Responsible Innovation for Digital Identity Systems

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Abstract

Digital identity (eID) systems are a crucial piece in the digital services ecosystem. They connect individuals to a variety of socio-economic opportunities but can also reinforce power asymmetries between organizations and individuals. Data collection practices can negatively impact an individual's right to privacy, autonomy, and self-determination. Protecting individual rights, however, may be at odds with imperatives of profit maximisation or national security. The use of eID technologies is hence highly contested.

Current approaches to governing eID systems have been unable to fully address the trade-offs between the opportunities and risks associated with these systems. The Responsible Innovation (RI) literature provides a set of principles to govern disruptive innovations, such as eID systems, towards societally desirable outcomes. This paper uses RI principles to develop a framework to govern eID systems. The proposed framework seeks to complement existing practices for eID system governance by bringing forth principles of deliberation and democratic engagement to build trust amongst stakeholders of the eID system and deliver shared socio-economic benefits.

Keywords – eID systems; digital ID; responsible innovation; trust

1 Introduction

Digital identity (eID) is rapidly becoming the dominant form of identification for individuals when interacting with businesses, governments, or aid agencies. It is an essential component of the global digital infrastructure, which has an estimated 4.4 billion internet users, 5.1 billion mobile users, and a global e-commerce spend of $3.5 trillion (S. Kemp, 2019; Young, 2019). Social media technologies have become quintessential for communication and economic activity, driving billions of daily transactions (Clement, 2019, 2020; Iqbal, 2020). Small and medium sized businesses rely heavily on digital services and eID infrastructure to deliver products and services. Companies such as 23&Me and DnaNudge combine DNA and digital identity data to build personalised services. Official identity documentation is crucial for accessing socio-economic opportunities, and currently an estimated 1.1 billion people lack access such an artefact (Gelb & Metz, 2018; World Bank, 2018). Governments have responded to this challenge by ramping up eID programmes as a means for providing official identification and replacing legacy, offline systems. This has meant access to financial aid and welfare is increasingly being linked to identification systems, such as Aadhaar and UN PRIMES – linking logics of universal access to digital access which in turn has led to exclusion from social protection for marginalized populations (Masiero, 2020). Global COVID-19 response strategies have also created a vast variety of technological solutions and techno-commercial arrangements underpinned by eID systems (Daly, 2020; Edwards, 2020; Masiero, 2020; Yeung, 2020).

eID systems can extract ever increasing amounts of personal data, that can lead to a loss of privacy and agency as these systems get linked to services and analytics platforms that then track, exclude or penalise non-compliant behaviour such as using welfare money to purchase alcohol or gambling products (Arora, 2016; Tilley, 2020). While eID systems demand greater transparency from the individual, owners of these systems are perceived as being opaque in their data management and decision-making practices (Hicks, 2020; Schoemaker et al., 2021). The certainty of eID provisioning limits the ability for vulnerable populations to negotiate their status with respect to the government and the care social service workers can provide on their behalf (Arora, 2016; Schoemaker et al., 2021). In the global south, governments are not just regulators of the ID data but also distribute it for private sector exploitation (Hicks, 2020). These regions may lag in the development of data protection and data privacy regulation or lack the capacity to implement and monitor regulation effectively.

In this paper, we consider a range of potential responses to the challenges of governing eID systems. First, we describe the current approaches to eID governance and discuss some of their key deficiencies, such as gaps in existing regulations and regulatory oversight bodies, the lack of incentives for organisations to implement effective data management processes, and the limitations of using siloed technological solutions to address a networked ecosystem problem. We propose that some of these deficiencies can be addressed if principles of Responsible Innovation (RI) – rooted in user or data subject trust – are more actively employed when considering governance models for eID systems. We then outline how an RI framework for eID systems governance might look like, highlighting that RI principles embed deliberate practices to manage and direct emerging innovations towards societally beneficial outcomes. The proposed framework seeks to bring deliberation and democratic engagement to the fore while considering how to develop or govern eID systems. Through this paper, we seek to build on nascent research in eID system governance and appeal for greater interdisciplinarity in researching and governing eID systems. The proposed framework is based on extensive review of RI literature and emergent eID systems literature and use cases. eID systems literature and examples have been used to substantiate the principles-based approach RI proposes, as opposed to use case specific issue-based approaches.

The proposed framework is modular and non-prescriptive but can be used as an assessment tool for individuals and organisations designing, developing, managing, governing or regulating eID based socio-technical systems. The proposed framework supports existing and future governance models for eID systems, based not only on the RI principles but also the literature we've reviewed that investigates concerns and potential solutions for governing them in a more responsible manner. The rate of proliferation of digital business models, both public and private, requires deeper analysis into the distribution of risks and rewards of digital systems across its ecosystem. Through greater engagement with users or data subjects the proposed framework aims to address issues of trust and contextual engagement often lacking in eID systems.

2 Digital Identity Creation Methods

Digital identity tends to be studied within silos that focus either on digital persona and identity management strategies (Boyd, 2011; Feher, 2019; Trottier, 2014), on the various underpinning ID technology types (Dunphy & Petitcolas, 2018; Takemiya & Vanieiev, 2018; Toth & Anderson-Priddy, 2018), the potential use of eID for socio-economic gain (Gelb & Metz, 2018; White et al., 2019), or the associated risks from these socio-technical systems (Baker & Rahman, 2020). Madianou (2019) suggests viewing identification components (such as biometrics, IT

infrastructure, blockchain and AI) as technological assemblages since the convergence of these components amplifies the risks associated with digital identification. We look at digital ID systems as a whole, not just technological assemblages, but also organisational processes and commercial arrangements that enable digital identification with or without an individual's awareness, and include the stakeholders involved in its development, deployment, management and usage.

Centralised eID infrastructures such as UN PRIMES and Aadhaar, India's national ID programme, are managed by large organisations. Transnational platforms, such as Google and Facebook, are private sector examples of centralised eID infrastructures. An individual user has to provide identification & authentication evidence as mandated by the central ID provider and relinquishes control of how their personal data is stored, used and analysed when they sign up to use the services that overlay the ID system. There is vast variance in data protection laws' prevalence, content and implementation of procedural security requirements on centralised eID providers.

