In Collaboration with PwC Colombia and the Centre for the Fourth Industrial Revolution Colombia

WORLD ECONOMIC FORUM

Data for Common Purpose: Enabling Colombia's Transition to a Data-Driven Economy

WHITE PAPER

DECEMBER 2021

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Foreword

In order to leverage data for the common good in today's complex and uncertain world, trustworthy public-private data exchanges will be foundational.

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As the global economic recovery progresses and the call for sustainable and inclusive change continues, leaders from government, business and civil society find themselves at a defining moment. Addressing the interconnected challenges of climate change, biodiversity loss, social inequity, geopolitical instability and economic uncertainty has become an urgent priority, demanding a new set of analytic tools, insights and decision-support systems.

Against this backdrop, the opportunity to benefit from the use of diverse datasets holds unique promise for navigating today's complex global challenges. The collaborative use of data can serve to guide leaders who are under increasing pressure to understand what is happening, why it is happening, what is likely to happen and what *needs* to happen.

Yet increasingly fragmented regulatory frameworks, competing commercial concerns, differences in social norms and siloed data architectures make it extremely difficult to realize this vision. The widening deficit of trust between citizens, commercial enterprises and governments also threatens to delay progress.

For more than a decade, the concept of collaboratively using data for the common good has been advanced by various stakeholders. It is now time to act.

The urgent challenge is to act in an era of increasing complexity. Given the accelerating impact of environmental, economic, public health and social challenges, another ten years of debate on public-private data collaboration will come at a cost. The cost of inaction, the cost of not using the best data to make the best decisions, will be too great. New tools for driving better decisions are needed now.

Given this call to act and deliver impact, the Centre for the Fourth Industrial Revolution Network has launched the Data for Common Purpose Initiative (DCPI) to put the principles of sustainable data sharing into practice. The DCPI's core mission is based on unlocking the sustainable value of data while protecting individual privacy rights and equitably distributing data's returns. The Centre for the Fourth Industrial Revolution Colombia, in collaboration with the Colombian government and its National Development Plan, serves as an example of this type of collaborative public-private engagement as Colombia transitions to a data-driven economy.

Executive summary

Collaborative and transparent data exchanges are essential if Colombia is to meet its 2050 carbon reduction goals and transition to net-zero.

The use of data has the potential to address some of the most pressing challenges facing governments, societies, businesses and science.[1]

World Economic Forum

This report, the fourth in a series published by the Data for Common Purpose Initiative (DCPI), is designed to help leaders understand the complex dynamics and difficult decisions they will face in managing data exchanges in their transition to a data-driven economy.

Based upon real-world insights from Project Moonshot, a public-private data exchange established by the Colombian government, the report highlights the following:

- Colombia (and other Latin American countries) are committed to stimulating their economic transition to a data-driven economy as a means of addressing social, economic and environmental challenges.
- There is an urgent need for trustworthy and transparent public-private data exchanges which, will be central to the country's economic transition.[2]
- Strengthening the trust of individuals demands new approaches in the use of consent mechanisms.
- Understanding the underlying economics of data exchanges and the value pools they create is critical for the long-term sustainability of data exchanges.
- The use of data exchanges within the Colombian energy sector is critical for managing its net-zero transition and meeting 2050 carbon-reduction targets.

This report offers the following considerations for continued progress:

- Establishing a multistakeholder community of Colombian policy-makers, energy sector practitioners, data scientists and civil society actors to learn first-hand how a collaborative data exchange can create new opportunities, lower shared risks and deliver meaningful impact.
- Developing an open and extensive toolkit for understanding, measuring and managing the ways that data exchanges for the common good create direct and indirect business value.
- Engaging individuals and local communities to gain a richer understanding of their perceptions of data exchanges and their trust and willingness to support them in future.

Introduction

Led by the Centre for the Fourth Industrial Revolution Colombia, Project Moonshot's pilot data exchange provides insights as to how countries can manage trust, consent and data value to achieve a data-driven economy.

This publication, led by the Centre for the Fourth Industrial Revolution Colombia, is part of the World Economic Forum's Data for Common Purpose Initiative (DCPI). The initiative explores the use of public-private data exchanges as a means of facilitating the transition from a traditional to a data-driven economy. The central idea of DCPI is anchored in unlocking the value of data for the common good, which might otherwise remain stored across multiple jurisdictions.

This report provides pragmatic insights from Project Moonshot, a data exchange for the common good being piloted in Colombia. Specifically, it explores new approaches for strengthening trust, a new lens for assessing the value of data used to deliver impact and new public-private data utility enterprises in the context of the Colombian energy sector.

Through a global multistakeholder approach, participants from government, the private sector and academia have identified key enablers to make Project Moonshot scalable, both technologically and ethically. The intent is for these to serve as a template to encourage the development and deployment of data exchanges beyond Colombia and the energy sector.

Concerns pertaining to trust, consent[3] and the value of data are all key considerations that present both challenges and opportunities for developing an efficient data exchange. This report provides insights on how to approach these challenges and manage them in a pragmatic and feasible manner.

The report reflects multiple interactions and outputs from a multistakeholder community of leaders committed to creating a global and interoperable network of data exchanges. We hope that the collaborative work being done with the Centre for the Fourth Industrial Revolution Colombia and the Colombian government will inspire others to participate in similar endeavours, with the DCPI serving as both an anchor and a compass.

1 Data: The bedrock of a sustainable economy

Addressing the challenges of a data-driven economy creates a space for innovation that can help strengthen trust.

> **Today's shared wealth lies in data. It promises commercial gain for business, improved public services for governments, better convenience and well-being for individuals, and positive outcomes for the planet and society.**[4]
>
> The Economist

Delivering on the promise of a data-driven economy is challenging. Using data to drive meaningful change requires leaders to continually balance competing concerns. Some of the core dilemmas to address include how to:

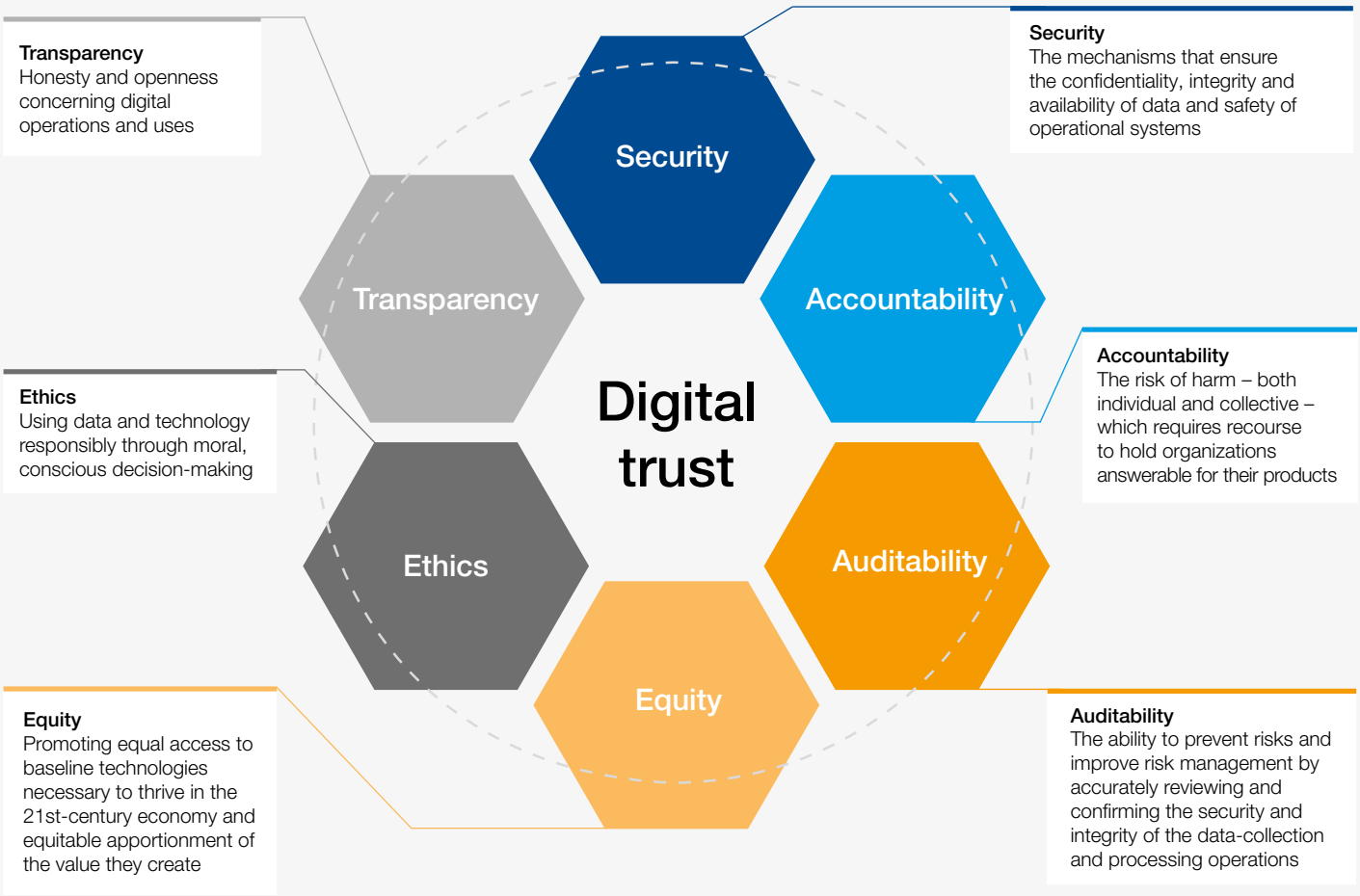
- Protect individuals and innovate to develop new services and experiences.
- Ensure data is secure and protected, yet open and accessible.
- Ensure that the long-term challenges of people, the planet and society are addressed while also navigating the day-to-day urgency of the global economic recovery.

Addressing these and many other entangled dilemmas presents an opportunity for linking, connecting and accessing public and private data in innovative ways. Innovating with the use of data provides a means for holistically understanding how various business, legal, technical, environmental and societal risks can be addressed in a fair, accountable and commercially sustainable manner.

Trust and value

Central to this report is its focus on the need for strengthening trust and a more disciplined approach for assessing the value of data. It examines how new approaches for engaging with individuals can enhance consent in meaningful ways and offers a shared taxonomy on the dimensions of trust for a more effective global dialogue (Figure 1).[5] It also examines how innovations in strengthening consent serve to strengthen trust across various dimensions.

FIGURE 1 | **Six dimensions of digital trust**



Source: PwC Colombia and the World Economic Forum, *Data for Common Purpose: Leveraging Consent to Build Trust* (2021)

From a value perspective, the report examines the question of data monetization and the foundational importance of the underlying collaborative value that can be created within a data exchange. For far too long, the economics of public-private data collaboration have been misunderstood and guided by a "cerebral fog of myths".[6] As *Infonomics* author Douglas Laney notes: "The first mental roadblock to monetizing information is a failure to think beyond selling it."[7]

When it comes to public-private data collaboration, the risks faced by private sector actors have historically outweighed the rewards. New ways to address that imbalance are needed. Given the complexity, and contextual dependency, of data valuation, this report provides insights on assessing the value of the *intended impact* data can provide in driving socio-economic change. It identifies the incentives for businesses to actively commit to the long-term success of public-private data exchanges.

