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Assessing National Information Ecosystems

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Carnegie Endowment for International Peace
Publications Department
1779 Massachusetts Avenue NW
Washington, DC 20036
P: + 1 202 483 7600
F: + 1 202 483 1840
CarnegieEndowment.org

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Introduction

Often driven by misunderstanding, fears abound over how new technologies will change an information ecosystem.[1] They might, and they might not. Either way, it's extremely difficult to know what those changes will be without first understanding what an ecosystem was like before the introduction of those new technologies. In other words, to know how a system has changed, one must first know what constitutes the system and its prior state. This paper proffers factors that can constitute baselines for assessing national information ecosystems that can be measured across decades, geographies, and cultures. Assessing these factors over time and comparing them among countries can foster understanding of the impacts of new regulations, conflicts, and technologies. Perhaps more importantly, such an approach offers an objective analysis of information ecosystems, which is much needed in these politically charged times. The framework can also be used to identify existing gaps in knowledge, guiding policymakers and researchers on funding and research priorities to establish baselines of national information ecosystems. As those baselines are established and maintained, comparative analysis between ecosystems can generate insights on policy interventions to redress threats within them.

What Are Information Ecosystems?

Information ecosystems form where humans develop and use tools to process information into outputs that can be shared as a means of communicating with each other. In a sense, information ecosystems are communities bound by shared ideas—like the concept of a nation state, identity, or organization—and connected via technologies, from alphabets to artificial

intelligence, that enable them to produce and share content. Information ecosystems can be small, like the couple thousand people speaking Lakota that keep the language alive, or large and sprawling like the millions of Jehovah's Witnesses connected through regular congregation, print publication, digital apps, and a dedicated online community.[2] Information ecosystems can exist within other larger ones, and they can also overlap. A university campus is an information ecosystem with its classes, departments, and shared information technology infrastructure; so too is a country with national networks, media, and standards around them. The essence of information ecosystems is that people within them share some ability to understand each other, and through their interactions form networks via which information passes. Information ecosystems are surrounded by a global information environment, which includes all the other human-made systems or constructs that impact them, such as economy, education, and politics.

Understanding information ecosystems matters because they are where decisionmaking occurs, be it on an individual or a collective level. If policymakers want democracy to thrive, or citizens to be resilient to external threats, or simply for people to heed public safety directions like evacuating before a storm, the right conditions are required.

Unfortunately, little has been done to study information ecosystems over time, particularly large national ones, so that key conditions for healthy systems remain unidentified. Unlocking those secrets requires long-term systemic analysis of multiple factors, coupled with an ability to make comparisons across information ecosystems. What factors can be measured over decades and at scale across countries that might enable the sort of trend analysis needed?

Establishing baselines requires the identification and measurement of critical components of a system as a starting point, against which an evolution in its state or performance can be measured repeatedly over time. For example, to understand how the physical environment changes, climate scientists measure factors like temperature and water levels. Similar equivalents for the information environment have yet to be found. To make fair comparisons and learn lessons across information ecosystems, measurements of such factors would need to meet the scoping requirements of being **feasible**, **repeatable**, **quantifiable**, and **comparable across cultures** and should relate to the constituent elements of information ecosystems, namely **people**, **technologies**, or **outputs**.

Studying complex systems presents a unique challenge in the volume of factors that could be assessed. To provide structure, this paper groups factors into three broad categories around the constituent elements forming information ecosystems, and then into sixteen subcategories containing dozens of variables. Only factors that met the scoping requirements are included. Factors have been framed in such a way that categories can endure no matter what new technologies are added to an information ecosystem, simply by adding measurements about specific technologies as they appear rather than creating new categories with each innovation. Categorizing factors introduces the potential for modelling information ecosystems that can then enable comparisons and identify trends. A list of those categorized factors is included below.