As digital business models have proliferated, federated identification, where digital businesses delegate authentication processes to existing identity providers, has become a commonly used authentication and transacting method. These partnerships represent techno-commercial arrangements where an individual's data is shared between organisations. By consenting to use federated ID verification, an individual user signs off on a data sharing agreement between the digital business and the identity provider. The extent of data shared has limited to no input from the individual beyond initial consent. Ownership, security and control of the individual's identity data becomes a shared exercise between the digital business and identity provider.

Data aggregator business models are another method of digital identification, where digital interactions of an individual across platforms and services are aggregated to create a 360-degree snapshot of that individual. This aggregated data is then sold to businesses to enhance sales and marketing efforts by analysing customer trends and behaviours. The individual has little to no knowledge of what data has been aggregated and sold unless systems are breached.

Surveillance practices can also create digital identities. Pre-emptive policing techniques can categorise groups into capricious classifications like "criminal", "annoying", "nuisance" (Niculescu-Dinca et al., 2016). Not only do the groups in question not know what identities have been created of them, these classifications are difficult to change once documented. Ambiguous data sharing arrangements between government departments can cause "at risk" individuals, (eg refugees) to be seen "as risks", which can justify greater surveillance (Fors-Owczynik & Valkenburg, 2016; Niculescu-Dinca et al., 2016). Surveillance categorisations from one public arena form identities for individuals across social institutions and can affect their access and outcomes to opportunities (Tilley, 2020).

Self-sovereign identity (SSI) provides an alternate paradigm for identification where the individual creates and controls their digital credentials. SSI relies on a decentralised identification framework, personal data storage lockers and (often) blockchain technologies (Lyons et al., 2019). However, its usage is still nascent and thus out of scope for this paper.

As highlighted above, eID methods are a mix of technological, commercial and organisational arrangements. Even where the individual initiates the creation of their eID, the processes for identity management are controlled and managed by organisations that have divergent socio-economic imperatives.

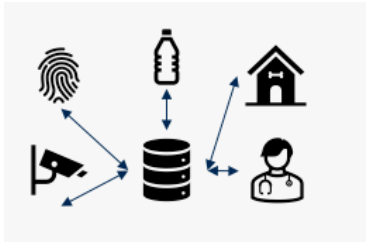
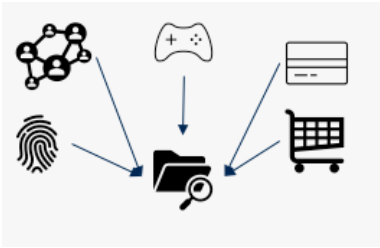
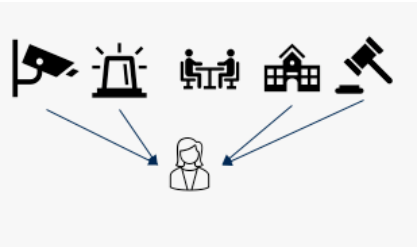
Digital Identity Systems				
	Centralised	**Federated**	**Aggregated**	**Sureveilled**
				
Attributes	• Ownership & control of identity data rests in the hands of a single entity	• Techno-commercial arrangements • Identity management is a shared practice	• Customer 360 data aggregated & sold to improve sales & marketing efforts	• Classification of individuals based on pre-defined criteria • Data sharing across linked services to coordinate response
Example	• Aadhaar, UN PRIMES • Facebook, Google	• Farmville & Facebook • Aadhaar & linked welfare distribution systems	• Equifax • Facebook	• Government services (policing, welfare, healthcare)
Risks	• Reliance on central identity provider practices • Regulations limited by geographic reach	• Similar risks to centralised model • Data sharing arrangements unknown	• Done without knowledge of the individual • Personal data monetised for organisational gain	• Done without the knowledge of the individual • Defines the relationship an individual can have with institutions

Table 1: Digital identity creation methods

3 Current Approaches to eID Governance

The current methods for governing eID systems have focused on addressing known risks associated with these systems primarily through regulatory frameworks, organisational governance and risk management approaches, and technological solutions.

3.1 Regulatory Frameworks

Regulations that govern personal data usage online fall under the categories of privacy laws, data protection laws, consumer law and competition law. By 2018, 161 countries had embarked on national identification programmes that were reliant on digital technologies; 132 jurisdictions had instituted data privacy laws and an estimated 28 more countries had plans to enact data protection laws (Greenleaf, 2019; World Bank, 2018). Data protection and data privacy laws aim to ensure an individual's control over their digital footprint.

However, laws are only as effective as their implementation. In the global south, regulations focussed on digital rights are still in their nascency, while large scale eID programmes have already been deployed to subsume significant proportions of the population (Hicks, 2020). In India, while a draft data protection bill was still being discussed in Parliament, enrolment in Aadhaar has surpassed 90% of the population (Pandey, 2017; Tomlinson, 2017). In the USA, privacy in the digital realm is diffused across a variety of federal, state, tort laws, rules and treaties, and digital businesses can only be taken to court on infringements of their own, often vague, privacy policies (Esteve, 2017). Legacy legal frameworks have limited adaptability to new technological developments and associated risks (Brass & Sowell, 2020). Moreover, a focus on data protection laws alone ignores the constant evolution of data mining methods, which can easily reidentify aggregated and anonymized personal data (Gandy Jr., 2011).

While regulations, such as GDPR, provide protection for individuals, the responsibility to actively monitor personal data trails still lies with the data subject, who may be unaware of their exposure to data processing risks, and unaware of their digital rights or how to exercise them. Organisations controlling data create significant procedural hindrances for individuals to access or delete their own data (Myrstad & Kaldestad, 2021; Turner et al., 2020). Owing to territoriality, victims of data protection violations, such as revenge porn, fail to get harmful content removed if hosted on servers in jurisdictions that are not signatories to data protection agreements (Cater, 2021).