2 Enabling the transition

Data exchanges are essential for helping Colombia overcome its unique "development traps".

Colombia provides an ideal example of how to manage the transition from a traditional economy to one that is data driven. At its core, Colombia's national government has committed significant political and capital resources to ensure it realizes the social and economic benefits of digital transformation. From an economic perspective, the intent of this transformation is to evolve away from industrial models of value creation based on linear models of production and resource scarcity to those of networked value creation, abundance, inclusion and equitable value apportionment.

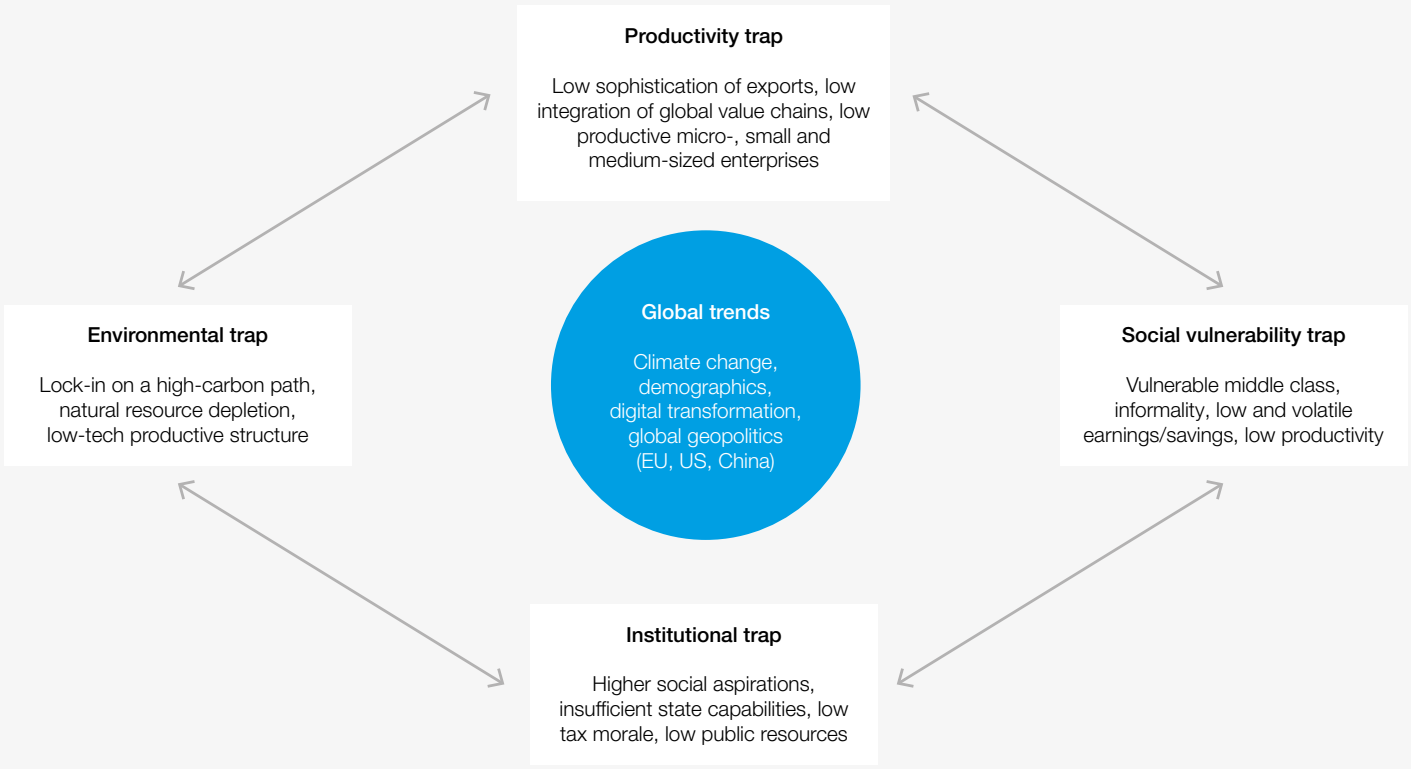
Colombia's National Development Plan is focused on:

- Declaring access to the internet as a national public service.
- Developing a pioneering national ethical framework for artificial intelligence (AI) as a regional reference.
- Issuing a national policy (Law 2015 of 2020) for the interoperability of clinical data and history.
- Providing free national training programmes on blockchain and data analytics for hundreds of small and mid-size enterprises (SMEs) and free training on X-Road (the secure, cloud-based, modular and open-source platform), and data science for thousands of citizens.
- Establishing a National Data Infrastructure Plan (NDIP).
- Providing digital citizen services, including interoperability, citizen folders and digital authentication.
- Delivering a National Social and Economic Development Policy (CONPES) for digital transformation and economic resilience.
- Developing a cross-border data exchange (DEX) for the common good in the Pacific Alliance (i.e. Chile, Colombia, Mexico and Peru).

As an emerging economy, Colombia faces a series of "development traps" unique to the region (Figure 2).[8] Along with addressing the complex challenges of climate change, economic volatility, geopolitical instability and social inequities, Colombia is having to confront issues related to the lack of sophisticated exports, low productivity, socio-economic vulnerability within its middle class, natural resource depletion, reliance on high-carbon-emitting industries, institutional capacity constraints and low public resources.

> **Releasing the full potential of the digital economy requires an adequate infrastructure and governance framework to facilitate the exchange of data and the development of new ethical business models and market mechanisms. For this reason, the National Data Infrastructure Plan is promoting data exchanges through different models, such as data trusts, data commons and/or data marketplaces.**
>
> Iván Durán, Minister of Information and Communication Technology, Colombia

FIGURE 2 | **Development traps of Latin America**



Source: OECD, *The "new" development traps* (2019)[9]

FIGURE 3 | **Digital Evolution scorecard**

"Stall Out" digital economies priorities (i.e. United Kingdom, Canada, Australia, France, Japan):

– Safeguarding against "digital plateaus" by continuing to invest in robust institutional foundations, the regulatory environment, and capital markets to support ongoing innovation.

– Continuing to use policy tools and regulations to ensure inclusive access to digital capabilities and to protect all consumers from privacy violations, cyberattacks, and other threats (while still keeping data accessible for new digital applications).

– Attracting, training, and retaining professionals with digital skills, often through reforming immigration policies.

– Identifying new technological niches and fostering environments friendly to innovation in those areas.

"Stand Out" digital economies priorities (i.e. United States, Hong Kong SAR, South Korea, Germany, Singapore):

– Expanding adoption of digital consumer tools (e-commerce, digital payments, entertainment, etc.).

– Attracting, training, and retaining digital talent.

– Fostering digital entrepreneurial ventures.

– Providing fast, universal, terrestrial and mobile broadband internet access.

– Specializing in the export of digital goods, services, or media.

– Coordinating innovation between universities, businesses and digital authorities.

"Watch Out" digital economies priorities (i.e. Italy, South Africa, Brazil, Colombia, Mexico, Philippines):

– Making long-term investments to address basic infrastructure gaps.

– Creating an institutional environment that supports safe, widespread consumer adoption of digital products and services, especially those that enable productivity and job creation.

– Promoting initiatives (particularly through public-private cooperation) that invest in digital access to historically disadvantaged segments of the population.

– Promoting applications that solve pressing needs and could therefore act as catalysts for widespread adoption of digital tools (such as mobile payment platforms).

"Break Out" digital economies priorities (i.e. Russia, China, India, Thailand, Indonesia):

– Improving mobile internet access, affordability, and quality to foster more widespread adoption.

– Strengthening institutional environments and developing digital regulations. Generating investment in digital enterprises, funding digital R&D, training digital talent, and leveraging digital applications to create jobs.

– Taking steps to reduce inequities in access to digital tools across gender, class, ethnicity, and geographic boundaries (although many access gaps still remain).

Digital evolution state +

Digital evolution momentum +

Source: Bhaskar, Chakravorti, et al.,"Which economies showed the most digital progress?", *Harvard Business Review* (2020)[10]

A key objective of Colombia's digital transformation journey is to establish public-private "data utility" companies. Both the city of Medellín Mayor's Office and its main utilities company (EPM) have established a network of early-stage independent enterprises focused on delivering data-centric products and services for the common good.

Given the complex and interdependent nature of these development traps, Colombian leaders from government, business, and civil society have focused on accelerating their digital evolution as a critical pillar for the country's strategic economic development. Using a Digital Evolution scorecard (Figure 3), Colombia finds itself as a lower left "Watch Out" economy. One of the defining attributes in this quadrant is the lack of trust among its citizens.

In view of this, data exchanges can serve as a catalyst to enable Colombia's economic transition. Helping to address the challenges of social and racial inequality, low productivity, corruption, education and achieving the United Nations Sustainable Development Goals, Colombia's commitment to becoming a data-driven economy aligns with the digital strategies of other countries in the Pacific Alliance.

"Project Moonshot is a data exchange platform aimed at accelerating Colombia's responsible digital transformation.

Because of the strong support for data exchanges within Colombia's NDIP, Project Moonshot is the country's first pilot. Project Moonshot is a data exchange platform aimed at accelerating Colombia's responsible digital transformation and led by a consortium including the World Economic Forum's DCPI, the Centre for the Fourth Industrial Revolution Colombia, PwC Colombia, the Ministry of Commerce, Industry and Tourism of Colombia, the Ministry of Information Technology and Telecommunications of Colombia, the Medellin Mayor's Office and Ruta N (the Business and Innovation Centre of the city of Medellín and part of the strategic committee).

As stakeholders engage with Project Moonshot, inevitably, tensions related to politics, economics, technology access and social inequities will arise. Therefore, the intention is to create a trusted and safe space where perspectives and policy decisions can be openly and collaboratively discussed.

Project Moonshot also serves as a regulatory sandbox, a safe space for identifying enabling data-policy environments to promote inclusive growth, sustainable development and citizens' well-being. By leveraging the use of Fourth Industrial Revolution technologies, it provides stakeholders with the opportunity to strengthen trust and enhance the privacy, security, engagement and rights of individuals in more granular, agile and human-centred ways.

Beyond ensuring the trustworthy use of emerging technologies, Colombia is also committed to establishing an ecosystem of public-private commercial entities (data utilities) serving various needs throughout the data-sharing community. Ensuring SMEs serve the common good and meet their business objectives is a unique business investment challenge. Like any other early-stage platform aspiring to reach scale, these data utility startups require financial, operational, technical and legal support in the early stages of their incubation.

From a social impact perspective, the need to meaningfully engage with citizens, civil society, private organizations and public institutions is also a top priority of Project Moonshot. With the ability to leverage diverse datasets to deliver shared outcomes, the aim is to provide citizens with new opportunities for consent and engagement. One of the top priorities is to ensure that the value created from Project Moonshot is equitably distributed.

Additionally, the initiative takes a forward-looking approach to ensure that individuals who generate data hold the production rights for the data assets created. The general aim is for individuals to be paid both at the transactional level (for the right to use their data) as well as for holding shares in local community "digital co-ops", which manage and monetize the digital rights to various derivatives, insights, analytic models and information assets created by Project Moonshot.

