

Leveraging Data Technology to Address Inequality: A Daoist Framework and Evidence from Four National Cases

Benyasiri Ngamsaad¹

*¹ Pathumthani University, Thailand

Email: m.ngamsaad@gmail.com

Abstract: Digital governance frameworks remain grounded almost exclusively in Western administrative traditions. This article develops and applies an analytical framework derived from classical Daoist philosophy to examine how governments can leverage data and digital technology to reduce social inequality without reproducing new forms of exclusion.

Five Daoist principles - *wu wei* (non-coercive action), *ziran* (self-so naturalness), *pu* (simplicity), *jian* (frugality), and the Zhuangzian caution against *jixin* (the “machine heart”) - are operationalized into five dimensions of digital governance design, each with a testable proposition. Using diverse-case selection logic, the framework is applied to four national initiatives - Estonia’s X-Road, India’s Aadhaar, South Korea’s open government data ecosystem, and Thailand’s Pao Tang platform - through document analysis of peer-reviewed studies, official evaluations, and international organization reports published between 2011 and 2024. In total, 87 documents were retained and coded (19 for Estonia, 28 for India, 17 for South Korea, and 23 for Thailand), with design-side indicators specified *ex ante* and coded separately from outcome evidence.

Initiatives advance equity to the degree that they embody minimal-friction interaction (*wu wei*), context-sensitive human-centered design (*ziran*), architectural simplicity and interoperability (*pu*), frugal and inclusive deployment (*jian*), and institutionalized safeguards against surveillance and algorithmic exclusion (*jixin*). Deviations on any dimension - most visibly Aadhaar’s early *jixin* safeguard deficit and the incomplete *ziran* accommodation of elderly and offline populations in Estonia and Thailand - systematically generate the distributional failures each initiative was designed to prevent.

The article offers one of the first systematic operationalizations of Daoist political philosophy for digital governance research, extending scholarship on non-Western public administration and yielding five testable propositions and design principles for equity-oriented digital government.

Keywords: digital governance; social inequality; Daoism; digital divide; ICT for development; comparative political theory

1. Introduction

Digital transformation has become the organizing ambition of public administration in the twenty-first century. Governments across income levels now deploy big data analytics, artificial intelligence, digital identity systems, and mobile service platforms in the expectation that these technologies will make public services more efficient, more transparent, and more equitable (OECD, 2020; United Nations, 2022). Yet a growing body of evidence indicates that digitalization is distributionally ambivalent: the same systems that extend services to previously unreached populations can simultaneously construct new barriers for those who lack connectivity, devices, skills, or legible digital identities (van Dijk, 2020; Eubanks, 2018; Helsper, 2021). The COVID-19 pandemic rendered this ambivalence acute, as digital channels became the default - and sometimes the only - gateway to income support, education, and health services, amplifying the consequences of digital exclusion for already vulnerable groups (Beaunoyer et al., 2020). Nor did this dependence recede with the pandemic: in its aftermath, many governments consolidated emergency digital channels into permanent “digital by default” service models, making the distributional stakes of digital design durable rather than episodic (United Nations, 2022).

The problem, this article argues, is only partly technical. It is also conceptual. The dominant normative vocabularies through which digital government is designed and evaluated - New Public Management efficiency, open government transparency, human-rights-based approaches - are products of Western administrative and philosophical traditions (Drechsler, 2013). This is not a defect in itself, but it narrows the design imagination. Scholars of comparative public administration have called for a more serious engagement with non-Western governance paradigms, not as exotic supplements but as coherent intellectual systems capable of generating distinct diagnostic questions and design principles (Drechsler, 2013). A parallel movement in the philosophy of technology has begun to ask what Confucian and Daoist ethics imply for the design and regulation of technological systems (Wong, 2012; Nelson, 2009; Miller, 2017). This article stands at the intersection of these two conversations.

Classical Daoism is a particularly promising and particularly neglected resource for digital governance research. Unlike traditions whose political thought centers on institutional architecture, Daoist political philosophy centers on the *quality of intervention itself*: when to act and when to refrain, how to achieve order without coercion, and how to ensure that systems serve rather than deform the people they govern (Moeller, 2006; Slingerland, 2003). The two are cited jointly here but represent distinct interpretive schools: Slingerland (2003) reads *wu wei* as a psychological ideal of effortless, skilled action, whereas Moeller (2006) reads the *Daode jing* as a largely amoral theory of political efficacy; the framework below draws on both and notes where the difference matters for operationalization. The *Daode jing* articulates an ideal of governance so unobtrusive that “the people all say, ‘We did it ourselves’” (ch. 17; Ames & Hall, 2003), while the *Zhuangzi* offers one of the oldest sustained meditations in world literature on the moral hazards of labor-saving technology (Zhuangzi, trans. 2013, ch. 12, pp. 91–93). These are not antiquarian curiosities. They speak directly to the central dilemmas of contemporary digital government: proportionate regulation, human-centered design, surveillance risk, and the danger that optimizing systems reshape citizens to fit the machine rather than the reverse.

Existing scholarship has not yet converted this potential into a usable analytical instrument. Prior invocations of Daoism in technology and policy discussions have tended to remain at the level of evocative analogy - technology should “flow like water” - without specifying dimensions, indicators, or falsifiable expectations. This article addresses that gap. Its contribution is twofold. First, it operationalizes five Daoist principles into five dimensions of digital governance design, each accompanied by a testable proposition (Section 3). Second, it applies the framework empirically through a structured comparative analysis of four national initiatives selected for maximal diversity - Estonia’s X-Road interoperability platform, India’s Aadhaar digital identity system, South Korea’s open government data ecosystem, and Thailand’s Pao Tang welfare-delivery application (Sections 4–5). The guiding research questions are:

RQ1. How can classical Daoist principles be operationalized as an analytical framework for evaluating digital governance initiatives aimed at reducing social inequality?

RQ2. To what extent do national digital governance initiatives align with or deviate from these principles, and with what distributional consequences?

The remainder of the article proceeds as follows. Section 2 reviews two bodies of literature: research on digital governance and inequality, and scholarship on non-Western - specifically Daoist - approaches to governance and technology. Section 3 develops the conceptual framework and propositions. Section 4 describes the comparative case methodology. Section 5 presents the case analyses. Section 6 discusses cross-case findings, design principles, and theoretical implications, and Section 7 concludes.

2. Literature Review

2.1 Digital governance and social inequality

Inequality is a multidimensional phenomenon encompassing disparities of income and wealth (Stiglitz, 2012), education (UNESCO, 2021), health (World Health Organization, 2018), and - increasingly consequential - digital access and capability (van Dijk, 2020). The World Bank (2020a) documents that high inequality is associated with fragile growth and social vulnerability, the OECD (2015) links it to diminished well-being and growth potential, and Sustainable Development Goal 10 places inequality reduction within and among countries at the center of the global development agenda (United Nations, 2015). What distinguishes the current conjuncture is that digital systems have become both an *instrument* for addressing inequality and an independent *axis* along which inequality is produced.