The digital marketplace is heavily impacted by platform economics, where a single player can dominate the market. While a dominant market position in itself is not anti-competitive, the abuse of a dominant position is uncompetitive. In digital markets, a dominant player can abuse its position through the accumulation of large amounts of personal data or with the use of concealed data processing practices (Khan, 2019). This creates objective costs for its customers in terms of risks of identity theft, inadvertent disclosure of personal data, and risks of manipulation and exclusion. Concealed data practices can undermine competition objectives by allowing privacy degrading technologies to persist unbeknown to its users, as seen with examples such as Apple promoting Apple music while subverting Spotify or Google search biases that rank Google products and services higher than alternatives (K. Kemp, 2020; Khan, 2019; Witting, 2019; Zingales, 2017). Additionally, through the extraction and analysis of vast amounts of personal data and ever more tailored services to its user base, dominant players can create significant barriers to entry for any privacy enhancing alternatives (EDRi, 2020).

An economic lens alone does not capture the trade-offs between privacy and access to free services, such as search and social networks, and anti-competitive practices (K. Kemp, 2020; Kerber, 2016). Recent examples have exposed the ineffectiveness of competition laws in dealing with large platforms, as they are willing to pay significant fines for violations but not to change their business practices (Amaro, 2019; EU Commission, 2017, 2018, 2019; Riley, 2019). Greater coordination among data protection, competition and consumer protection authorities is required when considering digital law infringements.

Digital identities are also constructed and complemented with a growing body of data from our extended environments, through IoT enabled devices we use, wear on our bodies and install in our personal and ambient spaces. The proliferation of these devices will create new threats and unexpected harms, but can create new data markets that can be monetised (Tanczer et al., 2018). Regulation alone cannot address the dynamism inherent in the digital space, nor can it be expected to be comprehensive or proportionate in its nascency. An alignment on a broader set of instruments, such as (use case specific) regulation through technology, innovation sandboxes, or technical and normative standards is needed (Engin & Treleaven, 2019; Ringe & Ruof, 2018). Engin and Trevleaven (2019) cite examples such as Civic Lab in Chicago, Citizinvestor and CitySourced as new models for improving citizen state participation through technology and informing changes in policy at local and regional levels.

3.2 Organisational Governance & Risk Management Approaches

Individuals perceive themselves to be lacking power in managing their privacy when interacting with digital systems providers and expect these organisations to be responsible in their privacy practices. This expectation, of responsible and ethical practices, can extend beyond current legal boundaries and into moral norms of information use (Bandara et al., 2020). Organisations must hence develop robust governance and risk management processes not only to ensure regulatory compliance but also to foster a safe environment for individuals to participate in their service offerings.

In order to comply with the GDPR and emerging national data protection requirements, there has been an increase in investment in the privacy and data protection function within organisations. Over 70% of organisations surveyed saw an increase in data protection and privacy staff and 87% had appointed a data protection officer (Deloitte, 2018). However, privacy policies, data usage and consent notices are often written in inaccessible language and formats that can lead to behavioural decision-making problems (such as framing effects and status quo bias), which cast doubts on whether true consent is actually being provided (Kerber, 2016). Additionally, consent is only one of many bases for lawful data processing, others may include commercial contractual reasons, the legitimate interests of data controllers or third parties (Art. 6 GDPR, 2016), or if proven necessary to perform a task for public interest (Art. 6 GDPR, 2016), such as aid, welfare distribution and national security. These alternate data processing methods may be used more often than consent methods and done without data subjects' knowledge.

The humanitarian sector, a 150-billion-dollar industry, has increasingly been required to show greater accountability to donors and traceability of funds. Digital infrastructures, such as biometric registration, provide an appearance of exactness that is deployed to address these demands, often in instances where it is not required (Madianou, 2019). While demanding greater transparency from vulnerable populations, developmental organisations running eID systems can seem opaque in their data governance practices and subsequent decision-making based on personal data collected (Schoemaker et al., 2021). "Standard practices"

don't take into account contextual and cultural concerns on the ground. Refugees and aid beneficiaries have limited avenues to cite their concerns or negotiate how they'd like their identities to be recorded (Baker & Rahman, 2020; Schoemaker et al., 2021). Remote location of ID registration centres may require vulnerable populations spend resources they don't have or bring up security concerns (Baker & Rahman, 2020). Errors in these infrastructures (such as lack of matches found or connectivity issues) are cited in percentages while ignoring the impact that errors can have on vulnerable populations (Drèze et al., 2017; Madianou, 2019). Most significantly, the digital infrastructures deployed may not address targeted inefficiencies. Aadhaar was aimed at addressing fraud in benefits distribution by ensuring traceability of food supply to the beneficiary. However, analysis suggests that fraud still exists with a majority of value leakage happening upstream (Drèze et al., 2017; Khera, 2019).

Corporations have limited incentives to address privacy and data security risks that lie outside organisational boundaries or are inherent in the digital value chain. Data aggregator business models are built on piecing together siloed information on individuals to mine or further sell onward. The onus of risk management across the entire ecosystem rests on the individual, who lacks information, resources and technical know-how to assess and address her risk susceptibility.

Some suggested methods of addressing ethically complex questions associated with digital business practices include invoking fiduciary responsibilities on platforms, mandating algorithmic transparency and developing public sector owned ID banks (Balkin, 2016; Dobkin, 2017; Pasquale, 2015; Schwarz, 2017). While relevant, these proposals primarily focus on large global entities while the use of eID technologies requires interventions at micro, meso and macro levels and contextual analysis of each use case. If applied to Aadhaar such interventions could entail the formalisation of a data protection law prior to deployment, civil society representation on the governing board of Aadhaar, transparency and formal notice on partnership arrangements with private sector suppliers and government departments, an independent auditor or Aadhaar operations and a clear means for addressing exclusions at every point of Aadhaar authentication (Anand, 2021).