Central to the vision of Project Moonshot is the intent to uphold the principles of a digital commons. Based upon the work of Nobel Prize winner Elinor Ostrom, eight principles guide Project Moonshot in how it is collectively managed (see Figure 15 in the appendix):

- Commons need to have clearly defined boundaries.
- Rules should fit local circumstances.
- Participatory decision-making is vital.
- Commons must be monitored.
- Sanctions for those who abuse the commons should be graduated.
- Conflict resolution should be easily accessible.
- Commons need the right to organize.
- Commons work best when nested within larger networks.

Source: Williams, Jeremy, "Elinor Ostrom's 8 rules for managing the commons", *The Earthbound report* (2018)

3

Strengthening trust

The Colombian government plays a critical role in fostering trust in its collaborative data exchange.

In establishing Project Moonshot, considerable effort was spent assessing the current data exchange landscape, researching the dynamics of data ecosystems and understanding how those conceptual frameworks could be best applied to the Colombian context. Central to this vision is fostering a multistakeholder framework that incorporates the needs of a diverse community of actors across an array of use cases. Additionally, given Colombia's complex, dynamic and constantly evolving data ecosystem, the framework is designed to be agile, inclusive and adaptive over time.

In the early stage of developing its NDIP, the leadership of the Colombian government played a crucial role in creating an open environment and coordinating the participation of actors across the data value chain. This broad, diverse and multi-sectoral community is actively supported by several government agencies, including the Ministry of Information and Communication Technologies, the Administrative Department for the Presidency of the Republic, the National Planning Department, the National Statistics Department and the Superintendency of Industry and Commerce.

From a priority perspective, Project Moonshot's main focus has been on establishing an enabling data policy environment aligned with the interests of the public sector, commercial entities, citizens and academia. Sub-pillars within this larger objective have included agreeing to shared principles, strengthening stakeholder trust, establishing an effective governance framework and prioritizing use cases.

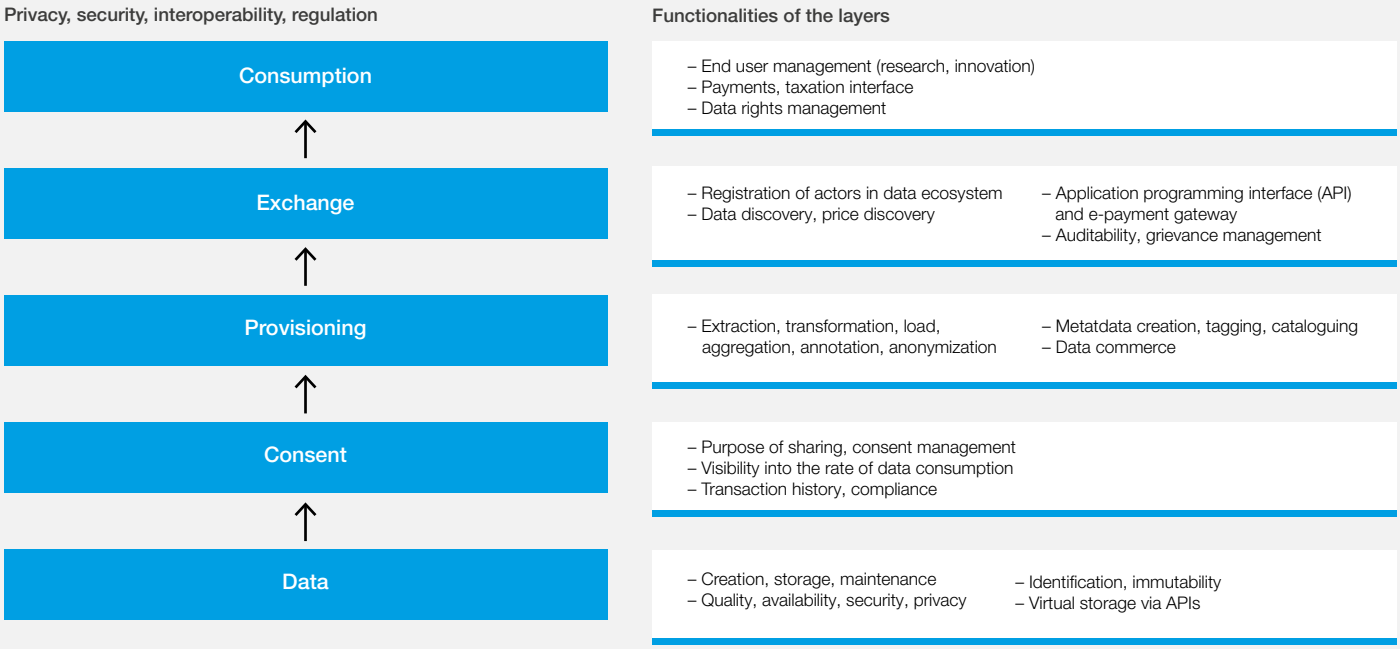
Across those four sub-pillars, three horizontal strategic themes have emerged:

- Exploring the role of government in orchestrating a data exchange governance model that creates trust and stimulates multistakeholder engagement.
- Prioritizing the creation of value, exchange of knowledge and support for innovation among all actors.
- Using open standards and technology infrastructure as much as possible to facilitate the trustworthy, secure and accountable exchange of data between public and private entities.

From a technology perspective, the intention of the pilot is to use X-Road, which aligns within DCPI's five-layer service delivery architecture (Data, Consent, Provisioning, Exchange and Consumption) to ensure confidentiality, integrity and interoperability between parties exchanging data (Figure 4).[11]

> **The Data Infrastructure National Plan defines key issues to consolidate a data-driven economy in Colombia as a fundamental condition for our country's economic recovery. Based on a shared vision of data as infrastructure, this plan addresses essential points, including the design and implementation of a data infrastructure, governance models and the encouragement of data exchange mechanisms among the different actors.**
>
> Daniel Gómez, Deputy Director-General, National Planning Department of Colombia

FIGURE 4 | **DCPI's five-layer service delivery architecture**



Source: World Economic Forum, *DCPI India Report*, in preparation

While the Colombian government plays an instrumental role in supporting and shaping the intended direction of the ecosystem, it does not have the resources or intent to be its central player. The government aims to provide the underlying communications and data infrastructure so that other ecosystem members can create value that leverages the core infrastructure to create defined services (see Figure 16 in the appendix).

The central challenge of Colombia's digital transformation lies in balancing the competing tensions of data protection and data innovation. As the World Economic Forum's 2019 report on Federated Data Systems notes: "The need to protect data in a way that upholds local norms, values and regulations while also enabling innovative and impactful uses is a foundational challenge that requires both technological and governance-related expertise."[12]

Decentralized technologies are foundational for Colombia's transition to a sustainable, inclusive and transparent digital economy. With a strategic commitment to use decentralized and federated data systems – where ownership and control reside with individuals and institutions – the aim is to stimulate innovation while minimizing risks and unintended harm.

BOX 1 | **Elements of a Federated System**

- A federated data system allows authorized users to perform queries on the data within a federated network of organizations. The results retrieved from each organization in the federation are then aggregated and returned to the individual who submitted the query. The data never leaves the organization that holds it. Instead, the data is "visited" and only the computed answers to the query are brought back to the federation system.
- Federated data systems use foundational, shared technology architectures, including operational components of security, auditing, authentication and access rights, among others. Agreement on which functions of this architecture are shared and which are left to local control is a critical component in setting up the federation that will allow access to the data.
- A central component of federated data systems is the use of APIs, which are managed using this shared technology architecture. The use of APIs and the foundational architecture enables a scalable, secure and reliable means of accessing the local data stores of the federated organizations, even though they likely use a variety of technology systems and data formats.
- Most importantly, the use of APIs allows the definition and enforcement of specific governance policies (including honouring local laws) by each organization within the federation. The use of APIs within a federated data system allows for crucial governance control to reside with each local entity in the federation, based on the overall agreement of the federation.

Source: World Economic Forum, *Federated Data Systems: Balancing Innovation and Trust in the Use of Sensitive Data* (2019)[13]

Another strategic enabler of Project Moonshot's technology architecture is the use of application programming interfaces (APIs), which provide a secure, open and reliable means of accessing disparate legacy technology systems and data formats. Using APIs and federated systems, a foundational architecture can provide functions such as differential privacy, security, identity-based access, authentication and system auditing.[14]

Over time, how this strategic framework will be operationalized and scaled (going from a minimum viable product to a robust and scalable platform) will be an open area for discussion. Of particular focus are discussions on how to operationalize the transaction and identity layers (e.g. authentication, authorization, payment and rights management) in a scalable manner, given the current gap in blockchain and distributed ledger technology (DLT) regulations.

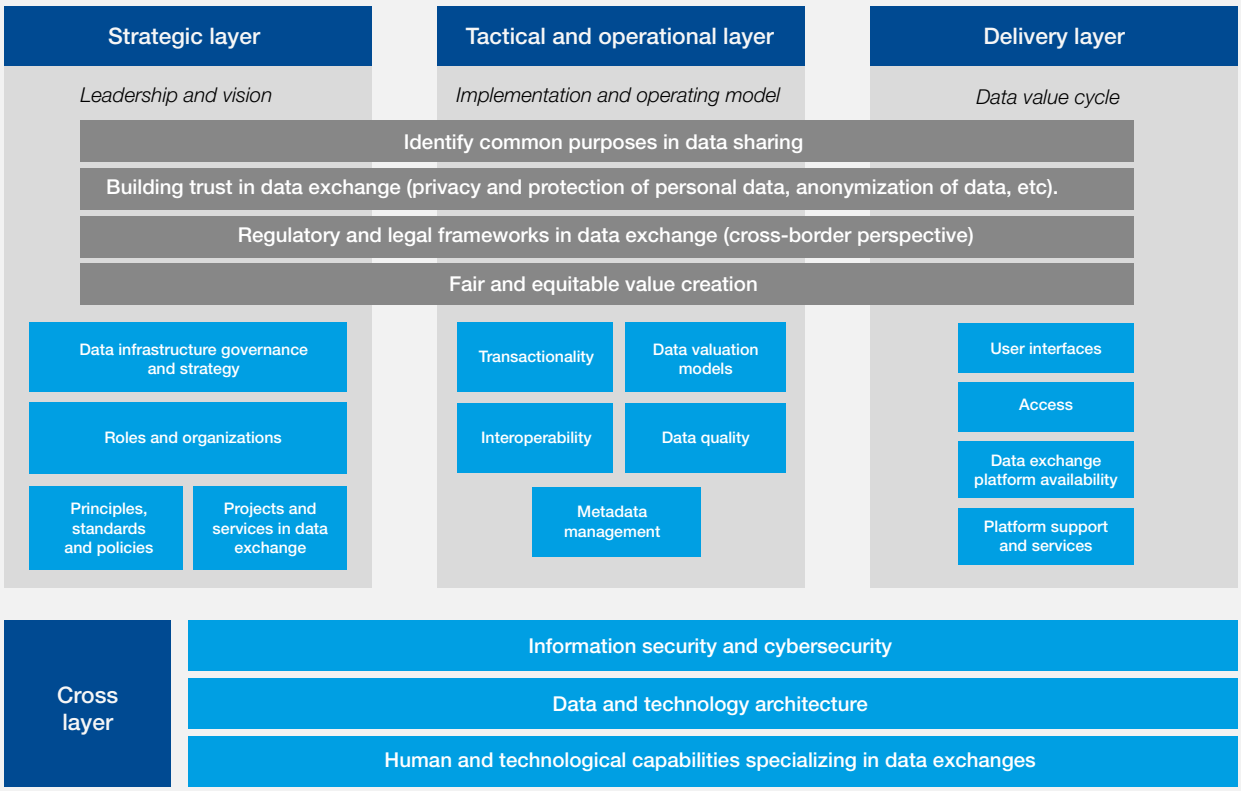
Along with its trustworthy, open and federated technology infrastructure, the second core objective of Project Moonshot is to advance an ethical and inclusive governance framework that strengthens the interactions and knowledge exchange among the ecosystem stakeholders, encourages social impact and stimulates commercial innovation for SMEs, governments and citizens.

