PARIS 21

ADVANCING DATA LITERACY IN THE POST-PANDEMIC WORLD

A primer to catalyse policy dialogue and action

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1 THE URGENT NEED TO FOSTER DATA LITERACY

"Statistical claims fill our newspapers and social media feeds, unfiltered by expert judgment and often designed as a political weapon. We do not necessarily trust the experts— or more precisely, we may have our own distinctive view of who counts as an expert and who does not.

Nor are we passive consumers of statistical propaganda; we are the medium through which the propaganda spreads. We are arbiters of what others will see: what we retweet, like or share online determines whether a claim goes viral or vanishes."

– Tim Harford, FT columnist and author, (2018)[1]

COVID-19 HOLDS A MIRROR UP TO DATA LITERACY IN SOCIETY

The COVID-19 crisis presents a monumental opportunity to engender a widespread data culture in our societies. Since early 2020, the emergence of popular data sites like Worldometer[2] have promoted interest and attention in data-driven tracking of the pandemic. "R values", "flattening the curve" and "exponential increase" have seeped into everyday lexicon. Social media and news outlets have filled the public consciousness with trends, rankings and graphs throughout multiple waves of COVID-19.

Yet, the crisis also reveals a critical lack of data literacy amongst citizens in many parts of the world. A surge of data actors presenting conflicting numbers has left the layperson more confused than informed. Keeping up with inconsistent reporting practices, dubious sources and heterogeneous data quality is becoming arduous and has contributed to wavering public trust in data, evidence and institutions in different parts of the world. (Misra and Schmidt, 2020)[3]

The lack of a data literate culture predates the pandemic. The supply of statistics and information has significantly outpaced the ability of lay citizens to make informed choices about their lives in the digital data age. Every day citizens are bombarded with aggregate statistics that may not be directly relatable to their own lives, face divergent views of "evidence-based" policies and experts or need to make decisions about their data privacy. Today's fragmented datafied information landscape is also susceptible to the pitfalls of misinformation, post-truth politics and societal polarisation – all of which demand a critical thinking lens towards data.

There is an urgent need to develop data literacy at the level of citizens, organisations and society – such that all actors are empowered to navigate the complexity of modern data ecosystems. The capacity to compare, contrast and parse meaningful information amidst escalating data noise, can propel citizen engagement and civic participation towards thriving deliberative democray. (Schiller and Engel, 2017)[4] Building a minimum set of relevant capabilities to augment public data literacy and use can help unlock the value of data and statistics.

FROM INTEREST TO IMPACT: BEYOND A FRAGMENTED UNDERSTANDING AND PRACTICE OF DATA LITERACY

Interest in data literacy has increased over time and in different parts of the world, including several non-OECD countries (see Figures 1 and 2 below, for instance), signifying a broad-based acknowledgement of its need in today's digital data age. However, much more needs to be done to mainstream its development through concerted efforts by different actors in society, including governments, private sector organisations, civil society and international organisations.

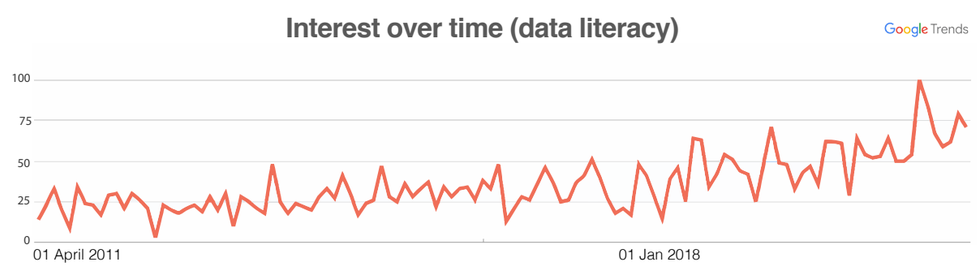

Figure 1: The steadily rising interest in the term "data literacy" in the past 10 years worldwide

Source: Google Trends[5] , as of March 14, 2021. "Interest" is captured by Google searches for the term "data literacy". Searches pertain to the period 2011-2021. The vertical axis represents search interest relative to the highest point on the chart, and doesn't convey absolute search volume. For more information, please refer to the Google Trends FAQ.