3.3 Technological Solutions

Technological solutionism has become prevalent with the proliferation of low cost technological assemblages and the increased involvement of private sector companies in addressing complex socio-political problems (Madianou, 2019). This has led to the expansion of identity-based technological infrastructures in public sector and development settings, at times even before the deployment of policies and laws to govern their usage.

Technological solutions for enhancing user privacy and security are used to mitigate risks associated with data leakage or identity theft such as using distributed ledger based systems, proactive vulnerability screening technologies and using a network of professionals to monitor and respond to security threats (Dunphy & Petitcolas, 2018; Malomo et al., 2020). Depending on the risk scenarios anticipated, a vast variety of technologies are deployed (Heurix et al., 2015; The Royal Society, 2019).These solutions, while extremely relevant, often rely on the knowledge of a small group of experts, while alienating end users from understanding the risks posed to them. These technologies can in turn create unintended risks that are significantly harder to remediate. Blockchain technologies, for example, run the risk of codifying inaccurate identity information permanently if inaccurately entered at source. Yet, the suggested adoption of new technology to solve complex socio-technical problems can receive more publicity and funding than using low-tech solutions (Madianou, 2019). Digital platforms use methods

such as customer feedback aggregation or the deployment of blockchain solutions to mediate trust in their business. However, the same platforms may not take any responsibility for a breach of trust in interactions (Bodó, 2020). Each failed transaction, however, then reduces user trust in the system.

Principles of privacy by design are seen as gold standard practices to achieve in addressing digital risks, and its inclusion in GDPR has pushed organisations to develop more robust and proactive privacy practices, when dealing with an EU user base (Cavoukian, 2006; ICO, 2020). However, these guidelines have fallen short of clear specification and enforcement for lack of an internationally approved standard, and so provide limited incentive for technology companies to change their internal systems development methodologies or new product development processes. Additionally, by only focussing on privacy risks we implicitly accept technological solutionism as a path forward without understanding an issue within its complex environment (Keyes, 2020).

3.4 Limitations of current approaches

Current approaches to governance have often left the individual out of the decision-making process on the development, deployment and usage of eID systems. Individuals as users, consumers, refugees, welfare participants and digital citizens have to adopt predefined processes of identification and verification to avoid missing out on crucial socio-economic benefits or opt out entirely. In addition, these governance mechanisms are very rarely aligned, are deployed and assessed separately, without a comprehensive understanding of the full normative, legal, technological and commercial governance ecosystem needed to respond to the challenges posed by eID system.

In existing eID systems, individuals are compelled to transact with organisations whose internal data processing practices are often unclear or unknown. Trust isn't just an engineering problem to solve and has "distinct cognitive, emotional, and behavioural dimensions which are merged into a unitary social experience" (Corbett & Le Dantec, 2018; Kaurin, 2020). Trust is built on reputation and mediated interactions between an individual and an organisation. Reputation is the perceived competency of an organisation in delivering a service and is based on past actions which provide a perception of what the organisation stands for today (Briggs & Thomas, 2015). Mediated interactions refer to a holistic experience of engagement, participation and responsiveness between an individual and an organisation over the lifecycle of their exchange (Corbett & Le Dantec, 2018). In addition to interpersonal relations, trust in institutions has been based on transparency in procedures, systems of accountability, internal rules, norms and governance mechanisms that establish trustworthiness for outsiders (Bodó, 2020). Digital technologies and processes, such as eID systems, impact trust as they bring new and unknown forms of risk to interpersonal and institutional relationships, and are often governed by procedures that sit outside known and familiar legal, political, economic, social and cultural practices (Bodó, 2020; Livingstone, 2018).

Opaque data processing practices diminish trust in organisations. Developing trust requires a two-way information flow to ensure individuals and organisations understand each other's' requirements and limitations. Interventions and artefacts built through stakeholder participation, such as security enhancing labelling practices, provide an avenue to enhance trust in digital technology ecosystems (Johnson et al., 2020). Greater stakeholder participation in the development and deployment of eID systems, can help build trust in the digital ecosystem, address contextually relevant ethical concerns, ensure safety and security of individuals as well as achieve collective socio-economic benefits.

4 Responsible Innovation

Stilgoe et al (2013) define Responsible Innovation (RI) as "taking care of the future through collective stewardship of science and innovation in the present". RI aims to move away from risk containment methods towards active steering of innovations through uncertainty. There are four principles to RI: anticipation, reflexivity, inclusion, and responsiveness with a focus on embedding deliberation and democratisation in the innovation process (Owen et al., 2013; Stilgoe, 2013; Stilgoe et al., 2013). These principles highlight that science & technology and society are mutually responsive to each other, and RI provides methods to steer activities, incentives, investments, prioritisation towards a shared purpose (Owen et al., 2013).

RI principles have been applied across several domains, directing research and innovation towards socially desirable outcomes. Public dialogue on the use of nanotechnology in healthcare helped steer research direction and associated funding into areas that support social values (Jones, 2008; Stilgoe et al., 2013). The STIR program (Socio-Technical Integration Research) aims to embed ethical deliberation early in the innovation process in order to reduce risks downstream (Fisher & Rip, 2013). In ICT, RI faces a multitude of challenges: most development and innovation work is done by the private sector, but responsibility of socially pertinent outcomes gets shared across multiple organisations including the public sector. While the ICT field has a plethora of professional bodies, each with their own ethical guidelines, the voluntary nature of these organisations limits the effectiveness and reach of proposed standards and guidelines (Stahl et al., 2013). Not only does ethical non-compliance have no repercussions in ICT, there is also a lack of educational preparedness in ethical issues for aspiring professionals (Thornley et al., 2018).

As we have highlighted, eID systems represent technological, organisational and commercial arrangements that connect an individual to a variety of socio-economic environments. With the current pace of digital innovation, we can expect that eID systems will continue to proliferate across geographies, sectors and services. Supporting this growth requires greater stakeholder participation and clarity on how the risks and benefits can be managed and distributed effectively across society. As we have seen in section 3, current governance approaches alone do not provide effective mechanisms for addressing the risk-reward trade-off and leave the individual out of the innovation process. Responsible innovation provides a supporting framework to govern the eID ecosystem that can foster trust and bring user considerations to the forefront of debate. We use the four principles of RI to develop a framework to govern eID systems (Table 2). The framework focusses on six broad areas for the governance of eID systems. It aims to embed democratisation and deliberation in the development, use and management of eID ecosystems.