Table 1. Potential Information Environment Factors for Further Study

Factor Category	Factor Subcategory	Factor Variables
People	Demographics	Age, gender, income, education, location, languages spoken, origin, geographic distribution, ethnicity, religion.
People	Capacity	Adult skill levels for processing information (e.g. literacy, numeracy, problem-solving in technology-rich environments), broken down by geography and demographics.
Tech	Device Ownership	Device ownership (e.g., landlines, mobile phones, gaming consoles, computers, e-readers, televisions, VR consoles, personal assistant devices) by demographic group.
Tech	Available Services	Communication services available, broken down by: type (e.g. phone, internet, website, application); location (domestic, foreign); infrastructure (e.g. undersea cables, fiber optics, satellites, towers, switches, data centers, artificial intelligence); business model (e.g. paid subscription, ad-based); use of customer data (e.g. improve service; increase use; share with third party); pricing per subscription; and usage limits (e.g. time, data, service throttling broken down by type). For applications, broken down by type (e.g. social media, messaging, search, generative AI applications, e-commerce).
Tech	Service Consumption	Number of individual subscriptions to communication services broken down by: name/brand; service type (e.g. phone, internet, website, application); rates of usage; location of subscribers. For social media, influencers over a threshold.
Tech	Infrastructure & Investments	Investments into information ecosystem broken down by: investor origin (foreign, domestic); focus of investment (infrastructure, service provider); type of infrastructure (e.g. undersea cables, fiber optics, satellites, towers, switches); type of services (e.g. cell, internet, online services).
Tech	Outages	Rates of communication outages in the country broken down by the layer affected (electrical, infrastructure, broken down by type), communications services, broken down by type (software, domain, website) and by the cause (government, sabotage, natural disaster).
Outputs	Advertising	Total advertising spending in ecosystem broken down by: type of media (e.g. print, TV, radio, web, social, SMS, email, out-of-home or outdoor); type of advertiser (e.g. retail, media and publishing, political, government, nonprofit, pharma and healthcare); use of AI-based real-time bidding.
Outputs	Content Moderation	Rate of content moderation in an information ecosystem by large online platforms (e.g. number of removals broken down by violation such as copyright infringement, spam, abuse, impersonation, disinformation, CIB; number of downranked content broken down by violation; percentage of fact-checking conducted by humans, algorithms, and AI and rates of false positives broken down by topics; number of trusted partners for fact-checking; number of collaborations with local stakeholders).
Outputs	Interventions	Number of intervention requests received by social media companies (e.g. takedown/data access requests by citizens/government), broken down by response.
Outputs	Surveillance	Number of wiretaps or interceptions of communications by authorities, broken down by reason, and if executed.

Factor Category	Factor Subcategory	Factor Variables
Outputs	Media Availability	Types of media available in the country, broken down by: source/brand, distribution method (e.g. print, online, radio, TV, social media, podcasts, mobile app), access model (free, paid), language, scope (national, local, regional), topic (current affairs, travel, entertainment), scale (conglomerates, independent), country of origin (domestic, foreign, expat-produced) and ownership type (private, public, community-owned).
Outputs	News Consolidation	Degree of news media consolidation and closures, broken down by type of outlet, coverage area, language, and reasons for closures.
Outputs	Website Consumption	Most commonly accessed internet domains, broken down by type (news, social, entertainment, commerce), country of origin, and time spent on site.
Outputs	News Media Consumption	Consumption of news media broken down by type (e.g. print, online, radio, TV, social media, mobile app), outlet/source, price point, and language.
Outputs	Topic Trends	Topic trends in content of news coverage over time, broken down by frequency and outlet.

The factors are then explored by what insights their measurement can provide about information ecosystems, as well as the challenges and opportunities in so doing. Where applicable, the relationships between factors are also explored. This discussion takes existing data into consideration and presents recommendations on what it would take to fill gaps. Taken together and measured mostly in aggregate, these factors can present an assessment of the state of an information ecosystem.

Constituent Factors

People

People are fundamental in information ecosystems; without them, information ecosystems do not exist. People produce the other constituent elements, **Technology** and **Outputs,** and through their use information ecosystems emerge. To understand the world, people take in information—be it news, campaign promises, policy options, or simply entertainment—and process it. A variety of things impact this processing, including age and identity, as well as the skill level or capacity of people for different forms of information processing depending on the type of information consumed.

While ground continues to be covered studying how people think, much of this work does not scale internationally to meet the scoping criteria outlined above for constituent factors. However, traditional **Demographics** can provide several insights on **People** that influence

perception and can be tracked at scale. These include variables like age, gender, education, languages spoken, and geographic distribution across the information ecosystem.