On the instrumental side, the information-and-communication-technology-for-development (ICT4D) literature identifies three recurring technological capacities (Heeks, 2018). First, integrated administrative data and big data analytics allow governments to identify vulnerable groups and geographic pockets of

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deprivation with unprecedented precision, supporting better-targeted social protection (World Bank, 2021; OECD, 2019b; Janssen et al., 2017), with artificial intelligence increasingly deployed for poverty prediction and risk analysis (OECD, 2019c). Second, open government data reduces informational asymmetries between state, market, and citizen, though its realized benefits depend on intermediary capacity and are unevenly distributed (Janssen et al., 2012; OECD, 2019a). Third, digital service platforms, GovTech innovation, and mobile applications lower the time, travel, and transaction costs of accessing public services (Mergel et al., 2019; World Bank, 2020b), a gain that is proportionally largest for remote and low-income populations when - and only when - those populations are connected (Althunibat et al., 2011; ITU, 2021; United Nations, 2022).

On the axis-of-inequality side, digital-divide research has progressed through three analytic generations: divides of physical access, divides of skill and usage, and divides in the *outcomes* that users are able to extract from technology (van Dijk, 2020; Ragnedda, 2017; Helsper, 2021). This third-level perspective is crucial for public administration because it implies that formally universal digital services can remain substantively regressive: identical portals yield unequal benefits to users with unequal digital, economic, and social capital. A darker strand of scholarship goes further, documenting how automated eligibility systems and data-driven targeting can actively harm the poor through opaque exclusion, error-prone matching, and punitive surveillance (Eubanks, 2018; Masiero & Das, 2019), and how the commercial logic of data extraction reshapes the citizen-state relationship itself (Zuboff, 2019). The policy literature has responded with prescriptions for digital equity - infrastructure investment, digital literacy, data protection, and participatory, open-by-default design (OECD, 2020; ITU, 2021; Open Government Partnership, 2021) - but these prescriptions are largely enumerative: lists of desiderata without an integrative account of *why* digital systems drift toward exclusion and what disposition of governance counteracts that drift.

2.2 Non-Western paradigms and Daoist resources for governance and technology

Comparative public administration has long recognized that the discipline's canonical frameworks universalize a historically specific Western experience. Drechsler (2013) identifies Chinese and Islamic administrative traditions as coherent alternative paradigms with millennia of accumulated statecraft, arguing that their marginalization impoverishes the field's problem-solving repertoire. Within the Chinese tradition, scholarly attention has concentrated on Confucianism, whose meritocratic bureaucracy and relational ethics map readily onto administrative concerns (Wong, 2012). Daoism has received far less attention from governance scholars - a neglect that is historically ironic, since the Huang-Lao current of Daoist thought served as the *de facto* governing philosophy of the early Han dynasty, and the *Daode jing* itself is substantially a manual of rulership (Moeller, 2006; Kohn, 2001).

Because the framework extracts concepts from classical texts and redeploys them in a contemporary administrative register, its method requires explicit defense as an exercise in cross-cultural conceptual translation. Comparative political theory has warned against the "one-way mirror" in which non-Western texts are interrogated with Western questions while their own problem-agendas remain invisible (Jenco, 2007), and against treating cross-traditional study as monologue rather than dialogue (Dallmayr, 2004; March, 2009). Three commitments respond to these warnings. First, the framework is built from questions the Daoist corpus itself poses - when to intervene, how to avoid deforming what is governed, and what technology does to its users - rather than from a Western checklist seeking Chinese decoration. Second, conceptual asymmetry is acknowledged rather than erased: the five terms are not mapped onto supposed Western equivalents but operationalized directly, with their semantic range stated and contested renderings flagged (Section 3). Third, the appropriation is admitted to be purposive - a calculative use of texts that problematize calculation - and this reflexive tension is treated as a substantive finding about the limits of any operationalization (Section 6.3), not as an inoculating aside.

Four clusters of Daoist concepts bear directly on digital governance. The first is *wu wei* (無為), conventionally rendered "non-action" but more accurately understood as non-coercive, non-forcing, effortlessly appropriate action - intervention that works with the grain of situations rather than against it (Slingerland, 2003; Lai, 2007). Applied to rulership, *wu wei* prescribes minimal, well-timed, proportionate intervention: "Governing a large state is like cooking a small fish" (*Daode jing*, ch. 60; Ames & Hall, 2003) - excessive handling ruins it. The second is *ziran* (自然), the "self-so" spontaneity of things developing according to their own natures; the sage-ruler's task is to protect the conditions under which the ten thousand things can flourish *as what they are*, rather than standardizing them to administrative convenience (Lai, 2007; Moeller, 2006). The third cluster comprises the aesthetic-ethical virtues of *pu* (樸, the "uncarved block," simplicity prior to artificial elaboration) and *jian* (儉, frugality), which Chapter 67 of the *Daode jing* names

among the ruler's "three treasures" - a normative preference for parsimonious, unornamented systems over complex and extractive ones (Ames & Hall, 2003; Schipper, 1993).

The fourth resource is critical rather than constructive, and it is the one most conspicuously absent from prior optimistic invocations of Daoism in technology discourse. In Chapter 12 of the *Zhuangzi*, Zigong encounters a gardener laboriously watering his fields by hand and recommends a well-sweep that would multiply his output. The gardener refuses: "Where there are machines, there are bound to be machine worries; where there are machine worries, there are bound to be machine hearts (*jixin*, 機心). I would be ashamed to use it" (Zhuangzi, trans. 2013). The parable is not a blanket rejection of technology but a warning that tools restructure the inner life and social relations of their users - that efficiency gains carry a hidden price in calculation, dependency, and the erosion of trust (Nelson, 2009; Miller, 2017). Any Daoist framework for digital governance that omits this self-critical dimension is philosophically incomplete and analytically toothless.

An honest reconstruction must also confront the "dark" reading of Daoist statecraft. Chapter 3 of the *Daode jing* counsels the sage to empty the people's minds and fill their bellies, and chapter 65 praises governing a people kept unknowing; read literally, such passages have historically underwritten obscurantist and manipulative interpretations of Daoist rule, most consequentially in the Legalist appropriation of the text through Han Feizi's commentaries (Han Feizi, trans. 2003; Moeller, 2006). The framework developed here does not deny these readings; it takes a position against them on two grounds. Textually, chapters 3 and 65 are read, with much modern scholarship, as polemics against elite manufacture of desire and rule by calculative cleverness rather than as endorsements of keeping subjects ignorant (Moeller, 2006; Ames & Hall, 2003). Functionally, the fifth dimension developed below builds the anti-manipulative commitment into the framework itself: a state that used data systems to render citizens maximally legible to power while keeping the system illegible to citizens would score as a paradigmatic *jixin* deficit, not as Daoist governance. The dark reading is thus treated as a standing risk internal to the tradition - one the framework is designed to detect, not to reproduce.

Two clarifications guard the framework's textual integrity. First, the ideal of *datong* (大同, "Great Unity"), sometimes loosely attached to Daoism in popular writing, originates in the "Liyun" chapter of the Confucian *Book of Rites (Liji)* and is therefore excluded from the framework developed here, although it remains a shared horizon of Chinese political imagination. Second, the *Daode jing*'s opening line - "The name that can be named is not the constant name" (ch. 1; Ames & Hall, 2003) - is read here not as a theory of correct naming but as a counsel of *epistemic humility about categories*: all classifications, including administrative and algorithmic ones, are provisional constructs that never exhaust the reality they sort. This reading, as Section 3 shows, has direct implications for how governments should treat the data categories through which citizens become visible to the state.