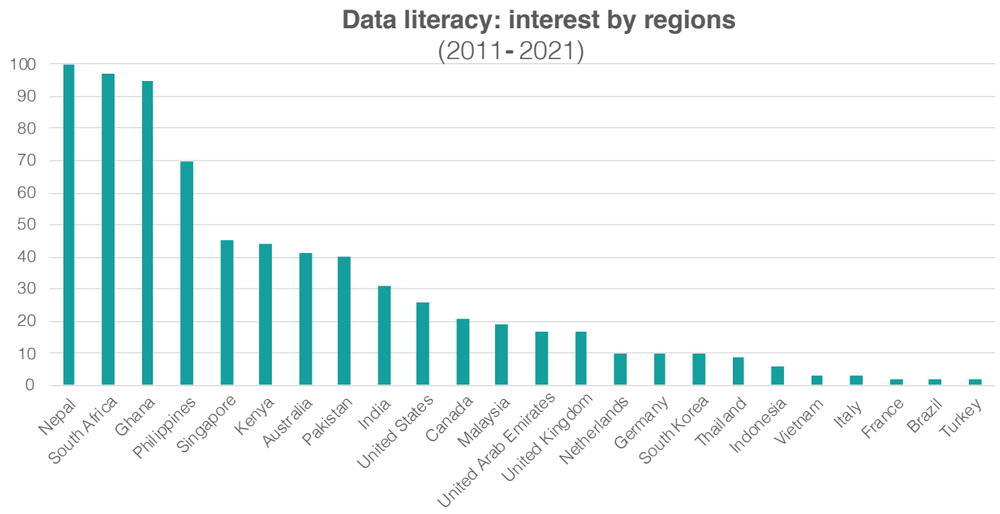

Figure 2: Data literacy is a matter of global interest, in particular among many low-and middle-income countries

Source: Google Trends[5], as of March 14, 2021. "Interest" is captured by Google searches for the term "data literacy". Searches pertain to the period 2011-2021. The vertical axis represents search interest relative to the highest point on the chart, and doesn't convey absolute search volume. For more information, please refer to the Google Trends FAQ.

Data literacy is often defined, conceived of and understood in different ways depending on the context, sometimes confounded with other adjacent competencies such as information, statistical or digital literacy. A modern framing of data literacy needs to account for the role of all actors, including citizens, not just as data consumers – but data producers and partners, requiring a shift in our thinking. Further, implementing data literacy policies and programmes remains a complex endeavour. The dual nature of this challenge (i.e. in both the thinking and doing aspects of data literacy) contributes to a lack of effective targeting of data literacy interventions and an absence of a broad-based measure to evaluate the impact of such efforts. (Montes and Slater, 2019)[6]

There is now an urgent need to go beyond an ad-hoc understanding and operationalisation of data literacy to forge a common language around what it means to be data literate and how to do data literacy effectively. This paper is part of an effort to drive a global dialogue to converge and catalyse the thinking and practice around data literacy, happening in different communities spanning media/journalism, development policy, official statistics and open data, etc. The paper first presents a few insights with key elements of the literature on data literacy (Section 2), and then covers common practices of implementing data literacy programmes, with selected examples from different actors and parts of the world (Section 3). It concludes by sharing some takeaways that emerged out of this stock-taking exercise and proposes a few questions to spur further dialogue and discussion (Section 4).

2 ELEMENTS OF DATA LITERACY – A MODERN UNDERSTANDING FOR POLICY IMPACT

"You may remember from your own childhood studying both Language and Literature. Language focuses on reading and writing, the production of material, the manipulation of language. The study of Literature focuses on the study of that language in use, the material produced by different authors, their use of different techniques, the context in which they produced their works and the impact their work had.

Data literacy is akin to the study of literature. Data literacy should be about the study of data and how it is collected, used and shared by different organisations."

- Jeni Tennison, Vice President and Chief Strategy Adviser, Open Data Institute (2017)[7]

With the advent of data revolution and rise of digital technologies, a broad spectrum of literacies (numeracy, statistical literacy, media literacy, digital and technology literacy, etc.) are needed in the information age of today. Frank et al. (2016)[8] argue that developments in the open data movement have put data literacy on the agenda of the broader community including businesses, governments and citizenry at large – making it an "essential life skill comparable to other types of literacy". The UN's Data Revolution website depicts data literacy at the intersection of statistical literacy, information literacy and technical skills for working with data (see Figure 2 below).