Much of this demographic data is already collected through national census efforts. These, of course, are not uniform across countries, opening the need for a conversation on how data about people across countries might be derived internationally in more similar ways and safely. For example, how a person constructs their identity, in terms of ethnicity or culture, can have a bearing on how they process information, or indeed, what types of media they might want available to them. Yet, measuring aspects of identity is fraught with many challenges. Imposing limited classifications upon people smacks of continued racism. And some places where information about identity has been used to target people in the past, such as France, have banned tracking of ethnicity and religion entirely.[3] Setting aside the inherent risks of assessing the people within an information ecosystem, one approach that shows promise for accounting how people view themselves is Canada's. In the Canadian national census, ethnicity or cultural origins refer to how the respondents identify their own roots, including those that might be more recently developed based on regional identities or newer national ones, such as Canadian or Quebecois.[4]

Demographic data can then be paired with factors related to **Outputs**, to assess whether **Media Availability,** for example, meets the needs of the current population, or how **News Media Consumption** and **Website Consumption** relate to both **Demographics** and what is currently produced and available within that information ecosystem.

Having an abundance of information available means little if the people within an information ecosystem are unable to make sense of it or are unaware of how its development might lead to faulty reasoning. Understanding changes over time in human **Capacity**, or the skill levels for processing various types of information, is key to assessing the state of an information ecosystem. However, the question around what skills should be tested remains open. Literacy has been a staple measure of the ability of people to comprehend written information, but in a multimedia world, more skills are required. As people increasingly use artificial intelligence, measuring awareness of how such tools impact informational outputs will also become important. Many policymakers have championed and made investments into increasing media literacy, which refers to programming that fosters the ability to critically assess mass media, making it one of the most recommended interventions for countering disinformation. Yet, programs for media literacy vary across implementation, impacting the degree of efficacy across its use cases.[5] In the past, the Organisation for Economic Cooperation and Development (OECD) has led comparative testing of adults on skills such as **Literacy**, **Numeracy**, and **Problem Solving in Technology-rich Environments**, which "reflects the ability to use digital technology, communication tools and networks to acquire and evaluate information, communicate with others and perform practical tasks."[6] Unfortunately, these assessments involve only a small number of countries and have been rather sporadic, with few countries participating more than twice.[7] To measure **Capacity**, a long-term commitment from governments or another stable donor would be needed to ensure testing of adults at regular intervals—but they are a must.

Measurement of **Capacity** can be broken down by basic **Demographics**, including age, education, and geographic distribution to assess variation in skill sets across various segments of the population. **Capacity** can also be assessed in conjunction with factors related to **Outputs**, such as **Media Availability**, **News Media Consumption**, **Website Consumption**, as well as **Technologies**, such as **Device Ownership** and various types of **Available Services**, to assess if skill levels meet the needs of the current information ecosystem.

Technologies

People use technologies to process information—be it to generate, share, or consume it. The types of technologies available and used within information ecosystem will thus impact both the types of **Outputs** available and also how **People** will engage with them, in turn shaping the overall state of the system.

As devices are used to access most information beyond that transmitted in-person, the types owned within an information ecosystem can provide insights into what types of outputs are consumed based on the way those devices work. **Device Ownership** can include variables such as the number of devices owned by individuals, broken down by type (for example, landlines, mobile phones, gaming consoles, computers, e-readers, televisions, VR consoles, personal assistant devices) and demographic group.

The presence of these devices can provide insight into the various ways people are accessing information in an ecosystem, particularly when coupled with **Available Services**. This factor assesses how people can connect devices to existing communications infrastructure. It can be broken down by type of service (such as phone, internet, website, application), the location of the service provider (domestic, foreign), and the types of infrastructure required to offer that service (for example, undersea cables, fiber optics, satellites, towers, switches, data centers, artificial intelligence). Given the breadth of applications, any service falling within this variable should be further broken down by type (social media, messaging, search, generative AI applications, e-commerce). Some of this tracking is already conducted by national census efforts, for example in Canada, Singapore, and the United States.[8] The quality of data varies. The U.S. Federal Communications Commission maintains data on broadband coverage across the country, but has received prior criticism on undercounting gaps in broadband coverage.[9] In contrast, Singapore, which has a much smaller land mass, has relatively few barriers in assessing national broadband coverage, and conducts quarterly assessments of all mobile operators with the requirement that they provide high-quality connectivity across at least 99 percent of the country.[10]

The business models of **Available Services** can vary considerably, with some offering paid-for subscriptions, and others targeting users with advertising to make the service free. Moreover, many service providers collect data about customers that they use for a variety of purposes, including improving services, targeting ads, increasing usage, and selling to third

parties. Assessing these variables can provide insights into the prevalence of mechanisms for targeted persuasion in an information ecosystem, which, when coupled with the **Output**-related factor of **Advertising** discussed below, can indicate a degree to which users are exposed.[11]

For those services charging a subscription, capturing the pricing of those offerings can shed light on potential accessibility issues when considered against **Demographic** data such as income. Tracking usage limits include noting any restrictions on time, data, and service throttling broken down by type (such as video streaming) and can provide insights on the flow of information through an information ecosystem.