2.3 The gap

Juxtaposing the two literatures exposes a specific lacuna. Digital-governance research possesses rich empirical knowledge of how digitalization produces both inclusion and exclusion, but lacks an integrative normative account of the *disposition* of governance that sustains equity. Daoist philosophy offers precisely such an account - a two-and-a-half-millennia-old theory of non-coercive, nature-respecting, self-limiting intervention - but has never been operationalized into researchable dimensions and applied systematically to digital government. This article performs that operationalization and application.

The contribution can also be located precisely against the instruments practitioners already use. The OECD Digital Government Policy Framework specifies six dimensions of digital-government maturity (OECD, 2020); the United Nations e-government survey tracks inclusion through e-participation and leave-no-one-behind indicators (United Nations, 2022); the digital-by-default versus digital-first debate concerns channel strategy; and the design-justice movement centers affected communities in design processes (Costanza-Chock, 2020). Each captures part of the equity problem; none supplies an integrative account of the governance disposition from which exclusion arises. Table 1 states, dimension by dimension, what the framework developed below adds relative to these instruments.

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Table 1. What each Daoist dimension adds relative to existing digital-equity instruments

Daoist dimension	Nearest existing instrument	What the dimension adds
<i>Wu wei</i> (minimal friction)	OECD digital-by-design; once-only initiatives (OECD, 2020)	A normative test of intervention quality: friction and channel coercion are treated as regressive burdens, not implementation details
<i>Ziran</i> (context-sensitive design)	UN leave-no-one-behind inclusion indicators (United Nations, 2022); design justice (Costanza-Chock, 2020)	A design-presumption test: systems are scored on whether they presume a default citizen, prior to and separately from observed outcomes
<i>Pu</i> (simplicity, interoperability)	Interoperability and once-only frameworks	Simplicity as an equity property: complexity is coded as a coordination cost falling hardest on the least-resourced
<i>Jian</i> (frugal, inclusive deployment)	Affordability and mobile-first guidance (ITU, 2021)	Cost-and-channel calibration to the endowments of the poorest intended user, not the median user
<i>Jixin</i> (institutionalized self-restraint)	Data-protection compliance checklists	Self-restraint as constitutive statecraft: safeguards belong to the definition of good governance, not to an external legal constraint

3. Conceptual Framework: Five Daoist Dimensions of Equity-Oriented Digital Governance

This section translates the Daoist resources reviewed above into an analytical framework of five dimensions. Each dimension is defined, grounded in its textual source, operationalized through observable design features, and expressed as a testable proposition linking the dimension to distributional outcomes. Figure 1 summarizes the framework.

Two textual-methodological notes precede the dimensions. First, translation policy: quotations from the *Daode jing* follow Ames and Hall (2003) and quotations from the *Zhuangzi* follow Watson's translation (Zhuangzi, trans. 2013), with Chinese characters supplied at each term's first use in Section 2.2. Ames and Hall's process-philosophical rendering is deliberately chosen and admittedly contested; where major translations diverge in ways material to the operationalization, the divergence is noted. The clearest case is *ziran* 自然: rendered "naturalness," it suggests deference to a pre-given order, whereas rendered "self-so" or "spontaneity" it directs attention to the conditions under which persons develop according to their own capacities. The operationalization below adopts the "self-so" reading, which grounds the design requirement of accommodating heterogeneous users rather than presuming a natural default citizen; *wu wei* 無為 is likewise operationalized in Slingerland's (2003) sense of unforced, well-fitted action rather than literal inaction.

Second, textual provenance: four of the dimensions (D1–D4) derive from established terms of art in the *Daode jing*, whereas the fifth derives from the *Zhuangzi*. The framework is therefore a synthetic construction spanning two classical corpora with distinct philosophical projects; the synthesis is flagged as such and defended at Section 3.5. The Huang-Lao current - the historical juncture at which Daoist ideas were actually joined to administrative practice as the governing philosophy of the early Han - supplies precedent for exactly this constructive use: Huang-Lao statecraft combined *wu wei* rulership with codified institutional technique, showing that the tradition itself has treated Laozian and Zhuangzian materials as combinable resources for institutional design rather than as sealed corpora (Kohn, 2001).

3.1 Dimension 1 - Wu wei: adaptive, minimal-friction intervention

Definition. Governance intervention that is proportionate, well-timed, and works through existing social flows rather than superimposing new coercive procedures (Slingerland, 2003).

Operationalization. Observable features include: automatic or "invisible" service delivery that requires no application where entitlement can be established from existing data; the once-only principle, under which citizens never re-submit information the state already holds; proportionate rather than maximal regulation; and rapid scaling and graceful withdrawal of crisis measures.

The negative pole is bureaucratic friction migrated online - digital forms that replicate paper burdens - and coercive mandates that force digital channels on populations unready for them.

Proposition 1 (P1). Digital governance initiatives that minimize citizen-side friction and avoid coercive channel mandates achieve more equitable service uptake than initiatives that digitize existing burdens or compel digital-only access.

3.2 Dimension 2 - Ziran: human-centered, context-sensitive design

Definition. Design that accommodates the “self-so” diversity of citizens’ capacities, circumstances, and life-worlds, rather than standardizing users to fit the system (Lai, 2007).

Operationalization. Observable features include: multi-channel access preserving offline and assisted alternatives; interface design accommodating low literacy, disability, age, and linguistic diversity; local intermediation for populations with limited digital capital; and participatory design with affected communities. The negative pole is one-size-fits-all deployment that presumes a connected, literate, working-age smartphone user as the default citizen.

Proposition 2 (P2). Initiatives that preserve non-digital and assisted channels and adapt design to heterogeneous user capacities produce smaller inclusion gaps for elderly, rural, low-income, and disabled populations than digital-first or digital-only designs.

3.3 Dimension 3 - Pu: architectural simplicity and interoperability

Definition. Preference for simple, transparent, interoperable system architecture - the institutional analogue of the uncarved block - over complex, fragmented, or ornamental structures (Ames & Hall, 2003).

Operationalization. Observable features include: shared data-exchange layers and interoperability standards that eliminate duplicated silos; the reuse of common components across agencies; comprehensible service logic that citizens and oversight bodies can understand; and open standards enabling scrutiny. The negative pole is accretion of incompatible systems, vendor lock-in, and complexity that conceals accountability.

Proposition 3 (P3). Interoperable, architecturally simple systems reduce access disparities more effectively than fragmented architectures, because integration lowers the coordination costs that fall disproportionately on the least-resourced citizens.

3.4 Dimension 4 - Jian: frugality and inclusive resource deployment

Definition. Economical use of public and citizen resources, directing capacity toward deficiency rather than concentrating advantage. This echoes the observation that “the way of tian (heaven) is to take from what has excess and supplement what is deficient” (*Daode jing*, ch. 77; Ames & Hall, 2003).

Operationalization. Observable features include: low-cost or free citizen-side access; technology choices matched to prevailing device and connectivity realities (e.g., mobile-first design in mobile-majority societies); prioritized infrastructure investment in underserved areas; and lean, reusable public technology rather than prestige procurement. The negative pole is high citizen-side costs, device-intensive requirements, and investment concentrated where connectivity is already dense.

Proposition 4 (P4). Initiatives whose cost and technology profiles match the resource endowments of the poorest intended users achieve higher coverage among those users than initiatives calibrated to median or affluent users.

3.5 Dimension 5 - Jixin: institutionalized technological self-restraint

Definition. Reflexive safeguards against the “machine heart” - the tendency of data systems to convert citizens into objects of calculation, expand surveillance, entrench dependency on fallible automation, and erode trust (Zhuangzi, trans. 2013; Nelson, 2009).

