Mixi users could easily check the last time fellow users had logged in • YouTube was also used after the disaster: fundraising appeals, educational videos, and requests help	

ANNEX II: ANALYZING THE CASE STUDIES

	PAKISTAN	INDONESIA	JAPAN	MYANMAR
SOCIAL TRUST	• international media trusted but not locally relevant (VOA 50%, BBC 60%) • verify information received through social networks • highly skeptical consumers of info • process of triangulation • eyewitness, consider other indicators of quality, consider the medium, look at particulars and ask around repeatedly • most faith in those who can report first-hand • live TV more than written • fact-filled stories • religious leaders are increasingly viewed as minding their own agendas • educated peers more influential - less reliant on word of mouth • seek certainty and reliability above all else • Local information isn't credible, while credible information isn't locally relevant • national media unreliable for accurate reporting of issues that impacted residents day-to-day life • Usage/Trust (%) - friends and family: 42/40 - neighbors: 38/16 - coworkers: 21/14 - tribal elders: 12/8 - government officials: 2/1 - Radio Pakistani 49/40 - Radio US: 20/16 - Radio British: 9.5/7 - Print Media Pakistani: 35/30 - TV Pakistani: 33/26 - Friday Sermon: 18/12 - Communal Gathering: 9/6	• media were criticized as sensationalist • perception of political interest in the media; undermines the effectiveness of the media • face to face is the most used and trusted but least efficient	• while the general level of public trust in media and in social media increased, radio gained the most trust from locals. • radio cited as being a more personable source of information - and it may even have been the most suitable after events as traumatic as these because distressing images couldn't be seen	• most trusted by Mon State respondents tend to be the ones they also recognize most readily. • In general, 81% of all respondents said they trust information from sources inside Myanmar more than foreign sources. • Trust in government news sources appears to be increasing due to reforms that have enabled government media to be more open. • Government media was fairer in conflicts between Muslims and Buddhists so trust foreign media much less than before. • not trust any news source completely. Instead, most respondents felt the need to always validate information against other sources • triangulation essential prior to fully trusting any information or passing such information on to others. • The sources of information people in Mon State trust the most are friends and family, Nay Pyi Daw Myanmar Radio National Service, MRTV, and Shwe FM. • Respondents had a high degree of trust in news from a familiar source, news presented with video or photographs, news spread by word of mouth, and news shared by elders and local authorities. • The newspapers, radio stations, and TV stations that are trusted by the most people in Mon State are all government-owned. • The most trusted media sources in Mon State are also the ones that have the greatest reach and coverage. These stations are Nay Pyi Daw Myanmar National Radio Service (trusted by 94% of users), MRTV (91%), and the newspapers Kyaymon (76%) and Myanmar Ahlin (73%).

ANNEX II: ANALYZING THE CASE STUDIES

	PAKISTAN	INDONESIA	JAPAN	MYANMAR
INFLUENCERS	• shifting political spheres of influence (away from tribal/religious; toward educated/tech-savvy) • People appear to rely on (non-electronic) social networks to access and verify information • role of transient people and diaspora in providing differing news and perspectives • residents leverage relationships with people whose professions or social status afford them the opportunity to spread stories and observation • mullahs do not understand and are ill equipped to address the problems their people face today; used to be most important • educated people are expected to share news with the illiterate and uneducated • youth with ability to use mobile technologies and the internet • residents with geographical mobility: traveling merchants and service providers, taxi and truck drivers, diaspora, nomadic women	• politicians • celebrities • local leaders • family and friends • media itself	• With new social media, because of collaboration and interactivity there is no clear distinction between the senders of information and the recipients. • Traditional media only allows one- way communication so government, humanitarian response agencies, and civil society can have direct influence here	