The governance framework has two objectives:

- Strengthening citizen trust through granular and consistent consent mechanisms to strengthen engagement at local, national, regional and global levels.
- Fostering appropriate economic incentives and business models where the interests of data rights holders, data service providers, data consumers and impacted individuals and communities are all equitably addressed.

Project Moonshot's technology infrastructure aims to ensure the security, reliability, integrity and accountability of the data at all layers of the technology stack, across a multi-jurisdictional ecosystem and in a manner that leverages existing open standards and technology investment.

FIGURE 5 **Project Moonshot's proposed data governance model**



Source: World Economic Forum and the Centre for the Fourth Industrial Revolution Colombia, *unpublished* (2021)

Enabling privacy and security

A robust regulatory structure that addresses data privacy, security, interoperability and other issues can protect the rights and interests of relevant parties, while facilitating innovative data uses for both public and private outcomes. Within the context of Project Moonshot, one particular area of concern is the increasing volume of internet of things (IoT) data. While the data generated by IoT devices can bring enormous social and economic benefits, the ubiquity of IoT sensors raises security and privacy challenges. To build and maintain trust in IoT devices and their ecosystem of service providers, manufacturers and governments, policy and legal frameworks need to be in place to ensure that data collection, sharing and use do not infringe upon individuals' privacy and meaningful engagement. Robust security policies, standards, frameworks, certification and other practices are critically important for real-time IoT data flows.

Best practices for data security may include:[15]

- Defining data in transit requirements such as encryption standards.
- Enforcing encryption in transit and secure keys.
- Using a certificate management service and defining a revocation process that enables the revoking of certificates if they are compromised.
- Deploying measures such as access control, privileged access management, credential choices and management, multifactor and granular authentication, encryption and web app security.
- Establishing a tool or detection mechanism that detects any attempts to move data outside of defined boundaries at the earliest possibility.
- Implementing secure protocols such as Transport Layer Security (TLS) or Internet Protocol Security (IPsec) to reduce the risk of data tampering or loss.

Regarding privacy, best practices should include:[16]

- Clear and consistent consent management/permissioning, where practicable, provided for data collection, storage and use, aimed at educating individuals to make informed choices.
- A clear declaration of granular consent management/permissioning components for authorized use: purpose, data holder, data requestor, data fields, frequency, timespan and duration.
- Removing personal information through measures such as de-identification (or other privacy-enhancing measures) and implementing minimization practices when collecting, using and sharing personal information is required to use a service and/or is collected with consent.
- Raising awareness about the risks and related policies regarding collecting data from vulnerable groups (e.g. children).
- Minimal data collection and processing for specified, explicit and legitimate purposes.
- A clear declaration on the scope of authorized uses and the life cycle of shared data, storage limitation, and whether and how the data will be shared with third parties.

"Strengthening citizen trust is foundational for addressing Colombia's development traps.

Trust is foundational

As previously noted, strengthening citizen trust is foundational for addressing Colombia's development traps. Uncertainty regarding its economic recovery, acute social inequalities, institutional corruption and an increase in climate-related natural disasters are all long-term challenges Colombia faces, and all demand a holistic understanding of their impact on the lives of individuals and vulnerable populations.

Underlying the concerns about privacy and security is a profound and growing threat of cybercrime. Globally, the cost of damage caused by hackers, malware and data breaches is projected to double from $3 trillion to $6 trillion by 2021.[17] Cybercrime threats have grown significantly throughout Latin America and especially during the COVID-19 pandemic.

As in many areas around the world, trust is at a low ebb within Colombia. According to the recent 2021 Visa Consumer Empowerment Study of the connected population in Colombia,[18] only 14% said they are completely satisfied with their current consent experiences when signing up for websites and apps. The same group cited "understanding the benefits of sharing" and "more choices for them to control what data is shared and how it is used" as the top ways their experiences could be improved. Only 9% of connected Colombians feel completely in control of their data, and 89% want at least more control over how their data is used.[19]

Identifying the policy and regulatory guard rails to help address individuals' desire for greater understanding and control while minimizing

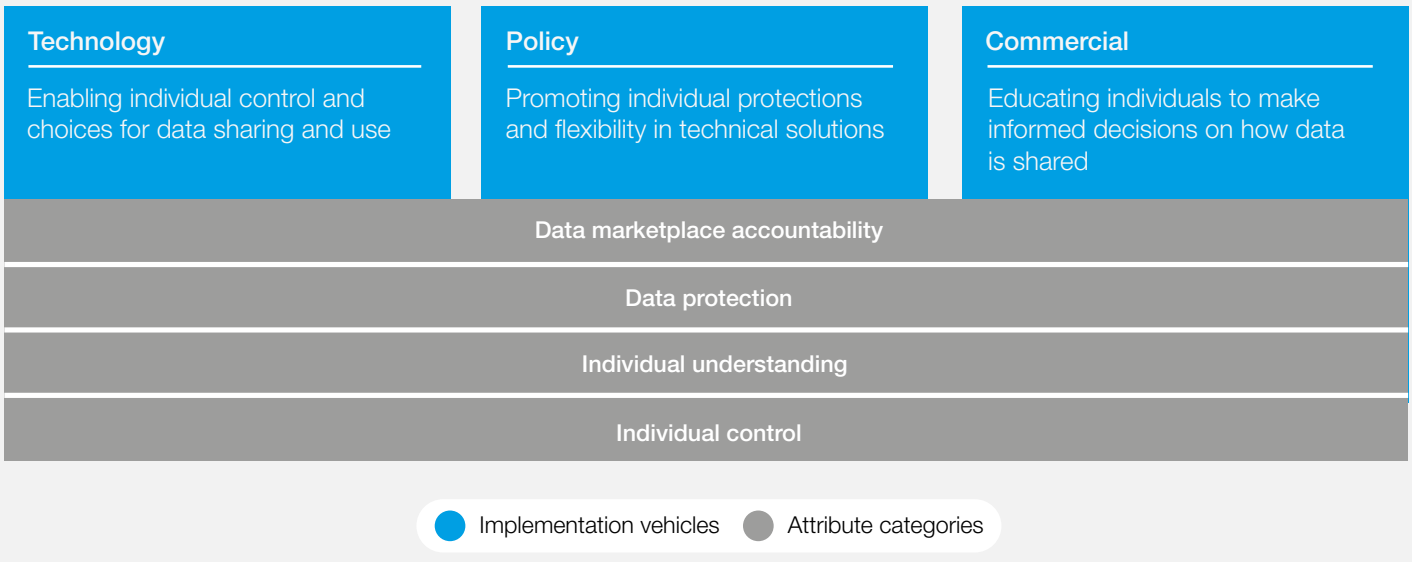
harm can serve to build a culture of trust. Trust can be strengthened through agile governance frameworks, which respond to the pace of technological change.

A priority for Project Moonshot is therefore to design effective consent mechanisms that educate and offer consistent experiences. Today, only 31% of connected Colombians feel that companies effectively educate them on the data collection process and options to control it.[20] Investment in education will improve individuals' confidence in how data generated by and about them can be used.

One key element for building trust through consent mechanisms is standardization. According to the same Visa study, 74% of the connected population in Colombia believe that all companies should be required to offer a standardized, simple explanation of what personal information is being collected, how it will be used, by whom, for how long and how individuals can manage their choices.[21] If there is standardization of consent requests, 83% are more likely to give permission for their data to be shared.[22]

Through a disciplined and focused assessment process, the intent is to gain a richer understanding of the key attributes of citizen trust within the context of Project Moonshot and how mechanisms of consent can advance those attributes. As Figure 6 notes, the intent is to identify the key attributes required to build citizen trust through consent via three pillars: policy (i.e. internal governance), technology and commercial interactions (i.e. citizen experiences).

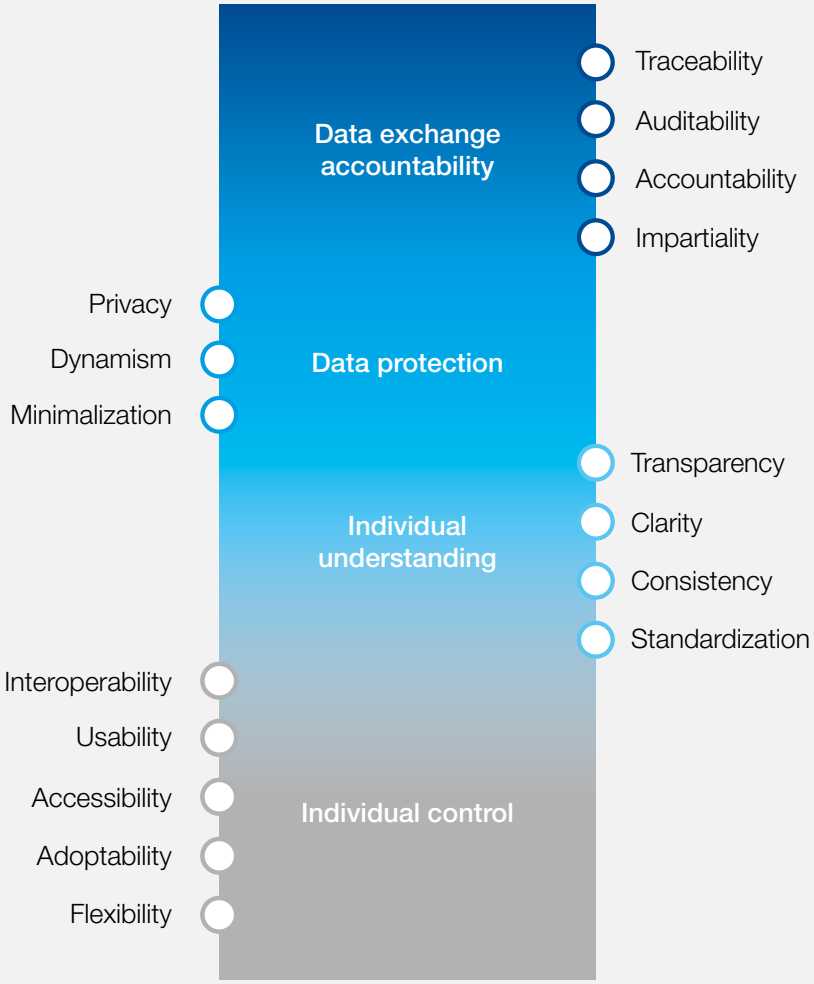
FIGURE 6 **Attributes of consent and trust**



Source: PwC Colombia and the Centre for the Fourth Industrial Revolution Colombia, *Data for Common Purpose: Leveraging Consent to Build Trust* (2021)

The dimensions where consent mechanisms can strengthen trust can be grouped in the following ways:

FIGURE 7 **Trust attributes for consent and permissions**



Data exchange accountability	Measuring, tracking and reporting how data moves through and outside of the data exchange
Data protection	Protecting data and reducing risk associated with the data that flows through (i.e. data in motion) or is stored within (i.e. data at rest) a data exchange
Individual understanding	Educating individuals and positioning them to make informed choices on how data is collected, used and shared through a data exchange
Individual control	Supporting the tools and interfaces that enable individuals to exercise their informed choices on how their data is collected, used and shared through a data exchange

Source: PwC Colombia and the Centre for the Fourth Industrial Revolution Colombia, *Data for Common Purpose: Leveraging Consent to Build Trust* (2021)

4

Catalysing adoption through data valuation

Central to Project Moonshot's strategy is the adoption of a coherent, impact-based approach to data valuation.