Operationalization. Observable features include: enforceable data protection and purpose limitation; independent oversight and judicial review; human-review and manual-override pathways for automated decisions affecting entitlements; fallback procedures when biometric or algorithmic verification fails; and transparency about data flows. The negative pole is function creep, mandatory linkage of a single identifier across unrelated domains, absence of redress for algorithmic error, and surveillance-intensive design. This dimension is deliberately critical: it treats every gain in state capacity as simultaneously a gain in the capacity to harm, and asks what binds that capacity.

Proposition 5 (P5). Initiatives lacking institutionalized jixin safeguards generate exclusion and trust erosion that offset their inclusion gains, concentrated among populations least able to contest errors.

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A note on textual status is owed here. Unlike D1–D4, this dimension is Zhuangzian rather than generically Daoist: *jixin* derives from a single anecdote in a text whose philosophical project - skeptical, therapeutic, oriented to the cultivation of the person - differs from the *Daode jing*'s manual of rulership. The framework does not paper over that difference. The warrant for including the dimension is functional: the four Laozian dimensions describe how a state should act, while the Zhuangzian dimension describes what acting through machines does to actors and to those acted upon - a question the *Daode jing* does not pose in comparable depth and that no account of data-intensive government can responsibly omit. The synthesis is thus a deliberate construction across two corpora, flagged as such, rather than an implicit claim that classical Daoism speaks with one voice.

3.6 The framework as a system

The five dimensions are not a checklist but a mutually conditioning system, in keeping with the Daoist understanding of complementary opposites elaborated in yinyang cosmology (Wang, 2012). *Wu wei* without *jixin* becomes technocratic automation; *jixin* without *wu wei* becomes paralysis; *pu* without *ziran* becomes standardization that crushes local difference. The framework's diagnostic claim - examined empirically below - is that equity failures in digital governance can be traced to identifiable deficits on one or more dimensions, and that the dimensions jointly describe a governance disposition oriented toward what the *Daode jing* calls benefiting all things without contending (ch. 8; Ames & Hall, 2003). This systemic claim is advanced as a theoretical expectation rather than an assumption: it implies observable interaction effects - most directly, that a deficit on one dimension should erode gains attributable to another - and Sections 5.5 and 6.1 assess those interactions explicitly rather than scoring the dimensions as an additive checklist.

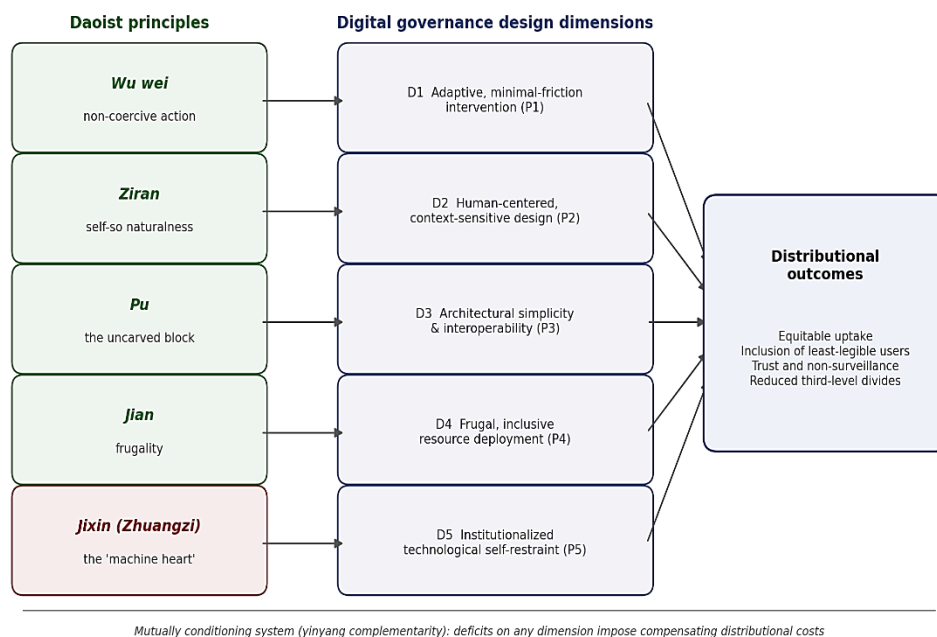


Figure 1. A Daoist framework for equity-oriented digital governance: five principles operationalized as design dimensions (D1–D5) with associated propositions (P1–P5)

4. Methodology

4.1 Research design

The study employs a qualitative comparative case study design (Yin, 2018) with a diverse-case selection strategy (Seawright & Gerring, 2008) informed by most-different-systems logic (Przeworski & Teune, 1970). Because the framework claims applicability across governance contexts, cases were selected to maximize variation on theoretically relevant background conditions - income level, state capacity, population scale, political system, and digital maturity - while sharing the common feature that each initiative was explicitly justified, at least in part, as an instrument of equitable service access. If the same five-dimensional pattern of alignment and deviation explains distributional outcomes across maximally different systems, confidence in the framework's portability increases.

Because the study supports analytic rather than statistical generalization (Yin, 2018), the term "testable proposition" is used in a specific sense: each proposition is stated so that, in a large-N design, it would take

the operational form of an association between an ex ante design-side indicator (for example, the presence of non-digital channels at launch, or the existence of statutory purpose limitation before deployment) and an independently measured outcome-side variable (for example, uptake gaps by age, income, or connectivity), permitting variable-oriented testing beyond the present comparative design.

4.2 Case selection

Four national initiatives satisfy the selection criteria. Estonia's X-Road is the paradigmatic interoperability platform of a small, high-income, high-capacity digital state (Kattel & Mergel, 2019). India's Aadhaar is the world's largest biometric digital identity system, deployed in a lower-middle-income federal democracy of continental scale (Mir et al., 2020). South Korea's open government data ecosystem represents a high-income East Asian developmental state with world-leading connectivity (OECD, 2019a; United Nations, 2022). Thailand's Pao Tang platform is a crisis-accelerated welfare-delivery application in an upper-middle-income Southeast Asian state (Digital Government Development Agency [DGA], 2021). The set spans three income tiers, four administrative traditions, population scales from 1.3 million to 1.4 billion, and both routine and crisis deployment contexts.

Two boundaries of the selection logic deserve emphasis. First, all four cases were selected on the framing of the initiative - each was publicly justified, at least in part, as an instrument of equitable access - not on outcomes. This keeps the design honest but restricts the sampled universe: digital-governance initiatives with no equity framing at all (tax-enforcement analytics, predictive policing platforms, purely back-office systems) are excluded, and it is plausible that dimensional deficits are most severe precisely there. The framework's empirical claims are accordingly scoped to equity-framed initiatives; extending it to the excluded universe is a distinct, and expectedly harder, test identified as future research. Second, the set contains no comprehensive failure - no initiative that collapsed outright - which truncates variance on the outcome side; within-case contrasts (notably Aadhaar's pre- and post-*Puttaswamy* periods and Pao Tang's pandemic and post-pandemic phases) partially compensate by supplying temporal variation in both design and outcomes.