ANNEX II: ANALYZING THE CASE STUDIES

	PAKISTAN	INDONESIA	JAPAN	MYANMAR
INNOVATION	• visit spaces where information is shared, debated and analyzed • reach beyond borders with personal connections to get information that is free and informed • Walkie Talkies • Cassettes of recorded information sent back and forth • bluetooth		• Japanese broadcasters decided to stream their material online using private sector streaming services like Ustream, Niconico Live and Yahoo! • ANY Liaison Council, which saw three major newspaper groups - Nihon Keizai Shimbun, Yomiuri Shimbun and the Asahi Shimbun Group come together so these publishers could co-operate better in any future disaster, allowing other media companies to use one another's facilities in emergencies • provision of temporary broadcast licenses for Saigai FM stations: One category for existing local, commercial radio stations that wished to become dedicated disaster information providers, and the license meant they temporarily widened transmission areas and another category for new radio stations, created to assist during the disaster • Ushahidi crisis map; volunteers categorized and mapped 12000 tweets over three months; this allowed the public to see what kinds of information and requests were coming from which areas; none of the interviewees in the research in Miyagi and Iwate were aware of this crisis map. • "packet communication": Packets are short messages of up to 128 bytes that are broken into smaller data packets and sent separately through internet • "disaster message boards": used 14 million times; One was text based, where people could input a message on the provider's website that would be stored online or automatically forwarded to pre-registered email addresses; the other was a voice recording that could be emailed to a recipient just like an answer phone message.	• Community sharing of cell phones
LEVERAGE POINTS	• Diaspora • Youth • Analytical capacity building • Education on institutions and politics • Employ trusted citizen sources	• Provisions of emergency generators, loudspeakers, and phone chargers at displacement locations • Training how to use mobile tools • Information bridges • Training and implementation of systems • SMS blasts	• Using local media – such as community radio or print media – should be embraced by humanitarian organizations. • Radio doesn't require literacy or proficiency like with digital technologies and is a resource that government agencies, aid organizations and NGOs can use to ensure accurate, life saving information is reaching those who need it most. • In times of emergency it is simply not possible to rely on only one, or even three or four kinds, of communication; Both low tech and high tech methods of communication have proven themselves equally important in a crisis	• Information Exchange in the former conflict areas • Mobile Phones • Exiled/Diaspora Media

ANNEX II: ANALYZING THE CASE STUDIES

	PAKISTAN	INDONESIA	JAPAN	MYANMAR
RESEARCH LIMITATIONS		• All of this is in reference to crisis communication not general ecosystem	• world leader in earthquake preparedness measures.	
LESSONS LEARNED		• any influences that discourage broad-based and local participation in communication practice will likely erode the communication resilience that's needed when disaster strikes • if communication not anticipated, people are not going to risk waiting for it	• Information and communication are a form of aid – although unfortunately, historically, the aid sector has not always recognized this. Getting information to people on the side of the digital divide, where there is no internet, may help them survive in times of crisis and help communities rebuild after immediate danger has passed. • Another study shows that only about half of the respondents (52.3 percent) in areas that experienced immense devastation were aware of the tsunami alert. • showed that it is not possible to rely solely on technology; underestimated the height of mega-tsunami's waves, which may have caused those who received only the first warning to prepare inadequately	

ANNEX III

JAKARTA INFORMATION ECOSYSTEMS PILOT

METHODOLOGY

The Jakarta Pilot research included desk and field research in the spring of 2014. Field research included 18 in-depth interviews. These took place in Jakarta (14), Washington, DC (1), and by Skype or phone (3) with individuals from the following organizations: Australia–Indonesia Facility for Disaster Reduction (AIFDR), Jakarta Disaster Mitigation Agency (BPBD), Communication Research Center, University of Indonesia; FloodTags; Humanitarian OpenStreetMap Team (HOT); International Organization for Migration (IOM); The Indonesian Society for Disaster Management (MPBI), Ogilvy Public Relations; PetaJakarta.org, SMART Infrastructure Facility, University of Wollongong; Red Cross (PMI) East Jakarta; United Nations Global Pulse Lab; United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA); University of Amsterdam; World Bank - Global Facility for Disaster Reduction and Recovery (GFDRR); and several independent journalists and researchers. Interviews included open-ended questions and discussion and a limited number of social network analysis questions asked of a subset of the interviewees. The discussion guide can be found in the appendix.