As opposed to surveying individuals, data for assessing **Available Services** in an information ecosystem will most likely be derived from the service providers themselves, and with the help of reporting regulation. If made available, data on this factor could provide insights into the available means for the flow of information, with the potential to indicate possible speeds and volumes of movement.

Having something available does not necessarily mean that people are using it. The availability of services should be compared against their usage, or **Service Consumption**, by people within an information ecosystem. **Service Consumption** includes variables such as the number of individual subscriptions broken down by the name and location of the service provider, type of connection (for example, phone, internet, website, application); rates of average usage per day by time; and geographic distribution of subscribers. For those services that enable users to create and share content with groups, such as social media, an additional variable can consist of reporting on influencers whose feeds are regularly consumed by audiences in an information ecosystem. Reporting on influencers can be based on audience sizes, for example, and include only those over a certain threshold whose reach brings greater responsibility and scrutiny.[12]

Most countries collect some information on **Service Consumption** in their censuses. Data related to the use of applications, such as social media, however, remains sporadic. In the case of Singapore and India, that data was primarily collected by marketing companies, which provide limited public information on their methodologies.[13] Data on **Service Consumption** can be enforced through regulation, compelling service providers to report on variables.

Many aspects of modern information ecosystems depend on underlying **Infrastructure** to function. The state of infrastructure, including its maintenance and dependency on hardware providers, will impact the **Available Services** riding those networks and **Service Consumption**. Data for assessing this factor includes investments into infrastructure by investor origin (foreign, domestic), focus of investment (infrastructure, service provider), type of infrastructure (for example, undersea cables, fiber optics, satellites, towers, switches), and type of services supported (such as cell, internet, online services).

In addition to **Infrastructure** being a potential measure of the state of an information ecosystem, insomuch as maintenance and development ensure services function, measurement of this factor can also provide insights into the susceptibility of an ecosystem to foreign interference—be it in a pervasive ability to conduct surveillance, control access to communication services, or push propaganda. This has certainly been some of the concern for many countries in North America and Europe who banned the Chinese firm Huawei from providing them with 5G network infrastructure.[14]

A lot of data related to **Infrastructure** already exists in both domestic and international trade databases. However, different countries and international databases use different ways to categorize the kinds of goods that are traded, and exact investment amounts in communication infrastructure specifically can be difficult to calculate and compare.

The functioning of services can also provide insights into the state of an information ecosystem. Tracking **Outages** across variables such as the layer affected (electrical, infrastructure, broken down by type), communications services (broken down by type), and the cause (government, sabotage, natural disaster) can provide a measure of an ecosystems ability to function. The governments of both Canada and France produce regular reports on internet outages.[15] For India, Singapore, and the United States, some commercial sites report on internet outages in real-time, but do not provide historical data.[16]

Outputs

People use **Technologies** to produce and share **Outputs**. Outputs consist of processed information that has been turned into a form fit for sharing between people, such as news stories, books, and social media posts. However, given the volume of outputs now produced in most societies, there are significant challenges in studying various outputs at scale, including privacy issues related to user-generated content on social media platforms. Qualitative analysis is widely used to assess outputs. Beyond challenges with scale, such methods can introduce bias and be easily politicized, as has happened with disinformation research.[17] The factors below aim mostly to look beyond the substance of outputs, in order to study aspects about those outputs or the control of them, both of which can be measured with limited qualitative assessment.

An often overlooked but prevalent output in most information ecosystems is advertising. **Advertising** is tied to persuasion, aimed at convincing people to buy a product or service, but also influencing decisionmaking during elections or on key issues of public importance, like climate change. A noticeable increase in ad spending can be an indicator of influence operations, as often happens before elections and other major political events. For example, advertising, and in particular advertising that paraded as editorial content, was a major source of information pollution in Ukraine leading up to the Euromaidan protests and in general might be a sign of a less than healthy information ecosystem.[18] Therefore, advertising is an output that warrants study in understanding an information ecosystem.