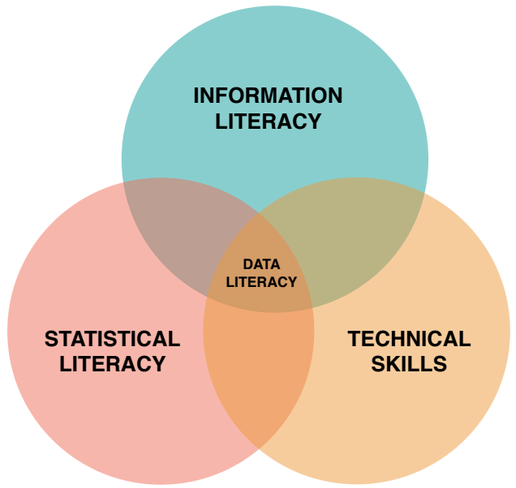

Figure 3: "What is data literacy?" graphic reproduced from UN Data Revolution website[9]

This paper reviews three main elements of data literacy in terms of how the term is framed and understood in some of the important literature on the subject.

INSIGHT #1: DATA LITERACY GOES BEYOND 'TECHNICAL' DATA SKILLS

An elementary way to understand what "data literacy" is to transpose the well-established definition of literacy and apply it to data. "Just as literacy refers to the ability to read for knowledge, write coherently and think critically about printed material, data literacy is the ability to consume for knowledge, produce coherently and think critically about data". (Gray, Chambers and Bounegru, 2012)[10]. Put simply, just as "literacy is our ability to read, write and comprehend language, data literacy is our ability to read, write and comprehend data." (Data to the people, 2018)[11].

One of the most recurrent formulations of data literacy in the literature is put forth by Bhargava and D'Ignazio (2015)[12], describing it as "the ability to read, work with, analyse, and argue with data". The authors offer the following expansion: "Reading data involves understanding what data is, and what aspects of the world it represents. Working with data involves creating, acquiring, cleaning, and managing it. Analysing data involves filtering, sorting, aggregating, comparing, and performing other such analytic operations on it. Arguing with data involves using data to support a larger narrative intended to communicate some message to a particular audience."

Data literacy is not simply about an acquisition of technical data skills typically associated with data science, data analytics or statistics. Tarrant (2021)[13] describes data literacy as "the ability to think critically about data in different contexts and examine the impact of different approaches when collecting, using and sharing data and information." Similarly, Gray, Gerlitz and Bounegru (2018)[14] call for efforts to develop "data infrastructure literacy", which includes not just "the competencies in reading and working with datasets but also the ability to account for, intervene around and participate in the wider socio-technical infrastructures through which data is created, stored and analysed". Sander (2020)[15] also argues for an extended critical big data literacy that places "awareness and critical reflection of big data systems at its center". Such expanded conceptions of data literacy allow for a broader movement to characterise citizens at large as data literate.

Raising concerns on the technical conceptualisations of data literacy that fail to confront deeper structural issues, Bhargava et al. (2015)[16] advocate for a broader framing of "literacy in the age for data". Taking a historical lens to literacy, they propose data literacy as "the desire and ability to constructively engage in society through and about data." This definition, the authors argue, encompasses elements and principles from different sub-kinds of literacy (such as media, statistical, scientific computational, information and digital literacies), moving from medium-centred conceptions of literacy towards an encompassing one.

In a similar vein, Schuller (2020)[17] describes that "ethical literacy" is a meta-competence that comprises other kinds of literacies such as – data, information, digital or statistical – which are fluid concepts themselves, with several over-lapping sub-components. It then defines data literacy as "the cluster of all efficient behaviours and attitudes for the effective execution of all process steps for creating value or making decisions from data."

There isn't a consensus on one overarching and actionable definition of data literacy. Several works on data literacy describe it as a use-centric phenomenon, with emphasis on "the ability of non-specialists to make use of data" (Frank et al. 2016)[17], while the others include ability to "collect and manage" data (Risdale et al, 2015)[18] or "select and clean" data (Wolff et al, 2016)[19] in addition.

A comprehensive view of data literacy should then look at relevant capabilities across the different data life-cycle stages that incorporates:

- Data Context: This includes a general awareness of the data and its environment. This involves an understanding of the underlying context of the data, its origins, purpose and associated systems.
- Data Planning: This includes identifying data needs based on real-world scenario and critical inquiry, developing a data strategy or plans, considering aspects of data governance.
- Data Production: This includes aspects related to data acquisition, design, sourcing, collection, processing, management, dissemination.
- Data Evaluation: This includes the "working with data" aspect such as interpretation, application, analysis and visualisation of the data.
- Data Use: This includes data communication, critique, engagement, argument and advocacy related to data-driven decision making. This can also incorporate ethical data sharing and reuse practices.