Jakarta field research also included three days of site visits to flood-affected areas in Kelapa Gading, Sunter, Muara Baru, Cililitang, Bidara Cina, and Kampung Melayu. Site visits included observation, photography, GPS mapping, and intercept interviews (lasting 10-30 minutes each) with a total of approximately 30 residents and local workers across those five areas.

DISCUSSION QUESTIONS

CONSIDERATION OF INFORMATION

- Have you assessed people's information needs /environments? What do you look for? (Trust points? Influencers? Decision points?)
    - If so, how is this information used?
    - If not, how do decisions about information provision and reporting get made?

INFORMATION FLOWS

- If you were to map the key flows of information in a flood-prone community, where would you start? What important flows are there?

  Potential topics for info content:

  A. General news affecting the community
  B. Weather
  C. Security
  D. Flooding

- Show some of the information flow maps - What do you think? Can you re-draw so this is more accurate? What are the key things to show?

INFORMATION PRIORITIES

- What do people need to know during and after a crisis?
- How do you know?
- Whose responsibility is it to provide the information?
- Can you tell how the information you share is used for people to make decisions? (Tell me a story...)
- Who is responsible for responding to queries and requests from a community during crisis?

FLOODS

- How did you hear about the floods this past January?
- How is information about floods collected and shared throughout communities?
- How can you tell if the information is being effectively communicated?
- Tell me a story about the floods.

PREPARATION

- How do you anticipate what communications will take place during disaster... but before the disaster happens?

FOR RESPONDER ORGANIZATIONS

- How does your organization handle communications during crisis?
- How would you assess recovery from the 2013 floods? 2014? In the case where recovery is progressing well, what has contributed?
- How do you perceive this issue of integrating international/national/local disaster preparation & response policy? What are the challenges?

ANNEX III: JAKARTA INFORMATION ECOSYSTEMS PILOT

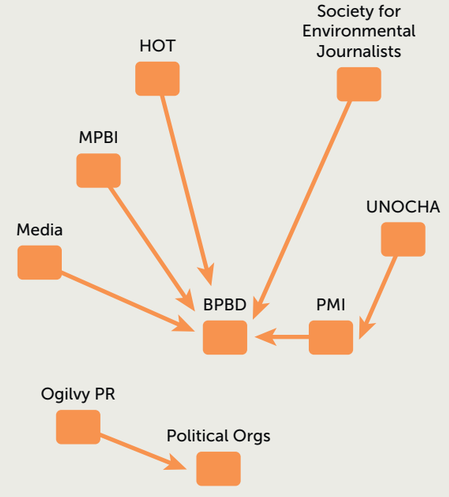
COMMUNITY VISIT MAP

ANNEX IV

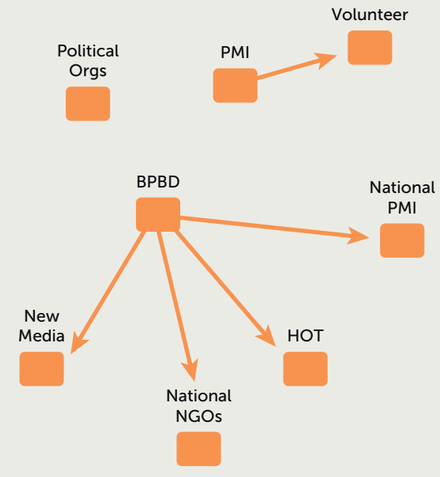
KEY FINDINGS: SOCIAL NETWORK ANALYSIS

The social network analysis was conducted to investigate perceptions of organizations involved in flood planning and response. The most effective organizations were seen to be collaborative and networked. The provincial disaster response organization, the BPBD (of which the Pusdalops high-tech communication hub is a part) was considered to be the most effective and the most collaborative in the communications space in Jakarta. BPBD has put a special emphasis on communications and improving information flows.