5 Responsible Innovation for Digital Identity Systems

RI provides a framework to develop eID systems in socially desirable ways. Our analysis is focussed on the entire system (see figure 1), including all participants (developers, users, ID providers, digital businesses, public sector organisations, regulators) and all forms of digital identity management (technical, organisational, socio-technical, commercial, surveillance). By addressing the system as a whole, we acknowledge the complex socio-technical interactions underpinning eID systems and aim to build an environment to achieve beneficial outcomes for all participants, rather than fall into the trappings of single path solutionism. We acknowledge that multiple pathways for responsible innovation in eID systems can be developed and our framework provides a guide to help develop these pathways. The proposed framework below is built not only on RI principles, but also substantiated by the extant eID literature

that highlights current issues with these systems and suggests potential solutions to address them.

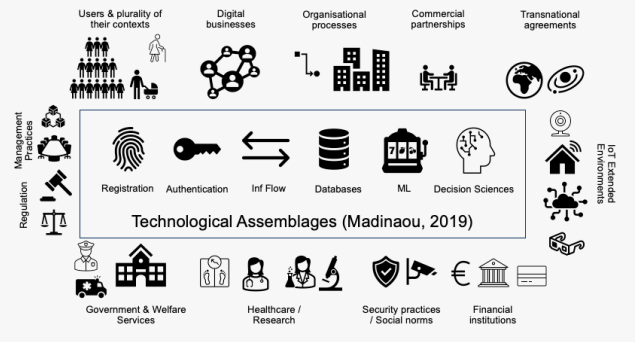


Figure 1: The Digital Identity Ecosystem

5.1 Shared values development (consultation, education, and consent)

End users of eID systems lack an understanding of how and which personal data is collected, processed and transported across divisional and organisational boundaries.

Developing shared values across the digital ID system stakeholder network provides a means to address this information asymmetry and clarify the contract between the individual and an organisation. It aims to develop a common understanding of how a digital ecosystem is expected to work for its stakeholders and dispel myths associated with the use of technologies. Two aspects of shared value development are discussed further: the substantive exploration of priorities and the mechanisms for shared values development.

The substantive exploration of priorities aims to untangle the relevant normative and contextual ethical issues. Normative anchors provide philosophical grounding for co-operation between technology and society in achieving set outcomes. Von Schomberg (2013) provides an example of how "*by anchoring on addressing global grand challenges*", the Lund Declaration provides guidance on key normative issues for the European Union to tackle. For eID systems, and ICTs in general, anchoring on UN Declaration of Human Rights provides a starter for engaging on core issues around privacy, autonomy and security (United Nations, 2015).

Contextual ethical investigation requires an understanding of cultural norms and socio-economic complexities for the region where an eID system is to be deployed. In Indonesia, children of unmarried mothers can face stigmatisation in the process of signing up for ID programmes, creating disincentives in registration (Summer, 2015). Women in Nepal, Iraq, Afghanistan and a number of Middle Eastern states cannot register for identity documents without male presence (Gelb & Metz, 2018). Addressing these issues requires active engagement with the community and civil society to tackle engendered social divides and also create practical solutions that drive adoption. Engagement on the normative and contextual ethical issues upfront allows for programmes to be more specific and gain greater buy-in.

Shared values development on programmes can be done through consultation, education and consent. Consultation forums enable engagement with the public on goals and outcomes of the programme. Ideally, they allow for consumers/ citizens to understand institutional aims and provide feedback that can be incorporated into large scale ID programmes. In large national ID programmes, the need for speed and efficiency can trump local requirements. Ramnath & Assisi (2018) suggest that the ingenuity of Aadhaar lay in its "start-up" culture and rapid speed of development and deployment without being hindered by bureaucracy or participatory design - an ideal not dissimilar from Facebook's (now defunct) disruption motto to "move fast and break things". Since its deployment, Aadhaar has been mired in judicial debate and civil protests as a violation of fundamental rights.

Public consultations can also provide an avenue for education. Baker & Rahman (2020) cite numerous examples of myths that propagate around eID systems in refugee

An RI Framework for eID Systems	Considerations	Description	Underpinning RI Principles	Suggested interventions
	Shared values development	• Participatory forums for clarity on expectations and outcomes from the use of eID technologies • Common grounding of knowledge across stakeholders of eID system capabilities and risks	• Anticipation • Reflexivity	• Development of normative & contextually relevant anchor points • Engagement through public consultation • Defining consent practices that keep end users informed
	Design imperatives	• Incorporating human centric values in the design and deployment of eID systems • Adjusting system practices based on findings from behavioural sciences and cultural norms	• Reflexivity • Inclusion • Responsiveness	• Identification & engagement with direct and indirect stakeholders • Articulation of stakeholder group values • Debate on value tensions and value sensitive design considerations
	Multi-level governance arrangements	• Legal, judicial and soft governance practices to mitigate systemic risks • Coordination of governance practices across industries and geographies	• Anticipation • Responsiveness	• National & transnational agreements • National clearing houses • Coordination across regulatory bodies • Standards & certification services • Value sensitive funding/ grants • Multi-disciplinary design teams • Embedded social science researcher • Training courses • Heuristic tools
	Organisation structure & commercial arrangements	• Analysing corporate structures, partnerships and incentives of partners involved in the design and deployment of the ID system	• Reflexivity	• Partner selection considerations to consider incentive misalignment • Transparency on partner selection process and data sharing agreements

				• Clarity on who benefits and who bears the risks
	Autonomy & ownership of the online self	• Development of policies and procedures that allow individuals ownership rights of their data (including access, modify and delete their own data)	• Reflexivity • Inclusion	• Connecting siloed identity research practices – thinking about the impact on the individual • Enabling user centric business models (data cooperatives, privacy enhancing competitive alternatives)
	Inclusion, exclusion & responsiveness	• Monitoring mechanisms that assess system effectiveness beyond volumetric analysis • Responsiveness to change to address exclusions and other negative outcomes	• Inclusion • Responsiveness	• Ethical impact assessments • Experiential assessments • Exclusion analysis • Planned adaptation in light of new knowledge

Table 2: Responsible Innovation for eID systems

settings: in Ethiopia & Bangladesh iris scans were assumed to be eye check-ups as part of refugee registration, Rohingya refugees in Bangladesh equated their new ID card to a change in their legal status as "officially UNHCR's responsibility" (Baker and Rahman 2020, page 81). Identification programmes may be carried out with limited education on digital rights of marginalised communities or due processes to appeal for change.