Advertising is a huge industry, making it a challenge to study. At the same time, industry analysts have been conducting some form of measurement on advertising in national markets for years, albeit keeping their analysis behind high-priced paywalls.[19] These assessments often take the form of measuring **Ad Spending**, broken down by type of media (such as print, TV, radio, web, social, SMS, email, out-of-home or outdoor) and by type of advertiser (for example, retail, media and publishing, political, government, nonprofit, pharma and healthcare). As artificial intelligence is adopted in placing advertisements, its use in facilitating real time bidding should also be tracked. As noted above, **Advertising** can be paired with variables from other factors, such as the use of customer data by services providers, to assess the level of persuasion present in an information ecosystem.

Factors related to content governance can provide a potential measure for how much control is being applied to the information ecosystem.

Rates of **Content Moderation** can be measured by the number of content removals by a large online platform broken down by violation (for example, copyright infringement, spam, abuse, impersonation, disinformation, coordinated inauthentic behavior); the number of downranked posts broken down by violation; the percentage of fact-checking conducted by humans, algorithms, and AI; and rates of false positives of that fact-checking broken down by topics. This factor can also include variables such as the number of trusted partners for fact-checking; and the number of collaborations with local stakeholders, to better understand how global companies are attempting to adapt to that information ecosystem.

Intervention Requests can be measured in the numbers received by large online platforms broken down by type (such as remove content, downrank content, ban a user), the requester (citizen, government, law enforcement agency), the reason, and if the request was executed. Most social media platforms already provide reporting on intervention requests broken down by country.[20] Reporting on content moderation practices, however, are only provided on the country-level for countries that have made it a regulatory requirement.[21] The European Union's Digital Service Act, and in particular Article 40, may make some of this data available to evaluate systemic risks. However, other democratic countries with appropriate checks and balances will need to follow suit with similar regulation to ensure access to similar data to study their information ecosystems.[22]

A third factor in **Surveillance** can be tracked in the number of wiretaps or interceptions of communications by authorities, such as law enforcement agencies, broken down by reason and whether it was executed. Such data is dependent on governments being transparent about surveillance; while the United States, France, and Canada offer such reporting, Singapore and India do not.[23]

The remaining factors relate to media and its consumption.

Media Availability relates to the types of content currently available in an information ecosystem. This factor can be measured by the types of media available in a country, broken down by the source or brand producing it, the distribution methods used in so doing (for

example, print, online, radio, TV, social media, mobile app, podcast), frequency of outputs produced (daily, weekly, monthly, and so on), the languages in which outputs appear, and the topics covered (such as current affairs, travel, entertainment). Additional variables of media availability relate to the operations of those organizations producing outputs and can include assessing the model used for consumers to access those outputs (free versus paid), the scope (national, regional, or local) and scale of operations (independent or conglomerate), the country of origin (domestic, foreign, expat-produced, and so on), funding sources broken down by percentage (investors, subscriptions, and ad sales) and ownership type (private, public, community-owned).

A particular challenge in assessing media availability within an information ecosystem is the interconnected nature of most countries as part of a global environment. For example, in Myanmar, exiled journalists play a significant role in providing news that would not be covered in local news media.[24] Despite local content laws, the Canadian information ecosystem is heavily exposed to American news and entertainment content.[25] Finding factors that shed light on how information moves across borders is key to understanding phenomena like foreign interference, and what that even entails in a world with significant movement of people. Tracking media availability provides a starting point.

Domestically, measurement of **Media Availability** could be aided by implementing basic transparency reporting by news media outlets, which would need to be done in such a way so as not to impact freedom of press. Ideally, assessment of **Media Availability** would be cross-checked against regular monitoring of topics covered by available news, undertaken by media scholars with sustained funding over time. Some of them have already made headway on this work, though most existing initiatives are either one-off or focused on one country only.[26] One exception to that is France, whose government conducts long-term tracking of media outlets available in the country.[27]

Another factor affecting **Media Availability** is **Media Consolidation and Closures**, which can be measured by regular tracking of existing outlets, marking closures and consolidations broken down by type of outlet, coverage area, language, and reasons for closures, such as the loss of a license due to a regulator ruling versus bankruptcy.[28] This factor is best tracked by media scholars with sustained support over time. Across the countries covered in our exploratory process, several one-off projects documented this activity, but none of them had data for tracking changes over time that we could find.[29] In the future, some of this data may become available in EU member countries through the European Media Freedom Act, which will enable the tracking of potential risks to media pluralism such as closures.[30]

The mere availability of media does not guarantee that it is consumed and thus **News Media Consumption** by people in an information ecosystem must be assessed in tandem. This factor measures variables related to news consumption broken down by type (for example, print, online, radio, TV, social media, mobile app), by outlet or brand, by price point, and by the language outputs in which they are produced.