Which organization do you consider to be the most effective in the crisis communications space?



What other organizations does this one collaborate with (if any)?



ANNEX V

NEW YORK INFORMATION ECOSYSTEMS PILOT

METHODOLOGY

The New York InfoEco study will examine how information ecosystems contributed to resilience before, during, and after the Hurricane Sandy disaster of October 2012, focusing on communities in Brooklyn and Staten Island. As an extension of the research conducted in Jakarta, the New York study will pilot the information ecosystems methodology to inform future research and planning on how to strengthen information flows to foster resilience. The approach of the New York study is complementary to, rather than repetitive of, that of the Jakarta study; thus we can consider the New York study almost as a second phase of the Jakarta study.

KEY QUESTIONS FOR JAKARTA AND NEW YORK:

What is the role of an information ecosystem in helping people adapt to change?

How do information ecosystems transform during disruption? How do they function during recovery?

How do information ecosystems contribute to resilience during disruption and recovery?

What is the best way to strengthen information ecosystems to strengthen the resilience of communities?

NEW QUESTIONS PROMPTED BY THE JAKARTA STUDY:

- **What are the particular characteristics of information flow within communities? Has this changed since Sandy? How does information flow between the "top" (government/recovery organizations) and the "bottom" (affected communities)?**
- **What are the differences and similarities across the two chosen field sites in Brooklyn and Staten Island?**
- **How does one determine the appropriate scale for a "hyper-local" perspective?**
- **What is the relationship between influence and trust during an unanticipated crisis situation?**
- **What is the (likely complex) role of information in decision-making at the community level? Are there observably distinct decision-making styles in communities related to questions of resilience and disaster risk reduction?**
- **Why do people stay in flood-prone areas, even when they have other options?**
- **What might we learn from better understanding the communities' self-organizing capacities?**

RESEARCH AREAS FOR NEW YORK STUDY

In preparation for the New York case study, the Center first conducted desk research as a preliminary step to test the extent to which elements of information ecosystems were taken into account in disaster planning, response, and recovery. Using the Eight Critical Dimensions of Information Ecosystems as a guide, questions included: What are the gaps in terms of how policymakers are incorporating a systemic consideration of information in their framework? How might incorporating an information ecosystems approach strengthen the resilience of communities and nations? While not an exhaustive portrait, the diagnosis already reveals areas in which policy and practice post-Sandy both incorporates and neglects a consideration of information ecosystems:

1. **Information Needs**: During the long-term planning, was any assessment done of how New York residents communicate, and how to incorporate this assessment into strategy? Desk research indicated not.
2. **Information Landscapes**: Flood maps were not up to date and insufficient to aid responders' understanding of the crisis. There were no redundant structures backing up the electrical grid. These failures had a strong negative impact on the affected population's health and ability to communicate.
3. **Production and Movement**: Loss of electricity curtailed access to all key sources of information. This highlighted insufficient redundancies in communications. Further research is needed to uncover information channels, flows, and impediments.
4. **Dynamic of Access**: Assessing this would require a better understanding of the community-level dynamics, which was outside of the scope of the policy documents reviewed. This indicates that broad policy documents should attempt better inclusiveness and portrayal of citizen experience.
5. **Use**: About half of the drowning deaths in flooded homes were in areas under mandatory evacuation. This brings up questions: did these people learn about the evacuation? If they did receive the information, what was their decision-making process? Questions arise about the relationship between information and decision-making.
6. **Impact of Information**: The high volunteer engagement in response and relief—from the Surge Capacity Force to Occupy Sandy—reveals that significant numbers of people used information about the hurricane to take action to help those affected. The desk review revealed neither how well the information informed them, nor whether or not their actions matched what was needed.
7. **Social Trust**: The recent creation and deployment of FEMA Corps is one measure that begins to answer needs for networks of trust around information. An evaluation of FEMA Corps' effectiveness during Sandy would help determine to what extent it (or other volunteer groups) played this role. Such an evaluation should determine not only how well these various groups helped bolster trust across affected communities and between communities and responders, but also what the broader gaps are in social trust related to information in New York.
8. **Influencers**: The literature provides information about high-level decisions and declarations that triggered action (including preventive actions taken by the New York and New Jersey governors and the US president before Sandy made landfall) and aid distribution. Government and responder actions seem to have been significantly better coordinated than in past disasters such as Hurricane Katrina. However, the desk review shed no light on the communications flows around these major actions. Further, the city-level focus of the literature reviewed does not reveal much about community level information influencers.