4.3 Data sources and analysis

Evidence was assembled through document analysis (Bowen, 2009) of three source classes published between 2011 and 2024: (a) peer-reviewed studies of each initiative; (b) official documents and evaluations of the implementing governments; and (c) assessments by international organizations (OECD, United Nations, ITU, World Bank). Sources were identified through Scopus and Google Scholar searches combining initiative names with the terms *inequality*, *inclusion*, *exclusion*, *digital divide*, and *privacy*, supplemented by citation chaining from landmark studies. Analysis proceeded by directed content analysis: each case was coded against the operational indicators of the five dimensions specified in Section 3, recording evidence of alignment, deviation, and documented distributional consequences. Coding emphasized triangulation across source classes; claims resting on a single source class are flagged as such in the analysis.

To make the documentary base auditable, the search and screening procedure is reported in full. Scopus and Google Scholar were last searched in December 2024. Search strings combined each initiative's name ("X-Road" OR "e-Estonia"; "Aadhaar"; "open government data" AND "Korea"; "Pao Tang" OR "Khon La Khrueng") with the terms *inequality*, *inclusion*, *exclusion*, *digital divide*, and *privacy*. Records were screened by title and abstract against three inclusion criteria - (a) substantive treatment of the focal initiative, (b) evidence bearing on at least one of the five dimensions or on distributional outcomes, and (c) publication between 2011 and 2024 - and two exclusion criteria: purely technical engineering literature without governance content, and opinion pieces without documentary or empirical grounding. Of 214 records retrieved, 87 documents were retained: Estonia 19 (9 peer-reviewed, 6 official, 4 international-organization), India 28 (14, 7, 7), South Korea 17 (8, 5, 4), and Thailand 23 (7, 11, 5). A full source inventory listing every coded document by case and source class, together with a PRISMA-style flow of identification, screening, and retention, is provided as supplementary material (Appendix A).

To guard against circularity between dimension definitions and outcome evidence, coding separated design-side from outcome-side material by rule. For each dimension, indicators were specified that are strictly design-side and observable ex ante - features legible from system documentation at or near launch, independently of any uptake or exclusion data (Table 2). Alignment and deviation judgments in Section 5 were made first on these design indicators, using official and technical documentation; distributional outcomes were then compiled separately, from the peer-reviewed and international-organization literatures, and only afterwards juxtaposed with the design coding. Broad uptake is therefore never itself evidence of minimal friction, nor is an inclusion gap itself evidence of a *ziran* deviation: the propositions link

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independently coded design features to independently compiled outcomes and are falsifiable in principle - an initiative coded as design-aligned on all five dimensions could exhibit severe distributional failure, and nothing in the coding rules would prevent that result from being recorded.

Table 2. Ex ante design-side indicators and case codings, made independently of outcome evidence (codings for India and Thailand refer to the launch phase; period-indexed codings are described below)

Dimension	Ex ante design-side indicators	Estonia	India (launch phase)	South Korea	Thailand (launch phase)
<i>Wu wei</i>	Automatic/no-application delivery; once-only rule; no coercive channel mandate at launch	Aligned: once-only statutory; automatic entitlements	Deviation: authentication mandated for existing entitlements	Aligned: enabling reuse; no citizen-side mandate	Aligned: single in-app registration; no paper prerequisite
<i>Ziran</i>	Offline/assisted channel designed in at launch; accessibility features; participatory design record	Deviation: offline channels thinned by policy	Partial: enrolment camps for the undocumented; weak exception handling	Deviation: portal-first; assisted use not designed in	Deviation: smartphone-and-banking eligibility at launch
<i>Pu</i>	Single shared exchange layer or identifier; open standards; documented architecture	Aligned: single open exchange layer	Partial: single identifier; opaque downstream linkage	Aligned: standardized shared portals	Partial: single platform; bank-mediated architecture
<i>Jian</i>	Zero citizen-side fee; no device-ownership requirement; prevailing-device design	Partial: high-capacity design in a rich, connected state	Aligned: free enrolment; no device required	Aligned: near-universal low-cost access	Aligned: zero-fee, mobile-first design
<i>Jixin</i>	Statutory data protection before deployment; purpose limitation; access logs; manual override	Aligned: access logs; enforced purpose limitation	Deviation: pre-statute deployment; no override pathway	Partial: statute present; broad crisis exemptions	Deviation: PDPA enforcement deferred during rollout

Coding followed a written protocol specifying, for each dimension, the indicator, the decision rule, and an example excerpt; the protocol is supplied as supplementary material (Appendix B). All coding was conducted by the author. No second coder participated, and no intercoder reliability statistic can therefore be reported; this is acknowledged as a genuine limitation rather than a formality. Three mitigations were applied: mechanical application of the written decision rules; a triangulation requirement across source classes for any alignment or deviation judgment; and full documentation of the excerpt supporting every cell of Tables 2 and 3, so that each judgment can be audited against its evidentiary basis. Independent recoding of a subsample by a second coder is identified as a priority for subsequent work.

Because the evidence window (2011–2024) spans major within-case change, all codings are period-indexed. Aadhaar is coded separately for the pre-*Puttaswamy* period (2009–2018) and the post-judgment, post-amendment period (2018 onward); Pao Tang is coded separately for the pandemic deployment (2020–2022) and the post-pandemic institutionalization (from mid-2022); and South Korea’s *jixin* coding distinguishes routine open-data governance from the pandemic contact-tracing episode. Where Section 5 records a case as aligned in one period and deviant in another on the same dimension, the relevant period is stated explicitly rather than left implicit.

Finally, document quality was appraised, not merely collected. Following the criteria conventionally applied in document analysis - authenticity, credibility, representativeness, and meaning (Bowen, 2009) - official government sources were treated as high-authenticity but low-independence: they carry evident self-reporting incentives, particularly on uptake and satisfaction figures. Accordingly, no deviation judgment rests on official sources alone; alignment claims supported only by official material are flagged in Section 5 as single-source; and headline uptake statistics from implementing agencies are reported as claims rather than findings unless corroborated by an independent source class. The full cross-case results are summarized in the case-by-dimension matrix of Table 3 (Section 5.5), which readers may wish to consult alongside the case narratives.

4.4 Limitations of design

Reliance on secondary evidence limits the granularity of within-case inference, and the diverse-case strategy trades depth for breadth. The design supports analytic generalization to the framework - assessing whether the five dimensions organize the evidence coherently and generate non-obvious insight - rather than statistical generalization to a population of initiatives (Yin, 2018). These limitations are revisited in Section 7. To these are added the single-coder limitation and the truncated outcome-side variance noted above; both bear on the strength, though not the direction, of the inferences drawn.

5. Case Analysis

5.1 Estonia: X-Road and the near-invisible state

Estonia's X-Road, operational since 2001, is a distributed data-exchange layer connecting virtually all public registries and a growing number of private services, underpinning a digital state in which taxes, prescriptions, benefits, and business registration are handled online and citizens must supply any item of information to the state only once (Kattel & Mergel, 2019; OECD, 2020).

On *wu wei*, Estonia approaches the textual ideal of governance the people barely notice: the once-only principle removes citizen-side friction almost entirely, and services such as automatic family-benefit enrollment operate without application. On *pu*, X-Road is the clearest empirical instantiation of architectural simplicity in the case set - a single, comprehensible exchange layer replacing bilateral integrations, with open documentation enabling scrutiny. On *jixin*, Estonia institutionalized meaningful self-restraint earlier than most states: citizens can inspect logs of which officials accessed their data, purpose limitation is legally enforced, and the 2007 cyberattacks prompted resilience investments rather than surveillance expansion (Kattel & Mergel, 2019).