Private sector actors may see public consultation as a risk to their business model or to proprietary information. However, it can be a means to gather data on the preferences of targeted consumer groups, and lead to improved design features, the creation of new markets and innovative services centred around user design features (Friedman, 1996).

Meaningful consent methods are seen as a barrier to a seamless experience in the online ecosystem and privacy policies are shrouded in vagueness. Consent may also be missing in national ID programmes where governmental departments assume that citizens showing up for registration implies consent (Baker & Rahman, 2020). Effective consent management strategies require eID system providers to provide transparency on data processing practices not just at initial registration to a service, but also as personal data is processed across services and moved across organisational boundaries, throughout the lifecycle of this interaction (Flick, 2016; Gainotti et al., 2016). Responsible design choices such as a "default opt-out" can help reduce unapproved data sharing practices. As mentioned in section 3.2, information asymmetry and framing effects need to be accounted for to ensure consent is effective. Data co-operatives, data commons and data trusts provide a collective means for organisation and handling consent in the face of informational asymmetry (Dutta, 2020; Ruhaak, 2019, 2020). Rather than dwell on a "one-size-fits-all" approach, consent mechanisms require a contextual understanding of the eID ecosystem, and the stakeholders involved.

eID systems are constantly evolving, either in functionality, partnerships, technology or user base, and shared values development practices should be applied on a recurring basis. The nature of intervention may depend on the changes in the system (expansion of services) or changes in the demographics of the user base. Shared values development builds trust between organisations and individuals with differing interests and incentives. Through substantive exploration, complex ethical issues can be identified early and discussed collaboratively. However, trust can also be eroded if the exploration or engagement are merely marketing gimmicks or check-box exercises (Corbett & Le Dantec, 2018; Sykes & Macnaughten, 2013).

5.2 Design imperatives (privacy, autonomy, trust, security, local norms)

Technology design shapes interactions between individuals and organisations. Moral considerations should be articulated early in design (van den Hoven, 2013). Shared value development elicits stakeholder considerations that are important for the design, development, and operations of digital ID systems.

Current practices prioritise speed and standardisation, rather than a deliberative assessment of design principles that fit user needs. Refugee ID programmes have generally followed a standard process for identification that includes full biometric verification along with photographs. In countries where photographing women without face coverings is not permitted by social mores, this can cause unrest and discomfort (Baker & Rahman, 2020). Digital platforms, through their architecture, can perpetuate existing social biases – such as political divisions and racial and gender based inequalities (Boyd, 2011). Biases of designers / network architects spill over into the design of technology solutions, where the participating population is more diverse. Not catering to diverse user needs can lead to

exclusions which have negative socio-economic consequences for the user and the provider.

Value sensitive design (VSD) incorporates ethical values into the design process of ID based systems (Friedman, 1996; van den Hoven, 2013; Winkler & Spiekermann, 2018). VSD provides a framework to identify direct and indirect stakeholders, understand their needs and develop technical implementations that address and uphold stakeholder values. Contact tracing application have shown how technical designs are heavily influenced by who is involved in the design process and how stakeholders exert their values on technical design decisions (Edwards, 2020; Veale, 2020). VSD methods can bring forth value tensions, an important aspect to consider in large scale digital ID programmes. Privacy of an individual, for instance, may be at odds with national security or health monitoring requirements. While not all value tensions result in technical trade-offs, bringing them forward in debate allows for the development of broader socio-technical solutions to address risks and divergent stakeholder requirements.

Design considerations also require a holistic understanding of how different stakeholders will engage with the system. Technical design choices may require unique social processes to complement them. The choice of biometrics enrolment alone in Aadhaar aims to address duplication risks but excludes manual labourers and older people (A. F. Rashid et al., 2013). Similarly, expediting technology deployment, such as contact tracing applications, to entire populations, ignores the exclusionary effect it can have on marginalised, poor or digitally untrained populations (Daly, 2020; Edwards, 2020).

Local norms and entrenched cultural practices need to be understood and factored into ID system design. Married women in developing countries may be discouraged from enrolling into ID programmes on the basis that it might lead to greater financial independence and an increase in divorce rates (Gelb & Metz, 2018). Cultural norms can't be tackled by technical solutions alone but require intersectional solutions and multi-disciplinary thinking. A commitment to review and adapt designed solutions based on new information is imperative to ensure the right outcomes are achieved. In India, Rajasthan's "Bhamashah Yojana" aimed to address women's exclusion from government programmes by mandating that all financial aid be sent to the bank account of the woman of the household. While this increased women's Aadhaar and bank account enrolment, it failed to account for their lack of literacy and social independence. Only 18% of women conducted financial transactions, with the men of the household conducting financial transactions in the women's name (CGD, 2017).

5.3 Multi-level governance practices

Digital identification happens in various forms: through dedicated programmes, through devices and platforms, through data sharing agreements and through data aggregation. Existing business models evolve through acquisition (such as Facebook and Instagram) and integration (across siloed national ID programmes). Personal data may be used across contexts (eg: photographs in national ID programmes being run against facial recognition technologies). New methods for identification continue to be developed such as voice recognition, ear recognition, multi-modal identification methods etc (Anwar et al., 2015; Frischholz & Dieckmann, 2000; Gandy Jr., 2011; Madianou, 2019; R. A. Rashid et al., 2008). Interventions in addition to regulation are required to address the multitude of aforementioned changes.