A number of common capabilities associated with data literacy can be identified in the literature, some of which is presented in Table 1 below. This can help carve out a minimum set of competencies for characterising data literacy.

Table 1: Different data-literacy capabilities across the data life-cycle

Paper → **Data life-cycle stages ↓** **Key capabilities referred to ↘**	**Context** (critical awareness towards data & its environment/ systems)	**Planning** (identify data needs, strategise, govern)	**Production** (design, source, collect, manage, disseminate)	**Evaluation** (interpret, apply, analyse)	**Use** (share, communicate, engage, make decisions)
Gray, Chambers and Bounegru (2012)[8]	think critically about data		produce coherently	interpret	consume for knowledge
Deahl (2014)[20]	understand data and its role in society		find, collect, manage	interpret, visualise	support arguments
Risdale et al. (2015)[16]			collect, manage	evaluate, apply	decision-making
Bhargava and D'Ignazio (2015)[10]	understand what data is, what aspects of the world it represents		creating, acquiring, managing	cleaning, filtering, sorting aggregating, comparing, etc.	use data to support larger narrative/ communicate a message
Bhargava et al. (2015)[14]					constructively engage in society through and about data
Wolff et al. (2016)[17]		undertake data inquiry process, develop hypothesis, identify data	select, collect/ acquire	clean, analyse, visualise, interpret	critique, communicate stories, consider ethical use
Sander (2020)[13]	awareness, understanding and critical reflection of big data practices and systems				implement critical knowledge for empowered use

Schuller (2020)[15]		establish data culture (identify/ specify/ coordinate data application)	provide data (modelling, sourcing, integrating, preparing)	evaluate data, interpret data products and data	derive actions (evaluate impact, act data-driven)
Statistics Canada[21]	awareness	data discovery, organisation, stewardship	gather, clean, explore, model, meta-data creation	evaluate quality, visualise, interpret, meta-data use	story-telling, making and evaluating decisions

INSIGHT #2: DATA LITERACY IS APPLICABLE AT INDIVIDUAL, ORGANISATIONAL AND SYSTEM LEVELS

While the formulation of data literacy is often done at the level of individual ability, many competency frameworks extend the concept to data literate organisations, and emerging literature also captures the importance of a broad-based data culture in society.

Pangrazio and Sefton-Green (2019)[22] posit that "data literacy focuses on developing the individual's understanding, control and agency within datafied systems." Common data literacy self-assessment tools also cater to individual data capabilities. For instance, the Australia-based company Data to the People produces a tool called myDatabilities[23], which is an online individual self-assessment survey with a range of 18 core competencies with up to 6 levels of capability across the dimensions of reading, writing and comprehension. The Data Literacy Project[24], launched by the global data analytics company Qlik, and including many partners from the private sector, offers a non-technical assessment[25] as well as a certification of individual data literacy skills.

One key takeaway from the important research conducted by School of Data[26] in 2016 was - "data literacy can be promoted and assessed at the individual level, but also in groups (such as organisations or communities)". Organisational assessments of data literacy "measure the degree to which data are used for daily operations in the organisation as a whole, i.e., the culture around data use in addition to the data literacy of the workforce." (Bonikowska, Sanmartin and Frenette, 2019)[27]. Sternkopf and Mueller (2018)[28] propose a maturity model of data literacy at the organizational level, with a focus on NGOs. The Open Data Institute has also developed a Data Skills Framework[29], a tool that helps analyse approaches to data literacy and skill gaps across a team, department or organisation. It illustrates how a varied range of data skills (strategic, managerial, leadership) need to be balanced with technical skills for successfully enabling data innovation.

Extending the above line of reasoning to a scale beyond a single organisation, data literacy is also applicable to a group of organisations, or a sector – and to the broader citizenry and society as a whole. For instance, governments in Canada[30] and Australia[31] have begun data literacy programmes within their public services. Recognizing the need to develop a social data literacy culture, Professors Diego Kuonen and Monique Lehky Hagen in Switzerland have initiated "an appeal for an urgent national data literacy campaign" in 2020. It calls for (1) large scale information campaigns, together with the media, to strengthen the data literacy of the public; (2) creation and promotion of accessible resources and lifelong training programmes, starting from kindergarten; (3) creation of independent, interdisciplinary, certified "data literacy" competence centres.