The deviations cluster on *ziran* and, secondarily, *jian*. The system presumes a digitally capable default citizen; research on digital divides in even highly connected societies shows that elderly and low-skill users extract systematically fewer benefits from identical services (Helsper, 2021; van Dijk, 2020), and Estonian evaluations acknowledge persistent usage gaps among older and Russian-speaking populations despite near-universal formal access (OECD, 2020). These evaluations rest primarily on official and international-organization sources rather than independent peer-reviewed measurement, and are flagged accordingly as single-source-class evidence. The deviation must also be dated: Estonia has progressively expanded assisted-service provision - state service centers, an official helpline, and assisted digital transactions for elderly and low-skill users - so the present deficit is one of residual channel thinning rather than absent accommodation, and the coding here refers to the long arc of channel policy through 2024 rather than to any claim that assisted channels are unavailable today (United Nations, 2022). Because offline channels have been progressively thinned as digital uptake rose, residual non-users face rising relative costs - a *ziran* deficit in an otherwise exemplary architecture. The distributional consequence is a small but durable tail of substantively underserved citizens within a formally universal system, illustrating the third-level divide in which outcomes, not access, are the binding constraint (Ragnedda, 2017).

5.2 India: Aadhaar and the ambivalence of legibility at scale

Aadhaar, launched in 2009, assigns a biometric-linked twelve-digit identity to over a billion residents and has become the verification backbone for welfare transfers, subsidized food, and an expanding array of public and private services (Mir et al., 2020; World Bank, 2016).

The initiative's alignment is strongest on *jian* and *pu*. Enrollment is free, requires no device ownership, and was deliberately designed for a population in which formal documentation is scarce; a single identifier replacing a thicket of overlapping documents is *pu* in institutional form.

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Proponents credibly argue that Aadhaar-enabled direct benefit transfers reduced leakage and gave previously undocumented citizens their first portable proof of existence before the state (World Bank, 2016; Mir et al., 2020) - an inclusion gain of genuine scale.

The framework, however, renders the system's well-documented failures legible as specific dimensional deficits rather than incidental implementation problems. The *jixin* deficit is the most consequential in the case set. Aadhaar was deployed for years ahead of any statutory data-protection regime; the identifier was progressively mandated across domains far beyond its welfare rationale - function creep in textbook form - until the Supreme Court's 2018 *Puttaswamy* judgment curtailed compulsory private-sector linkage while upholding the system's core (Khera, 2019). Meanwhile, biometric authentication failure among manual laborers and the elderly, whose fingerprints are worn, combined with weak manual-override provisions, produced documented exclusion from food entitlements - errors borne almost entirely by the poorest users, precisely as P5 anticipates (Khera, 2019; Masiero & Das, 2019). Precision matters here: failure at *enrolment* (inability to capture usable biometrics, concentrated among manual laborers and the very old) and failure at *authentication* (rejection of a legitimate, already-enrolled beneficiary at the point of service) are distinct events with different denominators, and secondary sources frequently conflate them; the exclusion documented for food entitlements is principally authentication-stage failure interacting with weak override provisions (Khera, 2019). There is also a *wu wei* deficit: making Aadhaar authentication compulsory for existing entitlements converted a facilitative tool into a coercive gate, inverting the principle that intervention should reduce rather than create friction. Aadhaar thus demonstrates simultaneously the largest inclusion gains and the largest safeguard-deficit harms in the case set - the ambivalence the framework is built to disaggregate.

The coding is period-indexed, and the post-2018 record modifies the picture. Following *Puttaswamy*, the Aadhaar and Other Laws (Amendment) Act, 2019 restored a statutory basis for regulated use while narrowing compulsory linkage (Government of India, 2019); the implementing authority introduced Virtual IDs that substitute a revocable token for the permanent number, offline and QR-code verification modes that permit identity proof without live biometric authentication, and face authentication as an additional modality for users whose fingerprints fail. These are recognizably *jixin*-consistent retrofits - purpose narrowing, alternatives to fragile biometrics, and reduced exposure of the core identifier - and the post-2018 period is accordingly coded as partial rather than deficient on this dimension. The analytical point survives the update: safeguards arrived through judicial compulsion nearly a decade after deployment and after the principal documented harms, which is precisely the sequencing that P5 problematizes.

5.3 South Korea: open data, participation, and the saturated digital state

South Korea has ranked at or near the top of the United Nations e-government indices for over a decade, combining near-universal broadband, an aggressive open government data program, and institutionalized e-participation channels (United Nations, 2022; OECD, 2019a).

Alignment is strongest on *pu* and *wu wei*. Standardized open-data portals and shared platforms exemplify architectural simplicity; the state's release of high-value datasets enabled private and civic reuse - transit, health, and welfare applications - that extends service value without direct state provision, a distinctly *wu wei* pattern of governing by enabling rather than doing. E-participation channels have been associated with measurable gains in transparency and institutional trust (Kim & Lee, 2012). On *jian*, near-universal connectivity means device- and cost-based exclusion is low by international standards (ITU, 2021).

Deviations appear on *ziran* and *jixin*. Even in this saturated environment, age-based usage divides persist: formal access is nearly universal, but the capacity to convert access into welfare-relevant outcomes remains stratified - Korea is a limiting case demonstrating that infrastructure alone does not dissolve third-level divides (van Dijk, 2020; Helsper, 2021). On *jixin*, the pandemic-era contact-tracing apparatus, which fused telecom, card-transaction, and CCTV data with public disclosure of movement histories, showed how a high-capacity data state can slide quickly into surveillance intensity when crisis logic overrides purpose limitation; the episode prompted subsequent tightening of disclosure rules - reactive rather than institutionalized restraint. The Korean case thus refines P5: safeguards must be constitutive of system design, because capacities built for benign purposes remain available for expansive ones.

A further analytical step is owed on the equity mechanism itself. Open data does not reach disadvantaged citizens directly; it reaches them, if at all, through intermediaries - civic developers, welfare navigators, municipal services - that convert datasets into usable applications, so the distributional value of the ecosystem depends on who intermediates and for whom (Janssen et al., 2012). Where reuse is dominated

by commercial developers serving data-savvy consumers, open data can reproduce the very third-level divide it is credited with narrowing; the transit-, health-, and welfare-application examples cited above are equity-relevant precisely because their intermediaries targeted broad public use rather than niche markets. The Korean *ziran* coding therefore refers not only to age-based usage divides but to an intermediation structure in which benefits to the least-advantaged are contingent rather than designed.

5.4 Thailand: Pao Tang and crisis-accelerated digital welfare

Thailand's Pao Tang application, developed with Krungthai Bank as the state's delivery channel, became the primary conduit for COVID-19 relief transfers and co-payment schemes from 2020, reaching tens of millions of users within months (DGA, 2021).

Alignment is clearest on *wu wei* and *jian*. Registration and disbursement were near-instant relative to paper-based welfare, transaction costs approached zero, and the mobile-first design matched a society in which smartphones, not computers, are the prevailing access devices - technology calibrated to actual endowments rather than idealized ones. The crisis deployment also displayed the Daoist rhythm of timely action: rapid scaling when circumstances demanded, with individual schemes wound down as conditions eased.