Hellström (2003) suggests a national level clearing house for the development of emerging technologies that brings together various stakeholders to define a future course of action for a technology. This allows for reflection and assessment of different digital identification methods. In 2017, the European Parliament endorsed the establishment of a digital clearing house to aid greater collaboration between national regulatory bodies – a welcome step in

developing interdisciplinary and multi-national alignment across regulatory regimes. Ethical impact assessments and privacy audits provide tools to assess the risks associated with ID technologies usage in different sectors. A national certification process for privacy assessments aligned to global standards (such as ISO 27701 & 27001, IEEE P7002) may enable private sector capacity development, reducing the burden of regulatory implementation and monitoring on government entities.

At national and international levels, governments can direct research and innovation in societally beneficial areas through the development of policy, alignment to normative development goals, allocation of funding, and enabling deliberation from researchers and entrepreneurs on societal outcomes of their research (Fisher & Rip, 2013; Von Schomberg, 2013). In the EU and through UK Research Councils, researchers are asked to consider the societal impact of their research in order to gain funding (Fisher & Rip, 2013).

At an organisational level, interventions that force deliberation and reflexivity can be introduced. Designers with technical backgrounds (or technology corporations) may default to technological solutions when trying to address socio-economic problems (Johri & Nair, 2011). Micro-level interventions such as training courses, dedicated social science researchers per project team and interdisciplinary approaches to problem development can help reduce a techno-deterministic bias in solution design. Additionally the use of heuristic tools and practices may reduce the influence of designer biases (Umbrello, 2018). Introducing social sciences and ethics-based training to engineering & design college curriculums also help future designers think about complex issues through diverse perspectives.

5.4 Organisational structure and commercial arrangements

In the context of eID ecosystems, transparency on technologies deployed, commercial arrangements, organisational structures and incentives can build trust in the system. These aspects are often overlooked or trumped by economic considerations.

Nigeria's digital ID programme was launched in 2014 with a plan to integrate multiple siloed identification databases across the government. The government partnered with Mastercard and Cryptovision in an effort to integrate identification with payments (Paul, 2020). While the overall project has faced delays, the partnership with Mastercard has raised concerns on the commercialisation of sensitive personal data (Baker & Rahman, 2020). Existing low trust in government is exacerbated by partnership with a commercial entity and limited transparency on the details of their partnership (Hosein & Nyst, 2013).

As experienced globally in COVID-19 response strategies, public sector programmes can rely on the private sector to deliver services, without transparency on partner selection processes or arrangements on data sharing (Daly, 2020). High value technology purchases may be made on a limited assessment of the ability of a government agency to implement the technology. It can lead to issues of vendor lock-in to maintain complex and unnecessary infrastructure (Gelb & Metz, 2018).

Inter and intra departmental data sharing arrangements also need to be made transparent. Aadhaar data is used across several state and central government programmes. There have been multiple instances of sensitive personal data being leaked on partnering government websites (Business Standard, 2018; Financial Express, 2018; Saini, 2018; Sethi, 2017).

Understanding and controlling for private sector incentives can be complex. Of the 2.9 billion Facebook users only 190 million live in the USA, while approximately 80% of its shareholders are based in the USA (CNN, 2020; Statista,

2020). Over 50% of its revenues come from advertising spend outside the USA (Johnston, 2020). Maximising American shareholder returns is implicitly linked with the need for advertising growth in foreign countries, coming at the cost of a potential loss of privacy for individuals in countries without necessary legal protections. Additionally, revenues made from these countries are repatriated without tangible benefits to their societies.

23andMe is a private company headquartered in the USA, offering mass genetic testing kits. In January 2020, it raised $300 million by partnering with GlaxoSmithKline in a data sharing agreement to build new drugs. 23andMe collects genetic data from the use of their $69 test kits and digital data from their user's online activity. Their terms of service require users to acknowledge that, by consenting to using 23andMe services, they will not be compensated for any of their data (23andMe, 2020). 23andMe's business model is built on data aggregation, analysis and sharing while its marketing campaign focusses on health benefits of knowing your genetic make-up. The scientific evidence on improving health outcomes based on DNA matching is ambiguous at best (Stanton et al., 2017). 23andMe claims that the data they share is aggregated and anonymised and that the creation of their database provides a means to improve societal health outcomes. Even by removing identifying attributes, individuals can quite easily be re-identified using genetic data (Segert, 2018). As 23andMe is a paid service, it invariably excludes those unable to participate due to financial constraints. 23andMe is open to sharing data with private enterprises while explicitly refusing to share data with public databases or law enforcement.

Data sharing is made possible through the use of APIs. APIs act as the nuts and bolts of data sharing enabling the commercial agreements between organisations. By default, APIs on Facebook allow access to a user's basic ID data (name, location, gender) and then a choice of over 70 data fields that help describe a user (for eg: check-ins, relationship status, events, friend's interests, video uploads) (Pridmore, 2016). After an initial approval by the user this API remains open indefinitely and tracks changes to a user profile or digital identity across platforms. An individual's relationship with an application is no longer limited to a one-off usage but is maintained, knowingly or unknowingly, until such time that they use the social media site.

5.5 Autonomy and ownership of the online self

eIDs are associated with a digital data corpus, built between data exchanges by users and digital systems; and the projected self, built through expressions and interactions mediated through social networking platforms (Feher, 2019). Problems relating to the digital data corpus are usually viewed as having engineering solutions, for example, how to identify & authenticate someone, what system architecture to deploy, how to keep this data secure etc. The projected self is a sociological study of how individuals create and attempt to manage their identities and reputations online. Both aspects are inter-related but are discussed in their own scholastic silos. Understanding both aspects of digital identities is important to ensure maintenance of an individual's data rights.