The above diagnosis is just a preliminary assessment; it points to ample areas for further investigation and improvement. The New York InfoEco Pilot presents an opportunity to delve deeper into each of these dimensions to develop guidelines for decision-makers in New York and beyond.

ANNEX V: NEW YORK INFORMATION ECOSYSTEMS PILOT

METHODOLOGY FOR THE NEW YORK STUDY

To answer these questions and help further develop our information ecosystems framework, the New York InfoEco Pilot takes a multi-method research approach, described in the table below.

	LOCATION	RESPONDENTS	N	KEY ISSUES FOR RESEARCH
QUANTITATIVE PHONE-BASED SURVEY	Brooklyn near the water; across Staten Island	Residents of the two areas during Superstorm Sandy (80%); residents of the two areas that moved in after Sandy (20%)	750, divided evenly between the two geographic areas	Information sources, trust in information, neighborhood influencers; the relationship of all these elements to Sandy recovery
FOCUS GROUPS	2 for each location as above	People who self-identify with qualities that indicate they are information influencers	4 groups total; 8-10 per focus group; N=32-40	Information flow within the community on issues related both to Sandy and other important issues of the day; community trust networks; decision-making in the context of cycles of resilience; and resilience factors in information ecosystems
POLICYMAKER IN-DEPTH INTERVIEWS	Anywhere in NYC; people with a citywide perspective	New York City disaster risk reduction decision makers	5	How do decision-makers incorporate elements of information ecosystems framework into their current approach to resilience (even if unconsciously)? Whether/how could information flow maps and other information-focused decision tools be useful?
COMMUNITY LEADER IN-DEPTH INTERVIEWS	Same 2 locations as above	Community leaders who have been instrumental in helping their home area to recover (and perhaps, improve) since Sandy	10 (5 in each location)	Role of community innovation in building complex adaptive resilience, successes and challenges in building resilient communities and resilient information ecosystems, and the role of trust and influencers in building community resilience.

ANNEX VI

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USE OF MEDIA AND TECHNOLOGY

ABOUT INTERNEWS CENTER FOR INNOVATION & LEARNING

Building on the breadth and depth of Internews' activities and experience accumulated over 30 years of promoting independent media in more than 80 countries around the world, the Internews Center for Innovation & Learning supports, captures, and shares innovative approaches to communication through creative research and development worldwide.

Founded in 2011, the Center strives to balance local expertise and global learning in support of our vision that healthy information ecosystems are a root solution to furthering human progress. The Center serves as an open knowledge hub that develops and inspires collaborative investigation and experimentation.

Through a rigorous, iterative process of pilots and experimental research, the Center seeks to contribute information and tools to better understand the changing worlds of information and communications.

In the Center, we strive to deepen and enhance the links between existing expertise in media and the increasingly diverse information worlds and research that can help address the challenges of today's dynamic information ecosystems be they global, hyper local or somewhere between.

This is far from a purely academic endeavor. Internews hopes that the Center's activities will engage and benefit both those who work at the front lines of global development and the communities they serve.

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