INSIGHT #3: DATA LITERACY IS FOR EVERYONE, BEYOND JUST DATA EXPERTS AND ENTHUSIASTS

"It is not only professionals that require data literacy – it is a basic requirement for informed citizens."

– David Spiegelhalter, former president, Royal Statistical Society (2020)[33]

Most literature on data literacy is responsive to the context-specifity of the definition, where capabilities are applicable to different types of data users. For instance, applying data literacy can mean different things in the context of journalists, educators or policy-makers. An occupation-agnostic way to view this is to delineate data literacy capabilities at varied levels of proficiency or roles and functions as different data actors. Taking such approaches allows for data literacy to not just be a domain of specialists, and be comprised of a minimum set of capabilities that can be embraced by laypersons.

For example, Ridsdale et al. (2015)[16] group data literacy competencies into conceptual competencies, core competencies and advanced competencies. Similarly, Wolff et al (2016)[17] identify four types of citizens who would require different levels of skill complexity given their expected interaction with data: reader, communicator, maker and scientist.

A foundational data literacy skillset for people can serve is an effective tool to accelerate social inclusion and informed participation in the datafied information ecosystem. The case for data literacy as an effective tool for empowerment from passive consumers to active citizens is reinforced by Carmi et al (2020)[34] As part of their "Me and my Big data – Developing Citizens' Data Literacies"[35] project that seeks to understand the levels of data literacy amongst UK citizens, the authors propose a "data citizenship framework". It explores relations between data, power and contextuality and comprises of three areas:

- Data thinking - Citizens' critical understanding of data (for example, understanding data collection, developing and evaluating data-based explanations)
- Data doing - Citizens' everyday practical engagements with data (for example, data handling and management)
- Data participation - Citizens' proactive engagement with data and their networks of literacy (for example, data activism, seeking opportunities to address misinformation, exercising rights like access to open data, individual and collective data privacy)

Bhargava et al (2015)[14] go further and argue that a central goal of data literacy promotion should be to empower "citizens and communities as free agents". They propose to leverage data literacy as a means and metric to galvanise greater social inclusion in the age of data, or "data inclusion". Their "human-centred approach to data literacy "seeks to foster: greater inclusiveness, enhanced community participation, prioritization of critical needs rooted in local contexts and increased resilience. Similarly, Gutiérrez (2019)[36] links data literacy as a pre-condition to political participation in a datafied world.

Consequently, to cultivate a broad-based data culture, it is critical that the notion is not confined to a domain of professionals, experts or enthusiasts, but extends as a generalised feature amongst non-specialists and citizens at large.

3 DOING DATA LITERACY – SELECTED PRACTICES AND EXAMPLES

Realising the returns on the data revolution and open data movement rests on how effectively the available data is utilised by different actors in society. To achieve this, there is growing acknowledgement on the need for widespread data literacy, but operationalising efforts to foster it remains a challenging undertaking, subject to capacity and opportunities.

WAYS TO OPERATIONALISE DATA LITERACY

Common methodologies for "doing" data literacy, as identified by the School of Data are clustered as short-term, medium-term or long-term efforts, briefly described below:

- **Short-term efforts**: These include workshops with a structured and pedagogic orientation (ranging from multi-hour to multi-day); community events with a more informal or social dimension with peer-learnings (for instance, data clinics or data meet ups); datathons or bootcamps, which are based on the popular format of hackathons with an intense and focussed problem-solving approach, catering to individuals that already have some level of data literacy
- **Medium-term efforts**: These are typically done in the form of trainings that allow for deeper participation and engagement for data literacy development. Examples include week-long workshops with follow-ups or communities-of-practice, or trainings spread out over several weeks (contrary to the datathons model, these rely on the accumulation of practice over a longer period, demanding a shorter span of time and effort per week, but spanning multiple weeks).
- **Long-term efforts**: These are "immersive endeavours" where skills transfer is meant to be done in an intensive learning environment with experts, with a lasting impact. These are typically done over several months to even a year or more. Examples include fellowship programs (where individuals can gain expertise by being placed within a data project for instance), participatory research initiatives, or mentorship programs (where instead of workshops, data literacy training can take place in the form of involvement in specific projects with the guidance of a mentor)

  Long-term efforts can also include support for institutional and systems-level capacity development that help create an enabling environment for establishing a data culture or implementing subsequent short- and medium-term initiatives. These can include government policy interventions and strategies for data literacy, sustained community engagement for research projects, periodic citizen involvement in data processes for programme monitoring or reporting as part of citizen-generated data initiatives etc.