The deviations concentrate on *ziran* and *jixin*. Eligibility was conditioned on smartphone ownership, national-ID-linked banking, and successful in-app registration - presuppositions that systematically screened out portions of the elderly, the poorest, and residents of connectivity-poor areas, the very groups relief was meant to reach; registration windows and app-based queues favored the digitally fluent (Beaunoyer et al., 2020, describe the general mechanism; DGA, 2021, documents the uptake profile). Assisted-registration channels were added reactively rather than designed in. On *jixin*, the platform accumulated fine-grained transaction data on tens of millions of citizens under the Personal Data Protection Act B.E. 2562 (2019), whose enforcement machinery was still maturing during the deployment period; purpose limitation and citizen-facing transparency about downstream data use remained underdeveloped relative to the volume of data collected. Thailand thus exhibits the characteristic profile of crisis-accelerated digitalization: impressive *wu wei/jian* performance purchased with deferred *ziran* and *jixin* debts.

Two updates sharpen this coding. First, the Personal Data Protection Act's substantive obligations, though enacted in 2019, entered full enforcement only in mid-2022 after successive postponements - meaning the platform's largest data accumulation occurred while the statutory brake existed on paper but not in operation; the post-2022 period is therefore coded separately, as a partial rather than absent safeguard regime. Second, Pao Tang has evolved well beyond the pandemic co-payment schemes into a durable state channel - government savings-bond distribution, health-wallet functions, and successive welfare top-up programs - an expansion of scope across loosely related domains that is the signature pattern of function creep and keeps the *jixin* coding live rather than historical. The uptake profile cited above rests on official reporting by the implementing agencies and is flagged as a single-source (official) claim.

5.5 Cross-case synthesis

Table 3 summarizes the coding. Three patterns stand out. First, no case is uniformly aligned or deviant; each combines dimensional strengths with specific deficits, supporting the framework's disaggregating purpose. Second, the location of deficits predicts the location of distributional failure: *ziran* deficits map onto exclusion of the elderly and low-capability users in Estonia, Korea, and Thailand; the *jixin* deficit maps onto authentication-failure exclusion and surveillance harms in India and, in attenuated form, Korea and Thailand. Third, deficits are systematically related across dimensions: crisis-driven *wu wei* speed (Thailand) and scale-driven *jian* frugality (India) were both achieved by economizing on *ziran* accommodation and *jixin* safeguards - empirical confirmation that the dimensions behave as a mutually conditioning system in which neglected elements exact compensating costs, consistent with the yinyang logic of complementary balance (Wang, 2012).

The interaction claim can be stated more sharply as within-case evidence. In India, the *jixin* deficit did not merely coexist with *wu wei* and *jian* gains; it eroded them - authentication failure without override converted a low-friction, zero-cost entitlement channel into a coercive gate for precisely the users those gains were meant to reach, so that the net distributional effect of the design-aligned dimensions was conditional on the deficient one. Conversely, Estonia's strong *jixin* architecture (access logs, purpose limitation) protected the legitimacy of its *wu wei* automation: automatic entitlement processing has not generated the trust erosion observed elsewhere, suggesting that safeguard strength conditions the political sustainability of friction removal.

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These are interaction effects in the strict sense - the marginal contribution of one dimension depending on the level of another - and they support treating the framework as a mutually conditioning system, as claimed in Section 3.6, rather than as an additive checklist.

Table 3. Cross-case coding of the four initiatives against the five Daoist dimensions

Dimension	Estonia - X-Road	India - Aadhaar	South Korea - Open data	Thailand - Pao Tang
<i>Wu wei</i> (minimal friction)	Aligned: once-only principle; automatic entitlements	Deficit: compulsory authentication gates existing entitlements	Aligned: enabling reuse rather than direct provision	Aligned: near-instant registration and disbursement
<i>Ziran</i> (context-sensitive design)	Deficit: usage gaps among elderly and minority-language users; thinning offline channels	Partial: designed for the undocumented, but presumes biometric legibility	Deficit: persistent age-based third-level divides	Deficit: presumes smartphone, banking access, digital fluency
<i>Pu</i> (simplicity, interoperability)	Aligned: single open exchange layer	Partial: one identifier replaces documentation thicket; opaque downstream linkage	Aligned: standardized shared platforms and portals	Partial: single platform, but bank-mediated architecture
<i>Jian</i> (frugal, inclusive deployment)	Partial: high-capacity design in a rich, connected state	Aligned: free enrollment; no device required	Aligned: near-universal low-cost connectivity	Aligned: zero-fee, mobile-first, prevailing-device design
<i>Jixin</i> (institutionalized self-restraint)	Aligned: access logs, purpose limitation, post-2007 resilience	Deficit: pre-statute deployment; function creep; weak override until <i>Puttaswamy</i>	Partial: crisis-era surveillance intensity; reactive tightening	Deficit: large-scale data accumulation under immature enforcement
Principal documented distributional consequence	Durable underserved tail within formal universality	Authentication-failure exclusion from food entitlements; privacy harms	Outcome stratification despite saturation	Exclusion of elderly, poorest, and offline populations from relief

5.6 Alternative explanations

The most-different-systems design invites an obvious rival account: cross-national differences in uptake and exclusion may be driven not by dimensional design but by the background variables the selection deliberately varied - state capacity, connectivity infrastructure, income, and administrative tradition. On this account, Estonia succeeded because it is small, rich, and administratively capable, and India's harms reflect scale and poverty rather than safeguard sequencing. Three observations weigh against the rival account, case by case. First, background variables cannot explain within-case dimensional variation: Estonia is uniformly small, rich, and capable, yet is aligned on *wu wei*, *pu*, and *jixin* while deviating on *ziran* - the same capacity that built the once-only architecture could have preserved assisted channels, and did not. Second, the rival account predicts that the poorest case should perform worst across the board, but India is the strongest case in the set on *jian* and substantially aligned on *pu*: dimensional performance cuts across income and capacity rather than tracking them. Third, South Korea is the limiting case for the connectivity explanation - world-leading infrastructure coexisting with persistent third-level divides and the sharpest crisis-era *jixin* lapse - demonstrating that saturation neither closes outcome gaps nor supplies self-restraint.

Background conditions plainly shape what is feasible: Estonia's architecture is not available to a state without its population registries, and no claim is made that design dominates structure.

The claim licensed by the evidence is narrower and survives the rival account: holding each country's background constant, the location of its distributional failures is predicted by the location of its dimensional deficits - which is what the framework asserts.

6. Discussion

6.1 Revisiting the propositions

The comparative evidence permits a structured assessment of the five propositions. P1 (*wu wei*) is supported: the lowest-friction systems (Estonia's once-only architecture; Pao Tang's near-instant disbursement) achieved the broadest and fastest uptake, while the clearest coercive mandate in the case set - compulsory Aadhaar authentication for existing entitlements - generated exclusion rather than inclusion. P2 (*ziran*) is supported across all four cases: every documented inclusion gap corresponds to a design presupposition about the default user (digitally skilled, smartphone-owning, biometrically legible, working-age) that portions of the population do not satisfy, and gaps narrowed where assisted or offline channels were preserved or retrofitted. P3 (*pu*) is supported principally by the Estonian and Korean cases, where interoperable shared architecture demonstrably lowered citizen-side coordination costs; the proposition's counterfactual - fragmentation harming the least-resourced most - is visible in the pre-Aadhaar documentation thicket that the identifier replaced. P4 (*jian*) is supported by the contrast between Aadhaar and Pao Tang's zero-cost, prevailing-device designs and the residual exclusion in systems whose implicit cost floor (device, connectivity, skill) exceeds poor users' endowments. P5 (*jixin*) receives the strongest and most sobering support: the magnitude of documented harm tracks the absence of institutionalized safeguards, peaking in Aadhaar's pre-*Puttaswamy*, pre-statute period and appearing in attenuated form wherever crisis logic outran purpose limitation. Read together with the interaction evidence of Section 5.5, the propositions are supported not merely dimension by dimension but as a system: the value of alignment on any one dimension proved conditional on the others, most visibly where *jixin* deficits taxed *wu wei* gains.