Given how rapidly the news sector is changing across most information ecosystems, measurements on **Media Availability, Media Consolidation and Closures**, and **News Media Consumption** need to be conducted annually. Such measurements could be managed in a two-pronged approach of mandatory transparency reporting by media outlets on subscription rates and domestic web-traffic, cross-checked against regular surveys representing the general population conducted by media scholars, such as that currently conducted by the Reuters Institute.[31] Surveys can also capture media and news sources produced outside of mainstream offerings, such as those produced by independent journalists, influencers, or smaller unregistered outlets. Both categories of **Media Availability** and **News Media Consumption,** coupled with measurements on other factors related to **Demographics,** can provide insights on whether needs are being met across the population.

It might be trite, but the web has become an important means of communication in most information ecosystems. Analysis of **Website Consumption** is currently being sold as a service by companies such as SimilarWeb, so technically it is feasible, however, it must be approached with privacy safeguards in place.[32] The Canadian Internet Registration Authority already tracks similar data for all .ca domains registered in Canada.[33] However, unless a country has cut itself off from the wider world, internet traffic is likely to extend across borders. Therefore, it is not sufficient to simply understand what Canadian-registered websites are most consumed in Canada, for example, but what websites in general. This could help identify what foreign-originating news is being consumed, to help understand what needs aren't currently being met.

Assessment of **Website Consumption** could entail measuring the most accessed internet domains within an information ecosystem, broken down by type (for example, news, social, entertainment, commerce), by domain country of origin, and time spent on site. Cross-checking website consumption against usage rates of virtual private networks (VPN) in an information ecosystem could help calculate a potential bias rate. Tracking website consumption patterns can shed light on what types of outputs are being consumed within an information ecosystem beyond news media, and if compared against measurements of other factors such as **News Media Consumption,** can act as a cross-check against transparency reporting by outlets and independent research.

A final factor related to **Outputs** is **Topic Trends** in news coverage over time, broken down by frequency of mention and outlet mentioning the topic. Tracking and measuring this factor is feasible on digital news only, and is already achieved to a degree by Google in its Trends product, though the assessment proposed here would go beyond that offering.[34] Ideally, measuring trending topics would not be limited to news media produced within that information ecosystem, but also in sources produced abroad that are commonly consumed by people within the country studied, requiring the combined factors of **Topic Trends**, **Website Consumption**, and **News Media Consumption**.

Tracking topics frequency alone may not be particularly revealing without greater context of how a term is used. However, it can help ring some alarm bells. In the UK, for example, one might have noticed that the topic of migration would become a cause for concern given consistent tabloid coverage over the years.[35]

One challenge with measuring **Topic Trends** are paywalls used by news outlets to manage subscriptions, which might be overcome through negotiated deals to facilitate web crawlers as part of a limited research agreement. Such assessment would require stable funding to ensure long-term measurement of this factor. As with aforementioned factors on media, safeguards would need to be in place to ensure that measurement of trending topics isn't used to impinge on media freedom.

Measuring **Topic Trends** in an information ecosystem provides insights into what is being covered by different kinds of news, including mainstream editorial news, tabloids, or other nontraditional news sites, and when looked at in conjunction with other factors such as **Demographics** and **Capacity**, as well as economic and sociopolitical conditions, might help shed light as to why people in some information ecosystems react the ways they do to current events. Are there a combination of factors that create a climate where disinformation easily sparks riots? Going back to the example of the UK, do such storms arise in information ecosystems experiencing declining literacy rates,[36] a sharp influx of new people,[37] trending coverage of migration with conditions like an economic downturn,[38] declining social services,[39] and perceived grievances that remain unaddressed?[40] This is a question that could potentially be answered once enough assessments of information ecosystems are built up, analyzed, and compared.