> **A sustainable solution is one which allows for the robust, repeatable and replicable use of data across different geographies and use cases, underpinned by a secure source of funding which enables continuity in the supply and analysis of the data to generate actionable insights.**[23]
>
> The GSMA

As the World Economic Forum's 2021 report on Empowered Data Societies notes:

> **Data is unlike an industrial product, which is consumed with use, or intellectual property, which loses its value once shared. Rather, the value of data often increases with availability and repeated analysis. Individual contributions may have little value, while their aggregate can be priceless. A single data point alone can either be meaningless or the key for detecting a critical anomaly, and it is often impossible to know which is true at the moment it is first collected.**[24]

Added to this complexity are concerns about data ownership rights, the accountability and auditability of highly complex data supply chains, the lack of meaningful engagement with individuals and an array of anti-trust concerns. The complexity of measuring the value of data has created inertia throughout the data ecosystem. The perceived or real risks of data sharing generally outweigh the rewards.

The question of how to better understand the value of data and the sustainable economics of a data marketplace is a critical pillar of Project Moonshot. By identifying a defined set of use cases and then examining the financial value of the intended impact delivered, frameworks can emerge to measure the value of improved decision-making and the importance of critical data sources in delivering the desired outcome.[25]

This impact-based approach assesses the role data plays in delivering positive social and economic outcomes (or reducing cost inefficiencies from poor decisions).[26] The approach examines the business value created and the identified datasets' unique role in driving the intended social and economic outcomes.[27] As public policy experts at the University of Cambridge note: "Value arises from data when businesses create jobs or become more productive, when governments deliver more effective public services, when the environment is clean, and when people live happier and healthier lives."[28]

Historically, the underlying economics of many "data for the common good" initiatives have been an afterthought. Built on models of data philanthropy (private actors giving data away for free and subsidized by donor grants), the question of who pays was rarely a priority.[29] While data philanthropy models may work for early-stage proof-of-concept pilots (and serve global development challenges where there is a market failure), there are multiple concerns about the long-term viability of data marketplaces not built upon sound underlying economics.

The uncertainty of the economics that underpin Project Moonshot includes both familiar and emerging risks. For governments, there are traditional concerns about private-sector price gouging, vendor lock-in and vendor stability.[30] Private-sector actors fear that government actors may not be willing to pay fair value, thereby leaving fixed operational costs uncovered, or that governments will simply demand that the data be given to them for free with no constraints or usage limitations.[31]

Private-sector actors are further concerned about margin instability (i.e. governments arbitrarily establishing price limits), cross-border data-flow restrictions, and business models based on downstream monetization of "behavioural data exhaust" without individuals' full awareness and consent.[32]

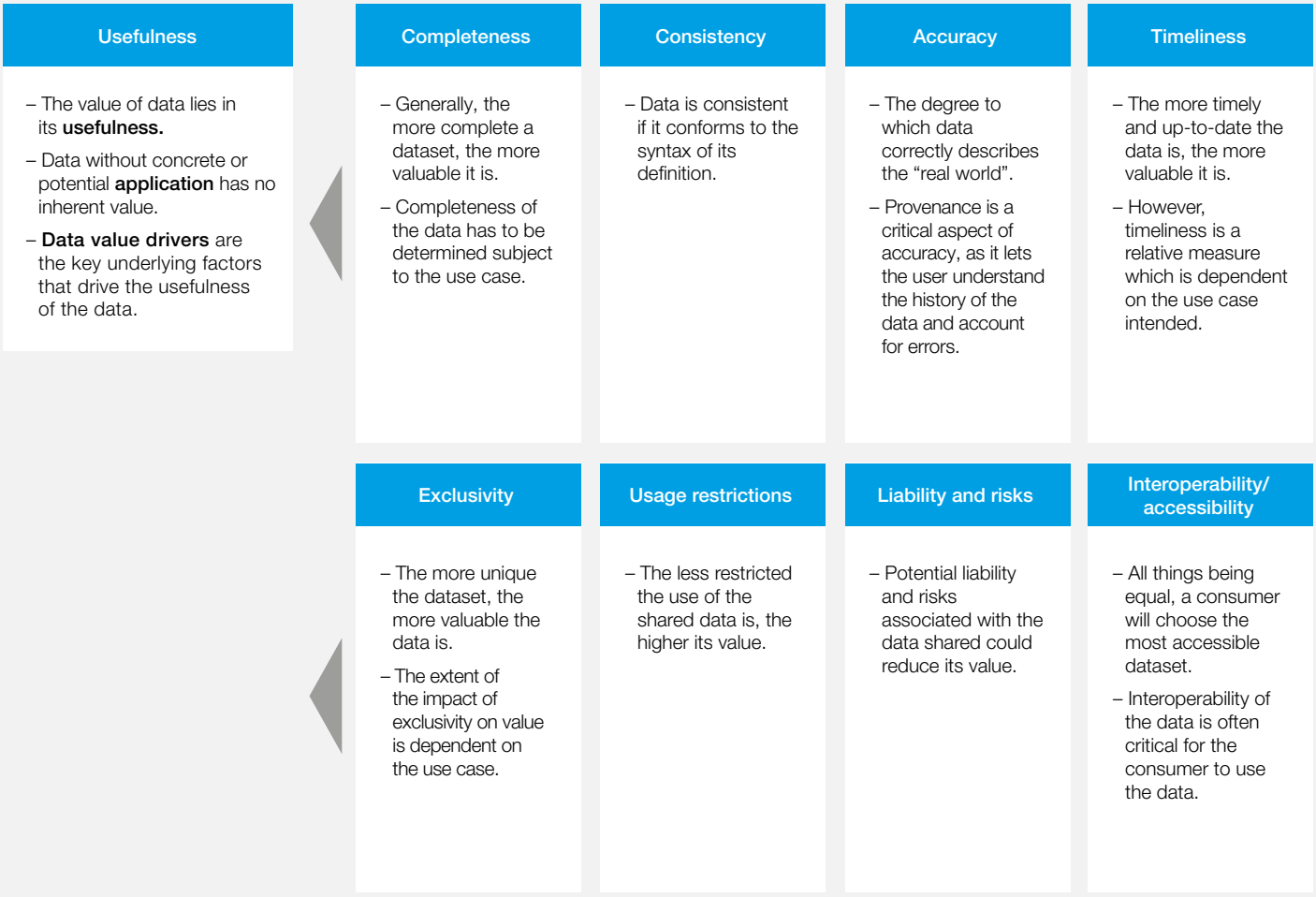
Data monetization strategies

The potential value of the Colombia Moonshot Project can be viewed from both monetary and non-monetary perspectives. As they relate to the data, multiple attributes determine data's value, including timeliness, accuracy, completeness, consent and market demand.

By aligning on a shared taxonomy of the various value dimensions of the data being collaboratively leveraged, Project Moonshot aims to provide a more informed and coherent analysis of the value of data within a defined usage context. This can also serve to create more agile, effective and fit-for-purpose data governance policies in Colombia and, more broadly, in Latin America.

Given the lack of coherent approaches in data valuation, the need for a more constructive and coherent taxonomy of the value dimensions can help stakeholders align on shared understanding of the monetary and non-monetary value of a data exchange (Figure 8).[33]

FIGURE 8 **Attributes of data value**



Source: IMDA Singapore, Key Data Value Drivers - Guide to Data Valuation for data sharing (2019)

Along with a more informed and coherent conversation on the complex topic of data value, this shared taxonomy also enables more granular, contextual and risk-based data policy frameworks to emerge. The broader adoption of the discipline of risk management and the use of risk-based impact assessments are critical for Project Moonshot.[34]

As the 2018 United Arab Emirates and World Economic Forum report on Personal Data Governance notes: "One of the main benefits of using risk-based approaches is that they can enable desired outcomes to be achieved and are therefore compatible with outcome-based frameworks. With risk-based assessments in place, the decisions of policy-makers

can be more fully informed on the anticipated value being created and do not represent one stakeholder's interests to the detriment of others."[35]

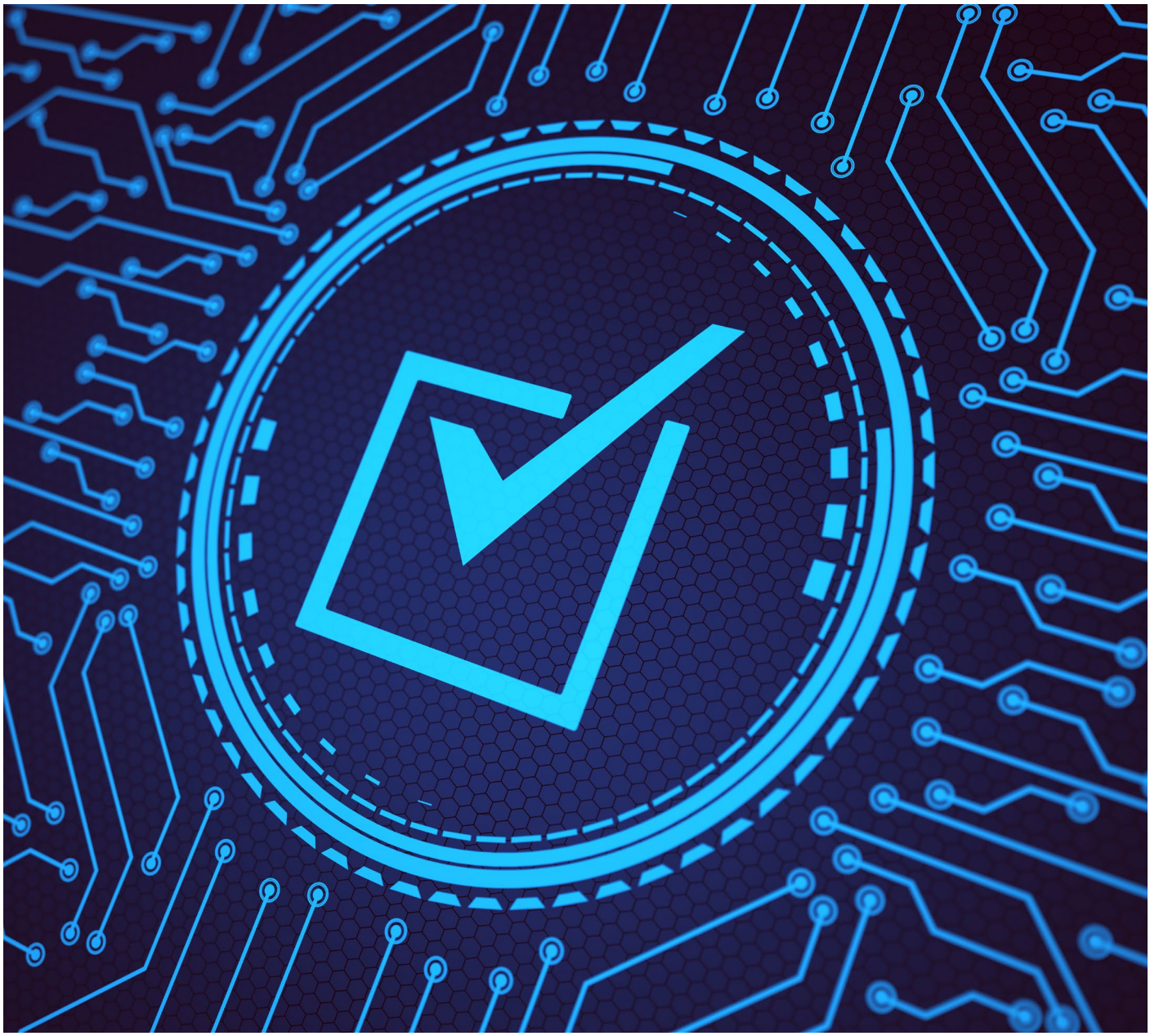
In particular, Project Moonshot will examine the following opportunities and challenges related to data valuation:

Opportunities

- Accelerating progress in managing increasingly complex environmental challenges due to climate change.
- Fostering innovation by enabling public and private entities to ethically access and responsibly use key data assets.
- Advancing new revenue models based on the responsible use of data for the common good.
- Aggregating new datasets that provide greater value.
- Providing governments with new tools and indicators for evaluating the effectiveness of their programmes.
- Identifying new tax revenue and tax collection opportunities.

Challenges

- Lack of trust and engagement among Colombian citizens.
- Power asymmetries between data holders and data subjects.
- Lack of data interoperability and accessibility across borders and industry sectors.
- Inability to mitigate the liabilities of commercial and non-government actors as they collaborate to address macro geopolitical, environmental and social concerns.



5

Unlocking data value in the energy sector

Empowering Colombians to help them make more informed decisions will bring them significant benefits.

> **Our main public policy for the sector is energy transition. This policy includes accelerating the incorporation of variable renewable energy in our power matrix, distributed energy resources, digitalization and electrification of the economy and enabling new technologies such as advanced metering infrastructure.**
>
> **With these policies we seek to empower end users by allowing them to consume or generate their own clean electricity, as well as to take advantage of new technologies such as the internet of things, big data and artificial intelligence. In short, we firmly believe that allowing Colombians to have readily available data from clean electricity generation and consumption to make better and more informed decisions will improve their day-to-day lives.**
>
> Diego Mesa, Minister of Mines and Energy, Colombia

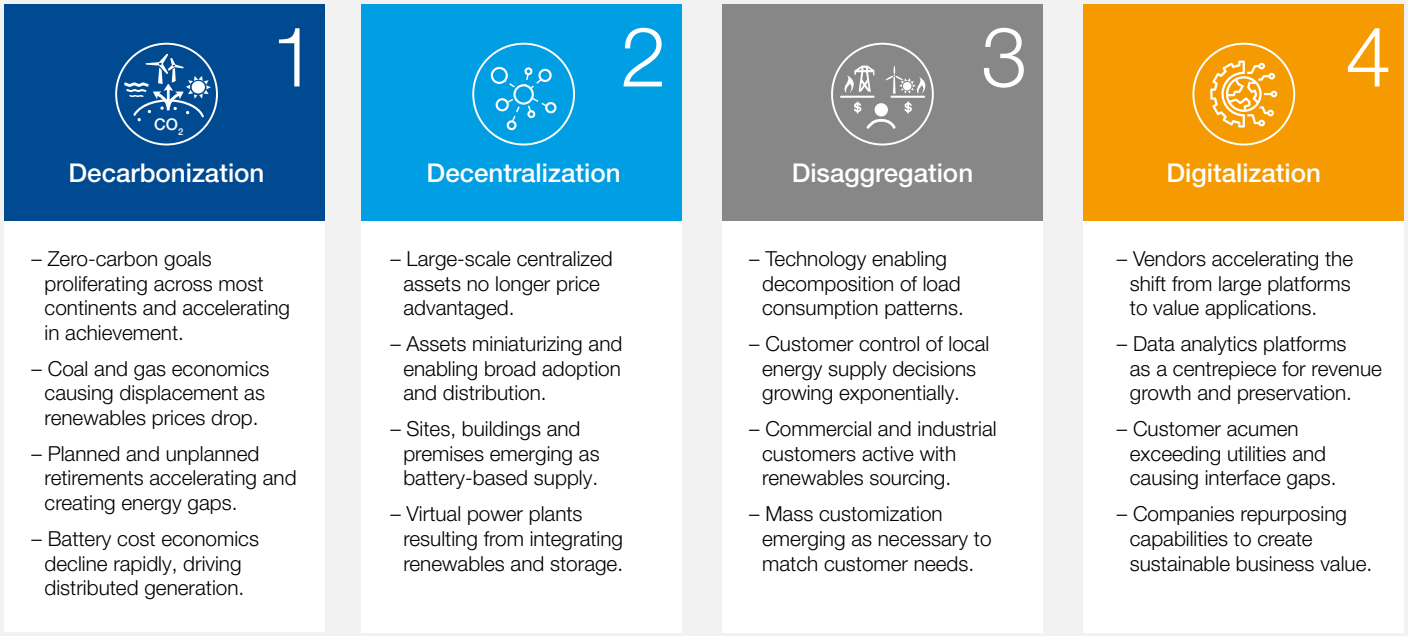
The urgency of addressing climate change and the energy sector's role to meet global carbon reduction commitments by 2030 is widely known and accepted. As leaders from both industry and the public sector continue to focus on the net-zero transition, it has become a top priority in Colombia in governments and corporate boardrooms.

The Colombian Ministry of Mines and Energy, the regulatory and planning authorities and the countries in the Pacific Alliance are all committed to:

- Reducing the dependence of power grids on fossil fuels.
- Incorporating distributed energy resources.
- Promoting the electrification of the economy.
- Providing universal access.
- Sustaining/increasing network reliability.
- Ensuring local/regional grid stability.
- Enabling network digitalization technologies, such as advanced metering infrastructure (AMI), smart grids, micro grids and data infrastructure.
- Deploying regulatory frameworks for energy storage solutions.

Additionally, national sectoral decarbonization initiatives aim to achieve net-zero operations by fostering the energy transition and promoting the adoption of non-renewable energy sources and their integration into the power matrix in accordance with Colombia's Energy Transition Law. Four drivers of change are unlocking innovation within the power and utilities sector: decarbonization, decentralization, disaggregation and digitalization (Figure 9). These drivers are being used to establish new Energy-as-a-Service business models, where data is foundational. Central to these objectives is the need to strengthen stakeholder trust in the digital transformation by developing AMI, strengthening data reliability and promoting data exchange mechanisms.

FIGURE 9 | **Four disruptive forces in the power and utilities sector**



Source: PwC, *Global Energy, Utilities and Resources, PwC Future of Industries – Power and Utilities* (2020)

FIGURE 10 | **Emerging value levers and applicability to power and utilities**

Energy as a service	Emerging value levers	Applicability to power and utilities
Capacity platform	Provide a platform on which asset owners can offer spare capacity to improve utilization.	Create virtual power plants, e.g. by enabling households to sell part of their PV+ battery capacity to other parties.
Anywhere access	Offer digital subscriptions that provide users with anywhere access to products or services.	Provide variable subscription plans/models for electricity, enabling customers to choose e.g. renewable power and access their energy account from anywhere, etc.
Digital product	Develop a fully digital platform that enables straight-through processing of products and services.	Engage customers on a digital platform that enables them to instantly buy, sell or trade energy capacity or purchase energy services.
Connected assets	Enable the connection of assets to improve asset performance management and operational improvements.	Provide real-time service to households by connecting their devices with sensors and analytics conveying operational data.
Disintermediation	Employ new technology to remove intermediaries from the value chain and link the end user with the original supply.	Use blockchain to enable peer-to-peer energy trading to reduce peak energy demand and leverage community-based microgeneration.
Data analytics	Leverage strong data analytics to identify and facilitate new market opportunities.	Shape the demand curve to create value from optimized energy assets and a more efficient and reliable grid.

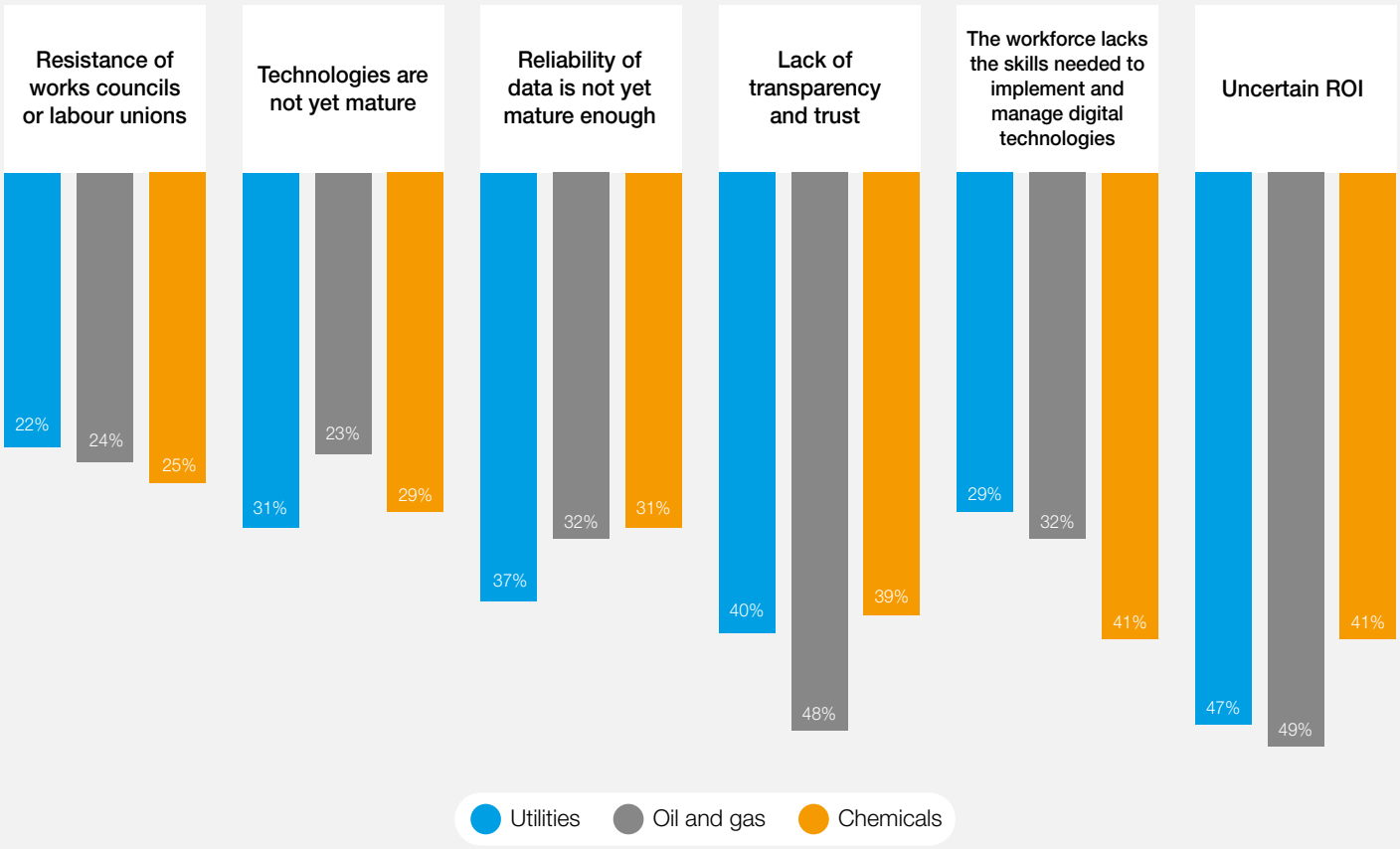
Note: PV+ – Photovoltaic battery system with a combined battery storage system