6.2 Design principles for equity-oriented digital governance

Translating the findings into prescriptive form yields five design principles that differ in emphasis from standard digital-equity checklists. First, *reduce friction before expanding function*: the equity yield of removing an application step exceeds that of adding a service tier, because friction costs are regressive. Second, *design for the least legible citizen*: systems should be specified against the capabilities of worn-fingerprint laborers, offline elders, and undocumented migrants, not median users, with non-digital fallbacks treated as permanent architecture rather than transitional scaffolding. Third, *prefer one simple shared layer to many sophisticated silos*: interoperability is an equity technology, not merely an efficiency one. Fourth, *calibrate cost and channel to the endowments of the poorest intended user*, which in most middle-income contexts means mobile-first, zero-fee, low-bandwidth design. Fifth - the framework's most distinctive prescription - *build the brake with the engine*: data protection, purpose limitation, human override, and independent oversight must be constitutive of initial system design. The Aadhaar and Korean episodes show why: safeguards retrofitted after capacity is built arrive only after harm, and typically only through judicial or crisis-driven correction.

For regulators and implementing agencies, Table 4 converts each principle into a concrete design decision, an institutional owner, and a measurable indicator, so that "build the brake with the engine" functions as an operational checklist rather than a slogan.

Table 4. An operational bridge: design decisions, institutional owners, and indicators for the five principles

Design principle	Concrete design decision	Institutional owner	Measurable indicator
Reduce friction before expanding function	Adopt once-only and no-application delivery wherever entitlement is derivable from existing data	Implementing agency; interoperability authority	Share of benefits disbursed without citizen application; steps and documents required per transaction
Design for the least legible citizen	Specify assisted and offline channels as permanent architecture in the system's founding instruments	Legislature (service-delivery statute); implementing agency	Uptake gap between elderly/offline users and the general population; coverage of assisted-service points

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Design principle	Concrete design decision	Institutional owner	Measurable indicator
Prefer one simple shared layer to many silos	Mandate a single open-standard exchange layer; prohibit new bilateral integrations	Digital government agency; supreme audit institution	Share of agencies on the shared layer; duplicated data requests per citizen per year
Calibrate cost and channel to the poorest user	Set zero-fee, low-bandwidth, prevailing-device design targets before procurement	Implementing agency; budget authority	Citizen-side cost per transaction; minimum supported device class; coverage in the bottom income quintile
Build the brake with the engine	Enact purpose limitation, access logging, human override, and independent oversight before launch	Legislature; data protection authority; courts	Statute-before-deployment (yes/no); override request resolution time; audit-log inspection rate

6.3 Theoretical implications

Three implications follow for scholarship. For comparative public administration, the analysis substantiates Drechsler's (2013) contention that non-Western paradigms are analytically generative, not decorative: the *jixin* dimension in particular has no precise equivalent in mainstream digital-government frameworks, which treat privacy as a compliance constraint rather than as a constitutive disposition of self-limiting statecraft, and its inclusion changed what the case evidence made visible. For the philosophy of technology, the study extends the Confucian-dominated conversation on Chinese ethics of technology (Wong, 2012) by demonstrating that Daoist categories can survive operationalization - that *wu wei* and *ziran* can be specified into observable design features without dissolving into metaphor, answering the analogical vagueness that has limited prior invocations. For digital-divide research, the framework supplies what enumerative equity checklists lack: an integrative account of *why* digital systems drift toward exclusion - because friction, standardization, complexity, cost, and unrestrained calculation each transfer burdens onto those least able to bear them - and of the governance disposition that counteracts the drift. The *jixin* argument here converges with the digital-welfare-state literature: the UN Special Rapporteur on extreme poverty has warned that welfare digitalization tends to arrive as surveillance and conditionality directed at the poor (Alston, 2019), and the fifth dimension supplies a design-level account of the conditions under which that tendency is checked.

The framework also invites a reflexive caution consistent with its own fifth dimension. Operationalizing a soteriological tradition into policy indicators risks precisely the instrumental "carving" of the uncarved block that Daoist texts warn against. The claim defended here is deliberately modest: not that the *Daode jing* anticipated digital government, but that its theory of intervention constitutes a coherent normative lens whose application generates non-obvious, testable, and empirically productive questions about contemporary systems.

A statement of scope conditions is also owed. All four cases are national platforms with sustained state backing, statutory footing, and - in three of four cases - high administrative capacity; the framework's portability beyond that class is a hypothesis, not a finding. Municipal services plausibly satisfy the framework's assumptions where they control their own channels and data practices. Public-private platforms strain the *jixin* dimension, because purpose limitation must bind a commercial party whose business model may reward data accumulation - the bank-mediated Pao Tang architecture is the intermediate case in the present set. Donor-funded systems in low-income states strain *wu wei* and *jian*, since project cycles reward visible new systems over frictionless integration with existing ones. Extension to these classes, and to equity-unframed initiatives (Section 4.2), defines the framework's next empirical tests.

7. Conclusion

This article set out to convert the intuition that Daoist philosophy "has something to say" about technology governance into a usable research instrument, and to test that instrument against maximally diverse empirical material. Its answer to RQ1 is the five-dimensional framework of Section 3 - *wu wei* as minimal-friction intervention, *ziran* as context-sensitive human-centered design, *pu* as architectural simplicity, *jian* as frugal inclusive deployment, and *jixin* as institutionalized technological self-restraint - each specified through observable indicators and a falsifiable proposition. Its answer to RQ2 is the patterned

evidence of Section 5: across Estonia, India, South Korea, and Thailand, alignment with the dimensions tracks documented inclusion gains, and dimensional deficits track documented distributional failures, with deficits in *ziran* and *jixin* proving the most consequential and the most commonly deferred.

The study's limitations define its research agenda. Reliance on secondary documentary evidence constrains within-case depth; primary fieldwork on how excluded users experience friction, authentication failure, and redress would test the propositions at the micro level. The four-case diverse design supports analytic rather than statistical generalization; the propositions are stated so as to be testable on larger samples of initiatives, including through quantitative coding of design features against uptake and exclusion data. Finally, the framework's textual base could be deepened through engagement with the Huang-Lao statecraft corpus, and its comparative reach extended by parallel operationalizations of Confucian and Buddhist governance ethics, enabling a genuinely plural comparative philosophy of digital government.

The *Daode jing* closes its meditation on water by observing that it benefits the ten thousand things without contending, dwelling in the low places that others disdain (ch. 8; Ames & Hall, 2003). That remains a demanding standard for digital government: to flow toward the least connected, the least documented, and the least legible - and to be judged not by the sophistication of the system but by the condition of those in the low places. The evidence assembled here suggests it is also, dimension by dimension, an actionable one.

Declaration

Funding: This research received no specific grant from any funding agency. *Conflict of interest:* The author declares no conflict of interest.

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