Taken individually, many of these factors might not mean much. Taken collectively, and measured over time and across countries, an understanding of the state of information ecosystems can emerge that can better guide policymaking. For example, with enough national baselines built and maintained over time, this approach could identify a country's susceptibility to foreign interference. This could include assessing the availability and consumption of information sources in relation to a population's demographics and capacity, to identify gaps in the kinds of information available and what foreign sources are currently being used. As mentioned above, the dependencies to build and maintain infrastructure to provide communications within an information ecosystem might introduce vulnerabilities. Likewise, foreign services providers might have an upper hand in controlling the flow of information for users in another information ecosystem that lacks regulatory protections. From a different angle, information ecosystems that are thought to be more resilient to foreign threats, such as Finland, might be studied to understand how factors there differ from countries perceived to be more susceptible.[41]

Future Work

This project aimed to identify constituent factors that can work internationally and over time to piece together an understanding of national information ecosystems, and collectively the global information environment. It does not aim to unlock all the information environment's mysteries or provide a singular framework. That is neither reasonable nor possible when dealing with such complexity. Indeed, there are many additional research questions that arose in conducting this work that are beyond the scope of this paper, such as: the weighting of factors denoting their relative importance; understanding the impact on information ecosystems of surrounding conditions such as the economy, conflict, and climate change or the processes interconnecting various constituent factors and conditions; and how to scale analysis of factors between the micro and the macro. This effort should be considered a first step of many.

This paper outlines constituent factors that can be measured—the next question is how much of those measurements already exist, and what it would take to fill any gaps. Some of the data for these categories already exists, although roadmaps will need to be prepared to help fill gaps. Drawing from our exploratory efforts, the team found that data on population demographics was often available, as was data on infrastructure investments and national phone and broadband subscriptions. Information on subscription rates to other services, however, were comparatively less accessible. A major gap is in longitudinal data, as most existing offerings were one-off studies or mapping efforts with limited specificity or scope. These gaps vary from country to country.

Building on this paper, a next step is to work with partners across countries to review existing data, identify researchers working on various factors, and map what is known on a given information ecosystem. In this step, Carnegie's Information Environment Project would help build country teams to assess national information ecosystems. Such an approach would identify a country lead who has experience working across disciplines, and can help find experts working on demography, education assessments, media studies, advertising, computer science (web traffic, trending topics), and the information communication and technology sector, to name a few. Together this team would prepare a baseline on what data exists and draft a road map for that information ecosystem to fill gaps. Over time, such a collective effort could build up an understanding of the global information environment that could then be used to assess a variety of issues, such as what constitutes a healthy information ecosystem in the context of democracy, or what makes some ecosystems more resilient to threats than others.

About this Paper

This paper draws on a year-long brainstorming process to identify constituent factors. As part of that work, the Information Environment Project reviewed 133 existing indices to understand their strengths and weaknesses as potential models and for possible use in assessing information ecosystems. The project engaged thirty-three researchers from twenty countries to brainstorm potential factors and share feedback on existing indices, and coded 124 possible factors that were reviewed by a core team of contributors bringing expertise from academia, the United Nations Development Programme, and the Organisation for Economic Cooperation and Development. The twenty countries were: Australia, Brazil, Canada, Chile, Estonia, France, Indonesia, Ireland, Japan, Kenya, Malaysia, Mexico, New Zealand, Nigeria, South Africa, Spain, Türkiye, the United Arab Emirates, the United Kingdom, and the United States.

About the Authors

Alicia Wanless is the director of the Information Environment Project at the Carnegie Endowment for International Peace, which aims to foster evidence-based policymaking for the governance of the information environment. Alicia is the author of The Information Animal: Humans, Technology and the Competition for Reality.

Samantha Lai is a senior research analyst at the Carnegie Endowment for International Peace's Information Environment Project.

John Hicks is a research assistant in the Technology and International Affairs Program at the Carnegie Endowment for International Peace.

Notes

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The information environment is integral to democracy. This is the space where people process information to make sense of the world using tools from alphabets to artificial intelligence to produce outputs from the spoken word to virtual reality and whatever comes along in the future. Manipulation of the information environment threatens the legitimacy of democracy if citizens are increasingly unable to make free and informed decisions. Our understanding of this complex system is still emerging at the same time as conflicts within the information environment erode its integrity. In response, democracies around the world are increasing control over their national information ecosystems. But with little evidence to inform policymaking, they risk backsliding into authoritarianism or having their interventions backfire as trust in public institutions is degraded by information pollution. Carnegie's Information Environment Project is a multistakeholder effort to help policymakers understand the information environment, think through the impact of efforts to govern it, and identify promising interventions to foster democracy.

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