Source: PwC, *Global Energy, Utilities and Resources, PwC Future of Industries – Power and Utilities* (2020)

Yet despite the growing demand from governments, citizens and international organizations for meeting carbon reduction goals, there remains scepticism within the power and utilities sector on the benefits of digital transformation.

In a 2019 global PwC study (Figure 11), which included the top 40 power and utilities companies, a key finding was that the survey respondents expected only 10.2% cumulative revenue gains and 8.7% cost reductions from digital investments during the subsequent five-year period.[36]

FIGURE 11 | **Top emerging challenges of power and utility companies**



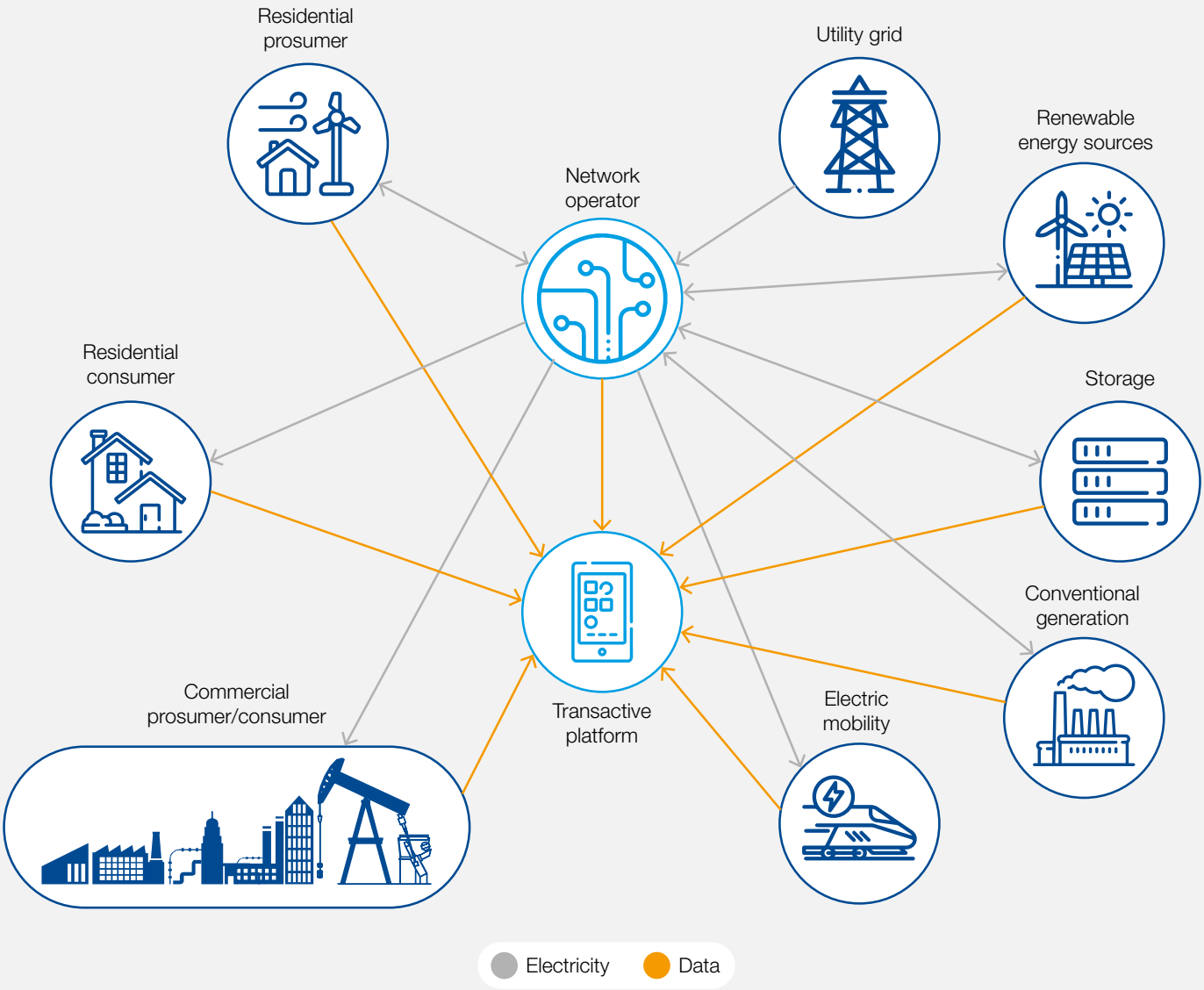
Source: PwC, *Digital operations study for energy: Power and utilities* (2019)

Along with the general scepticism about the value of digital transformation, additional surveys within the power and utilities sector found significant gaps in data analytics capabilities and data infrastructure.[37] Those that have invested in data analytics have generally prioritized operational and customer relations improvements. Less than a fifth of the firms surveyed in the supplemental studies were seeking to directly monetize data.

There is very little interest in open data initiatives and the sharing of operational data with third-party companies that could leverage it to provide value-added residential services. Survey respondents within the utility sector generally felt that new approaches for leveraging data would be tantamount to giving away strategic assets that could later prove valuable.[38]

Against this backdrop of having a clear mandate for carbon reduction as a step towards Colombia's transition to a data-driven economy, Project Moonshot aims to identify ways of encouraging change within the sector. The project can align stakeholders on shared goals, prioritize the top challenges and deploy data-driven interventions in a trustworthy and responsible manner. In short, it is supporting sectoral decision-makers to make better and more informed decisions to optimize their resource allocation, meet demand expectations and improve citizens' day-to-day lives (Figure 12).

FIGURE 12 | **Transactive energy markets**



Source: PwC Colombia based upon Fahad M, Elbouchikhi E, Benbouzid M, Guerrero J, Microgrid Transactive Energy Systems: A Perspective on Design, Technologies, and Energy Markets (2019)

Applying a valuation framework within an energy sector data exchange

As noted in section 4, the underlying data economics are a critical pillar of Project Moonshot. Understanding the value of data in the Colombian energy sector requires a series of impact-based risk assessments to arrive at the value of data for improved decision-making to reduce cost inefficiencies and improve revenue generation.

Of central importance in arriving at such a data valuation for the intended impact delivered is the need to take a holistic view of how data will be used throughout the wider decision-making process. As such, there are five critical phases along the data-to-decisions value chain: stakeholder alignment, data governance, insight generation, insight adoption and economic sustainability (Figure 13).[39] All five elements are integral for delivering data-driven value over time.

FIGURE 13 | **Five phases of the data-to-decision value chain**

Source: World Economic Forum with McKinsey and Company, *Data Collaboration for the Common Good: Enabling Trust and Innovation Through Public-Private Partnerships* (2019)

Stakeholder alignment

The first step required for assessing the value of data within the Colombian energy sector is to holistically frame the various value and risk dimensions within the context of the intended stakeholder outcomes. The central issue becomes one of rigorously defining the use case and aligning on which value dimensions Project Moonshot is best positioned to deliver: new operational insights, rapid decision-making, improving predictive forecasting, improving operational efficiencies or improving innovation. A number of discussions in Project Moonshot have focused on data rights management, given the complex challenges of data ownership.

Against each of these value dimensions, detailed assessments of the commercial, regulatory, operational, security and privacy risks also need to be completed. Arguably, commercial risks are the most complex and challenging of these concerns.

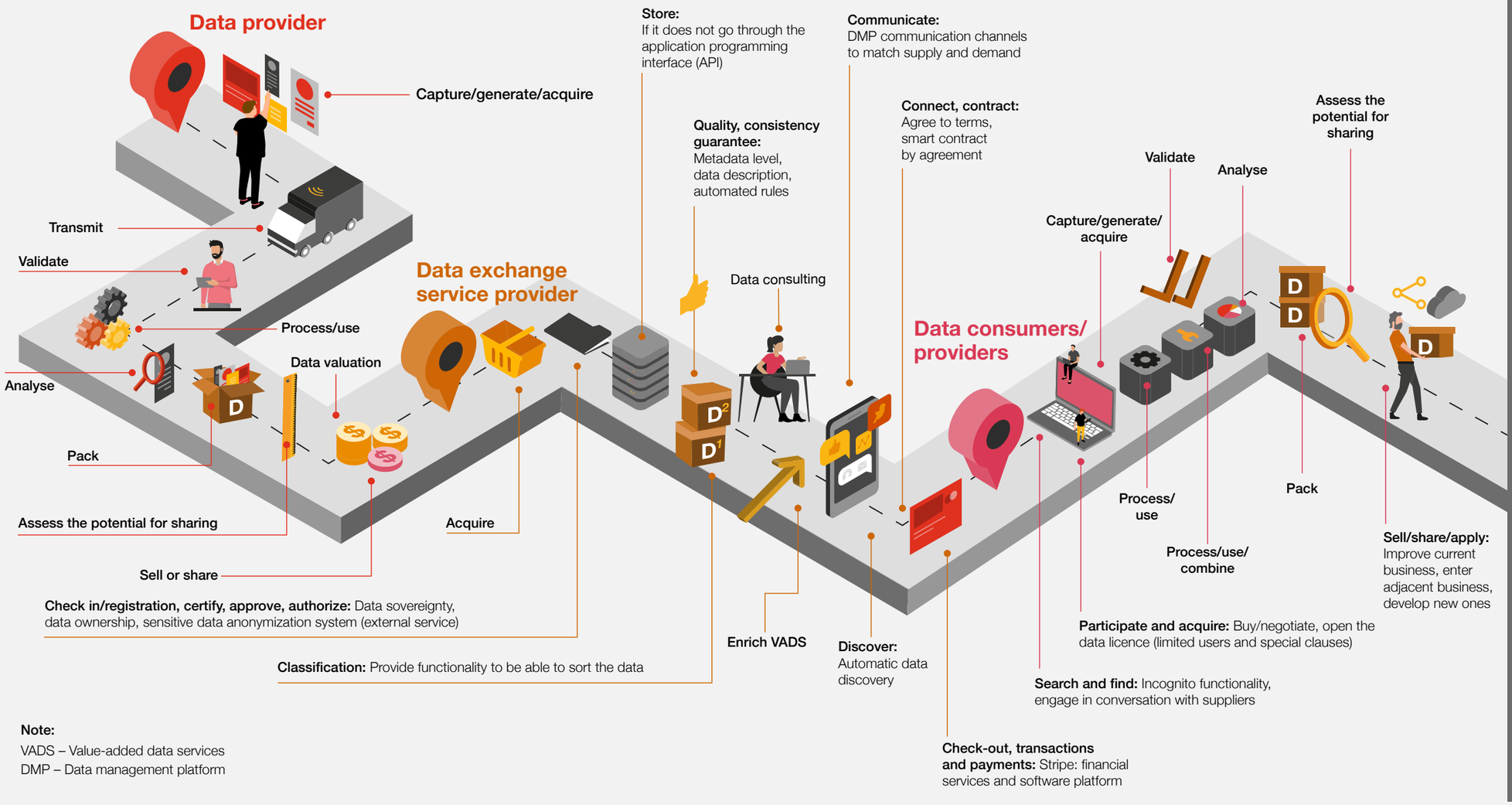
Once the various stakeholders have completed due diligence to ensure commitment and resource availability, aligned on a shared vision, completed an opportunity and risk assessment and agreed on a shared and measurable outcome that balances competing incentives, the next phase of Project Moonshot's data valuation process focuses on establishing an operational data governance plan, including, but not limited to, auditing, redress and ethical review boards.[40]