Most data literacy efforts are concentrated at the short or medium-term horizons. Investment in long-term efforts is emergent, but scanty. Further, while data literacy can be developed as a capacity of communities and organisations rather than solely of individuals, practices to develop data literacy beyond the individual level are limited. Finally, the dynamics of language, geography, and gender are still under-explored when it comes to developing data literacy competencies.

EXAMPLES OF DATA LITERACY INITIATIVES

As the attention of the global data and statistics community has gradually shifted from making data available and accessible to promoting data use, several initiatives have emerged to foster data literacy. Civil society, private sector organisations, governments, statistical offices, and international organisations have started supporting capacity development efforts to build data skills amongst different types of users. A selection of such initiatives by different actors of the data ecosystem is presented in the Table 2 below. These may cover initiatives that target development of data literacy more directly or the development of some competencies that are relevant to data literacy.

Table 2: Selected examples of doing data literacy

Data literacy initiative	Led by	Target audience	Geographic focus	Description
DataBuzz[38]	The Government of Belgium and Flemish Community Commission (VGC)	Youth and adults		The DataBuzz is a 13-metre fully electric bus that has been converted into a mobile education lab. During interactive and free-of-charge workshops, participants are introduced in a playful way to concepts such as online privacy and protection of personal data. (Seymoens et al., 2020)[39] Apart from catering to the youth, DataBuzz also offers free workshops in adult education centres, centres for basic education and other training centres for illiterate adults throughout Flanders, as part of the Everyone Data Literate![40] project supported by the Digital Belgium Skills Fund.

ODI learning programme[41]	Open Data Institute (ODI)	Varied and depending on proficiency levels (beginner, intermediate, advanced)	Global	The ODI learning programme provides data literacy and capability for everyone. ODI has chosen specifically to separate data literacy from data skills training or data sciences. Their educational programmes teach practical skills through experiences that teach people to think critically about data. Courses range from a few hours (Anonymisation is for Everyone, Introduction to Data Ethics), to days (Open Data in Practice), or weeks (Strategic Data Skills)
100-hour Nepal Data Literacy Program[42]	World Bank Group, with country partners (Nepal in Data and Open Knowledge Nepal)	Government and non-government actors (mass media, civil society, and academia)	Nepal	The program comprises a 100-hour modular, customizable pedagogy to support both technical skill building and efforts to enhance a 'culture of data use' among Nepalis. Topics range from cleaning wrangling, to visualisation and storytelling, to leading a data-driven project. The WBG delivered face-to-face trainings in 2019 to a cohort of over 75 mid-career professionals, to enable them to become data literacy trainers.
Data Playbook toolkit[44] and the Data Literacy Consortium[45]	International Federation of Red Cross (IFRC), in collaboration with the Centre for Humanitarian Data, and FabRiders	Humanitarian actors in particular	Global	The Playbook includes resources for IFRC and National Societies to develop their literacy around data, including responsible data use and data readiness. It has been used and inspired data skills approaches and courses across the Red Cross Red Crescent Movement, OCHA, UNHCR, etc. Modules include data essentials, data culture, data sharing, responsible data, etc. It also serves as a foundation for the informal network called the Data Literacy Consortium, convened by IFRC, the Centre for Humanitarian Data, FabRiders, and others. This serves as a space for people and organisations to share experiences and best practices around data literacy
Data literacy training products[46]	Statistics Canada	Individuals, in particular data beginners	Canada	Statistics Canada has developed a series of data literacy training resources online. Topics covered include data stewardship, introduction to data terminology and concepts, understanding and exploring data, etc.
Qlik Data Literacy Program[47]	Qlik (data analytics company)	Businesses (organisations and individual employees)	Global	The Qlik Data Literacy Program offers a range of learning resources and consulting services to build data literacy of workforce across enterprises, regardless of skill or role. The package includes an assessment, instructor-led or self-paced learning resources, a workshop, advisory consulting with experts, and a certification.
Databasic[48] and the Data Culture Project[49]	Catherine D'Ignazio and Rahul Bhargava (Centre for Civic Media at MIT Media Lab)	Individuals and organisations - in particular data beginners	Global	DataBasic is a suite of easy-to-use web tools for beginners that introduce concepts of working with data. It is designed to be an online platform with an interactive pedagogic focus – that is designed for learners, not users. Its associated initiative, Data Culture Project is a self-service learning programme for organisations. It contains free tools and guided activities that are hands-on and designed to build the capacity of organisations to work with data. Modules include building a data sculpture, asking questions, gathering an analysing data, telling data stories etc.
School of Data Fellowship[50]	School of Data	Data-literacy practitioners or enthusiasts	Global	Fellowships are nine-month placements with School of Data that that equip individuals with the skills to take their data-literacy work forward, such as how to train, how to network or how to organise events. The aim is to increase awareness of data-literacy and build communities by annually recruiting and training the next generation of data leaders and trainers. The fellows then provide support to journalists, civil society organisations, and individual change makers to use data effectively within their community and country.