All data goes through a lifecycle of creation, maintenance, storage and archival or deletion. EU GDPR provides a mandate on individual's rights to their data including the right to access, modify, port and delete data from online platforms. The right to be forgotten, of an EU citizen, only manifests itself in the EU, as GDPR is territorially limited. If the same person were to search for their information while living outside the EU or by VPN to a non-EU server, they would be able to find previously "forgotten" information (Kelion, 2019). We are never truly forgotten in the digital world.

Platforms and digital services may claim that they don't own users' personal data, yet their practices and policies can be unclear. The largest platforms – Google & Facebook – make

the lion's share of their revenue from contextual and remarketing based advertising that uses its users' personal data to build targeted advertisements (Esteve, 2017). There are early signs of legislative developments at a state level in the USA, as California passed the California Consumer Privacy Act in January 2020 with better privacy controls for users. Laws for data portability and ownership are also being drafted at the national level (Eggerton, 2020; Mui, 2019).

New models of data ownership and digital services are being developed that challenge transnational platform power paradigms. Barcelona's technological sovereignty movement moves away from the depoliticization and technocratic rhetoric of smart cities that are driven by global multi-nationals and towards business models that are transparent, democratic and owned and run by the community (Lynch, 2020). Data cooperatives offer an avenue to develop business models that exploit personal data responsibly. MIDATA is a data cooperative that pools personal healthcare data for common good and decide what data is used and for what purpose. Data cooperatives offer an opportunity for excluded minority communities to pool resources and benefit from medical research from the use of their data (Blasimme et al., 2018).

Identity management on digital media has been compared to Erving Goffman's definition of stage performance for impression management online (Ravenlle, 2017; Trottier, 2014). The management of identities however isn't always controlled as social connections can tag content that negatively affects this image. The recordable nature of digital data entrenches this issue, since untagging or deleting inflammatory posts doesn't eliminate the data from the platform. In fact, users perceive that impression and identity management online is only 70% controlled by the individual (Feher, 2019). Alternate social media platforms provide some capabilities to address these issues. MeWe, positioned as an alternative to Facebook, has a privacy by design model and. Its privacy bill of rights states that the individual, not the platform, owns their data. Users have control of their own newsfeed and profile and user permissions are required prior to any posts on a user's timeline. The platform claims to not track or monetise user content and only partners with third parties that are aligned with its own privacy imperatives (MeWe, 2019). The platform has over 6 million users and a rapid adoption rate, using privacy features as a competitive advantage. Signal and Telegram messenger services have seen similar surges in usage as preferred privacy enhancing alternatives to WhatsApp (Kharpal, 2021).

5.6 Inclusion, exclusion, and responsiveness to change

The ever-increasing infrastructure of eIDs can have exclusionary effects. Manual workers tend to fail fingerprint scanning technologies significantly more than normal (Gelb & Metz, 2018; A. F. Rashid et al., 2013). Inaccessible government ID registration centres exclude the poor who may not be able to afford a trip to the centre or exclude women who aren't able to travel to such centres without a male partner (Baker & Rahman, 2020; Gelb & Metz, 2018). Lagging infrastructure investments may mean that vulnerable populations in remote villages do not get food rations due to an unreliable telecommunications signal (Drèze et al., 2017). Older or less digitally savvy consumers may also be excluded from critical business services if delivered solely through digital mediums.

RI provides a framework to think about who benefits from eID systems and who gets excluded and how exclusions can be addressed (Owen et al., 2013; Stilgoe, 2013). eID technologies require a means to monitor how they are impacting society and adapting to reduce harms. Programme impact assessments need to go beyond usual volume metrics of coverage and also consider ethical, experiential and exclusionary dimensions.

Ethical assessments should understand how target populations perceive the use of eID systems, if people

understand their rights and how their identities are mediated. Experiential assessments should focus on understanding how users of ID systems affect human agency. Exclusions based assessments should monitor the participation levels of different population segments. For government programmes – are those most in need being served and if not, why not? Are alternate channels for engagement addressing exclusions? For private sector actors – are they missing out on segments of population that don't understand their technology? For example, are older people unable to participate in online purchasing? Are there mechanisms to help them participate safely?

Understanding the ethical, experiential and exclusionary aspects helps ID systems adapt to current and future needs. It is an iterative process of development by the system provider rather than the current norm where all users have to conform to a standard process. This requires ID system providers to have a commitment to generate, evaluate and act on new information and respond to its stakeholders needs (Brass & Sowell, 2020; Petersen & Bloemen, 2015).

6 Conclusion

eID systems offer an opportunity for significant socio-economic gains through the development of targeted services to meet people's needs. Currently eID development and management gives primacy to engineering practices, even though they are part of complex socio-technical systems. Extant literature highlights that current eID system governance practices are siloed, and rarely aligned across the ecosystem, as they focus on risk management practices limited to addressing known and localised risks without much regard for the networked nature of digital ecosystems. The proliferation of eID systems across sectors and their importance in digitally enabled economies requires a more forward-looking approach that balances uncertainty and innovation. RI provides an analytical framework to build innovation with care and responsiveness to its stakeholders, supporting the current and future governance of eID systems. The proposed framework in this paper acknowledges the networked nature of digital business models and seeks to improve socio-economic outcomes for all stakeholders through greater deliberation and democratic engagement while governing eID systems.

There is a growing body of knowledge addressing specific issues associated with digital business models, such as privacy enhancing technologies (PETs) to address surveillance risks, self-sovereign identity models to redress the locus of information ownership and improving data lifecycle management practices. In contrast, this paper provides a broader principles-driven approach to eID systems governance. The proposed framework aims to be modular and complementary to the issue-specific literature and existing governance methods for eID systems. The proposed framework can be used as an analytical tool to assess existing practices and identify gaps and areas for improvement. While all the principles in our framework may not be relevant to every digital entity or circumstance, it provides practices that can be considered across a variety of contexts.

Future studies can expand on the application of the proposed framework for eID systems in real world settings, in particular highlighting outcomes on trust and socio-economic benefits achieved through greater stakeholder engagement in governance of eID systems, while considering the power relations and incentives of stakeholders.

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