As it relates to Project Moonshot, the envisioned process flow of a data transaction – the data journey map (DJM) – identifies the needs and risks of the three main ecosystem actors: data providers, data exchange service providers and data users (Figure 14). The DJM extends from the acquisition of data through the verification of its quality and concludes with the evaluation of the user. The process of constructing the DJM includes:

- The importance of acquiring quality data.
- The evaluation of its value creation potential.
- Classification of data for sharing.
- Ensuring specialized datasets meet quality, protection and privacy standards.
- Generation of new services and business models based on data, which also encourage the sharing of data to achieve established goals.

FIGURE 14 | Project Moonshot data journey map

Learn the path of emerging data markets



Note:
VADS – Value-added data services
DMP – Data management platform

Data provider

They are the creators and owners of the data.

Data exchange service provider

They can be individuals or platforms (data markets) that connect supply and demand and that can have a data domain across industries, regions and segments.

The data generated and collected can be transferred to consumers directly or indirectly through intermediaries.

Data consumers/ prosumers

They are individuals or organizations that collect or buy data that is subsequently processed with analytics to improve or develop new business.

Source: PwC Colombia, *under Project Moonshot led by the Centre for the Fourth Industrial Revolution Colombia* (2020)

In addition to aligning on the intended outcome and ensuring all the actors in the transaction are fairly compensated, it is also important to create a regulatory sandbox, given the ambiguity of many existing data policy regulations and the need to demonstrate commercial business trials independent of current regulatory regimes. Allowing commercial relationships and sustainable revenue streams to grow takes time. Regulations and government oversight that are well defined on what is and what is not permissible address the uncertainty and unpredictability of early-stage commercial ventures.

Conclusions and considerations

The need for sustainable, equitable and scalable approaches in the collaborative use of data has never been stronger. The challenges leaders face at the global, national and subnational levels are increasingly complex and are accelerating in their severity. Data exchanges for the common good, such as Project Moonshot in Colombia, provide a unique opportunity to drive positive change.

The continued engagement of public, private and civic institutions will be vital for data exchanges to scale and have a positive impact over time. Clarity on balancing complex and competing interests with transparent, human-centred and trustworthy governance models will be critical for these new initiatives to take root and expand.

Above all, strengthening trust is the first and most pressing requirement for advancing data exchanges for the common good. Stakeholder trust remains at crisis levels and its six interconnected attributes – accountability, ethics, auditability, transparency, equity and security – must all be addressed. In relation to this, advancing new mechanisms for gaining individual consent to strengthen trust can play a key role.

Likewise, the need to continually support government officials, business leaders and civil society members in the evolution of their functioning pilots is also critical. The work of Project Moonshot and the Centre for the Fourth Industrial Revolution Colombia hold unique promise in this regard as they invest in multistakeholder dialogue, piloting use cases and global knowledge exchange.

In the future, governments will need to commit significant financial resources, human capital and technology infrastructure in their transition to a data economy. Enterprises will need to expand the scope of their data monetization strategies to include impact-based approaches which assess the value of data in delivering intended outcomes. Individual citizens will need to continually demand greater clarity, consistency and control to understand and manage how data made by and about them is being used.

Ensuring the continued progress of data exchanges for a common purpose will require coordinated action along multiple fronts. An initial list of areas for further consideration include:

– Providing policy-makers with direct access to decision-makers within Colombia's energy sector to learn how access to collaborative data exchanges are creating new opportunities, lowering risks and delivering impact.

– Engaging directly with local communities and impacted populations to understand their perceptions of data exchanges and their willingness to trust and support them.

– Developing a common toolkit for understanding, measuring and managing how indirect business value can be created by using private sector data for the common good.

– Advancing a disciplined counterfactual assessment framework which would demonstrate to leaders the cost of suboptimal decisions resulting from incomplete and poor-quality datasets.

There is no denying that the challenges ahead are significant. Political, technical, social, commercial and ethical concerns are tied in a complex knot. There are no straight pathways for navigating the transition to a data-driven economy. Yet progress is happening: one step at a time. It is now more important than ever to remember the adage, "we are not defined by our challenges but elevated by them".

Appendix

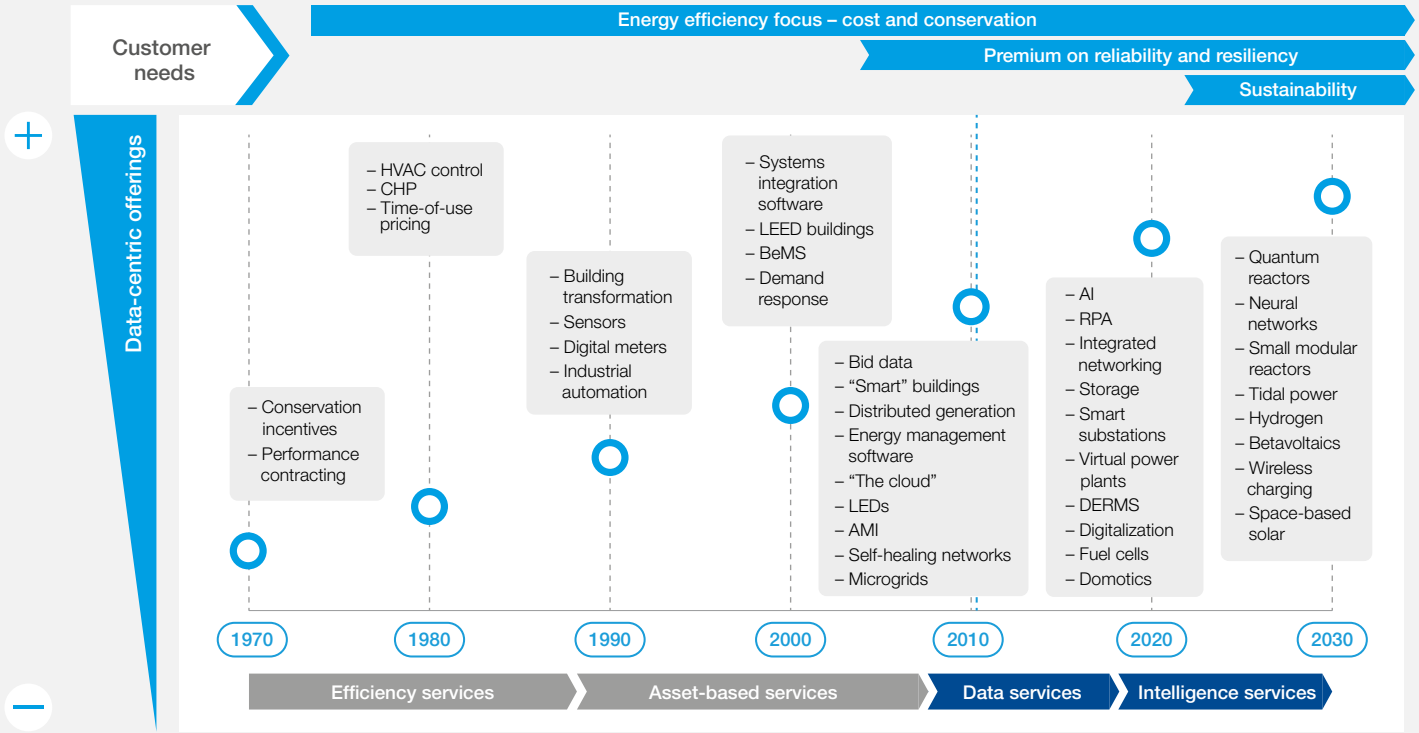
FIGURE 15 **Elinor Ostrom's principles and the data economy parallels**

Ostrom's principles	Data economy parallel
There are clear boundaries and rules about who is entitled to what.	Clarity on the rights of different entities to control, access, use and share data.
Monitoring actions is feasible.	Transparency and auditability of how data is being collected, used and shared.
There are mechanisms for resolving conflicts.	Regulators who can enforce both mandating and limiting access to data.
Individual responsibilities and benefits broadly balance.	Transparency and better understanding of both rights and how value from data returns to people and organisations.
Users themselves are responsible for monitoring and enforcement.	Transparency and contractual terms to enable monitoring and auditing of data use and sharing; in a data economy this may require agents who can act on behalf of data subjects.
Sanctions for abuse are possible and graduated, getting progressively tougher.	Enforcement of a range of consequences for the misuse of data, ranging from the withdrawal of access permissions to fines and other penalties.
Decisions are legitimated by the participation of users.	For individuals, consent and opt outs need to be informed and viable (which requires competitive alternative services). Organisations need to proactively engage with communities such as through representative data governance bodies and public participation exercises.
Decisions are also legitimated by government recognition.	A comprehensive data strategy and institutional/regulatory framework.

The table sets out Ostrom's design principles and their data economy paralells. Note that the commons – resources such as fish or grazing that Ostrom studies are rival, whereas data is non-rival.

Source: Bennett Institute for Public Policy, *The Value of Data Summary Report* (2020)

FIGURE 16 **A timeline of key technology innovations and their adoption within the energy utilities sector**



Note:
HVAC – Heating, ventilation and air conditioning
CHP – Combined heat and power
LEED – Leadership in Energy and Environmental Design
BeMS – Building Energy Management System
RPA – Robotic processes automation
LEDs – Light-emitting diodes
AMI – Advance metering infrastructure
DERMS – Distributed energy resources management system
Domotics – The control of domestic appliances by electronically controlled systems

Source: PwC Colombia, *unpublished* (2021)

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