4 PROMOTING DATA LITERACY – LESSONS LEARNT AND FUTURE OUTLOOK

There is growing recognition of the need to strengthen data literacy among individuals, organisations and communities in different countries. However, previous and current interventions to foster data literacy remain inadequate to confront the challenges of today's datafied information ecosystems. Evidence from the first Global Data Literacy Benchmark 2020[I] produced by Data to the People, suggests that 48% of employees require help to read, write and comprehend data, and a paltry 7% of employees are able to help their peers read, write and comprehend data.[51] Results from the 2017-18 survey by Qlik[II] also present a sobering picture: only 24% of business decision makers were fully confident in their ability to work with, analyse and argue with data. About 32% of C-suite leaders, and a meagre 24% of 16-24 year olds were viewed as data literate.[52] While these results need to be interpreted with caution, they do point towards a significant gap at the prevailing levels of data literacy. Notably, PARIS21's statistical literacy indicator[III] also suggested that between 2016 and 2019, starkly low levels of use and critical engagement characterised the presence of statistics in national newspapers from 70 International Development Association (IDA) countries.[53]

Based on the scan of the literature and practices covered in Sections 2 and 3 above, a few take-aways and areas for further reflection are noted below:

TAKE-AWAY #1: FORGING A COMMON LANGUAGE AROUND DATA LITERACY

Despite the growing body of rich literature on data literacy, the phenomenon is defined in various ways by different actors in varied contexts. Several practitioners see limited value in the exercise itself, noting that data literacy is a continuum of competencies with fluidity in various types of adjacent literacies. Carving a working definition that is specific without being limiting, and inclusive without being un-actionable remains a challenging task. This has an impact on how data literacy is taught and assessed.

There is a need for a standardised framework to capture at least a minimum set of foundational and cross-cutting data literacy competencies relevant for an individual, organisation or system. This will help to identify clear data literacy needs, support the effective targeting of policies and programmes to enable data literacy, and provide a benchmark to assess the impact of such efforts. The Data Literacy Charter[54] launched by the Stifterverband (a joint initiative of companies and foundations in Germany) in January 2021 is a step in this direction. The charter signatories, which also includes PARIS21, express a shared understanding of competencies and guiding principles associated with data literacy.

Going forward, we have an opportunity to formulate an actionable definition of data literacy applicable across varied contexts. This definition should answer, in particular,

- How can data literacy be defined distinctly enough from adjacent competencies related to statistical, digital or information literacy for better policy and programmatic targeting?
- How can we move towards an inclusive, convergent and consensus-driven notion of what it means to be data literate?

TAKE-AWAY #2: ADOPTING A DEMAND-DRIVEN AND PARTICIPATORY APPROACH TO DOING DATA LITERACY

Often, approaches to data literacy are supply-driven, with the underlying assumption, "if you build it, they will come". This is arguably one reason why general data literacy initiatives have had limited outreach and success. Winch (2017) further notes that in the context of Civil Society Organisations (CSOs), the "disconnect between data literacy and willingness to voluntarily integrate data into programming [of CSOs]" comes from two reasons: 1) Trainings are not applied enough and 2) Data processes are donor-driven.

A targeted, **demand-driven** approach that accounts for the incentives of citizens to engage in the broader data culture can be an effective way to boost data literacy. Implementing data literacy initiatives can then be embedded in wider programmes that factor in the local realities and needs of citizens by design. Such efforts are also likely to generate an enabling environment that can outlast a particular data literacy initiative itself, and be aligned with the underlying socio-political dynamics that individuals, organisations and communities find themselves in.

Data literacy forms part of a bigger shift towards establishing a data culture that aims for greater inclusion and empowerment. Pivoting to a **participatory** approach can help leverage the role of citizens not just as data consumers, but as data partners and producers of data who have an active agency and rights. Citizens can critically engage in datafied ecosystems when data literacy development motivates participation in their communities, in individual as well as collective contexts. (Carmi et al. 2020)[32]

- The work on community engagement by the Tanzania Data Lab[56] or emerging insights from the GovLab's citizen data assembly[57] can point us to such directions. Markham (2019) describes how art-based installations at museums can be one way to take "data literacy to the streets".
- Gray et al. (2018)[12] proposes that data literacy initiatives and programmes can include "teaching about data infrastructures as relations rather than simply about datasets as resources." Apart from technical and statistical skills, knowledge about the "social life of data" can be incorporated via infrastructure ethnography, projects, experiments in participation, etc. Public institutions, civil society organisations and others could serve as "sites of more substantive participation and deliberation about the ways of relating, seeing, doing and being that they engender".

The forward-looking agenda for data literacy should include a demand-driven and participatory lens to operationalising it. In particular it should account for the following considerations:

- How can we create incentives at the individual level, that also account for socio-political and economic dynamics at the community or system levels to foster data literacy with ownership?
- How can data literacy initiatives cultivate sensibilities for "data sociology, data politics as well as wider public engagement with digital data infrastructures"? (Gray et al.2018)[12]

I The Global Data Literacy Benchmark is a comprehensive measurement of data literacy of more than 5,000 employees from around the globe. It covers 5 countries (Australia, Canada, United Kingdom, India and United States of America), 14 industries and 9 core occupations.

TAKE-AWAY #3: MOVING FROM AD-HOC PROGRAMMING TOWARDS SUSTAINED POLICY, INVESTMENT AND IMPACT

Bringing together different actors for scaled-up support

Stimulating broad-based data literacy is an intricate team-sport, involving a collaborative approach by different actors in the data ecosystem. While civil society, private actors, open data and journalism communities have been active in doing data literacy, we need to translate ad-hoc programming efforts into sustained policy mandates and action by governments, statistical offices, international organisations, aid providers and other influential development actors.

We need to focus on direct support towards programmes beyond the individual level, targeting a long-term horizon. This can be done by mobilising and securing the necessary resources for developing citizen data literacy directly, or as part of statistical capacity development programmes and other sectoral initiatives.

Going forward, there is an opportunity for government ministries, international organisations, non-profits, civil society and the private sector to coordinate efforts to develop data literacy effectively, leveraging their comparative strengths, avoiding duplications and missed opportunities. There is also an emerging role for national statistical offices (NSOs) to advance citizen data literacy as stewards of the public data ecosystem (UNECE, 2019)[59]. Misra and Schmidt (2020)[2] provide a few ideas to develop NSO-governed participatory data ecosystems where data literacy forms a key part of the business process of relevant data institutions.

Becoming intentional about impact

We don't know enough about what works and what doesn't, for whom, and under which conditions. The lack of a coherent and widely-accepted operational definition with associated capabilities has also left us without a guiding framework and tools to design targeted policy interventions to enhance data literacy, track their progress and empirically evaluate their outcomes. Developing suitable measures that allow for a fit-for-purpose quantification of progress on data literacy will bolster the case for investing in data literacy beyond ad-hoc programming.

Going forward, we need to bridge the evidence gap on outcomes and impact from data literacy programmes. There is an opportunity to develop a convergent, coherent data literacy assessment, measurement and impact evaluation framework for the national, regional and global levels that is applicable in different contexts.

It is critical to understand and advance data literacy as a means to an end – with the goal of leaving no one behind in our increasingly datafied information landscape. Nguyen (2020) succinctly identifies four key risks we face today, that data literacy can help address: "(1) technical issues of flawed, incomplete and biased data that can lead to inaccurate conclusions; (2) low data literacy among larger parts of the public; (3) opportunities for powerful organisations to expand their influence and/or to enter even more domains of the public-private spheres; (4) data ownership and ethics; and (5) data freedom, security and protection. Data literacy offers paths to holistic strategies for addressing these challenges."[60]

Hence it is imperative to catalyse concerted action to recognise and prioritise the development of data literacy as part of socio-political and civic processes, and national and global development agendas in the coming years and decades. An empowered data literate society is a vital ingredient of a resilient democracy prepared for future pandemics and crises.

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