

# Digital Exclusion in the Age of Artificial Intelligence: Structural Inequality and the Emerging Algorithmic Divide

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## Abstract

Computers that learn are now part of daily life shaping jobs, money handling, medical choices, schools, how people talk online, even government work. These smart systems often run faster, guess outcomes better, grow easily but also change who gets chances and who holds control. Being left out digitally isn't just about lacking internet anymore; it hides inside hidden rules made by machines. Some folks have devices and signals but still miss from data used to train programs, struggle to grasp what machine choices mean, or find no way to challenge those automatic results. Looking closer at how AI systems leave people out, this work pieces together ideas about internet access gaps, hidden biases in code, and rules meant to keep tech fair. Uneven data feeds into unclear algorithms, often shaped by dominant languages, while many lack basic understanding- this mix widens a gap not just in access but in real influence. Drawing from early surveys and comparing different oversight models, it shows where harm might grow if ignored. Solutions take shape through clearer processes, broader language support, shared decision power, and designs that prioritize equity over uniform fixes. What counts as inclusion shifts when who gets heard changes quietly behind layers of automation. What stands out in the paper is how leaving people out of AI isn't just about code or machines. It grows from old imbalances, choices made by powerful organizations, uneven schooling. Real change means adjusting how systems are built, who watches over them, helping everyone understand what they face so these tools lift lives instead of deepening divides.

Starting off, the study lays out a framework called the AI Exclusion Architecture Model to show how data setups, tech design, people's understanding, along with rules interact. Instead of just listing parts, it digs into patterns found by examining real cases and interpreting key themes. What stands out is that automated tools used in hiring checks, loan ratings, or what shows up online may deepen old inequalities especially if protections fall short. What stands out is how being left out of AI spaces isn't just about lacking tools it plays out across skills, access, and trust in systems. Fixing gaps means going beyond better software fair rules must guide design, code needs clear explanations, languages other than English matter, people need steady chances to learn how algorithms shape choices. Seen through the machinery of automated decisions, unfairness online becomes harder to ignore, pushing conversations about fair tech forward, suggesting that if AI hopes to be accepted long term, it has to open doors instead of closing them. Unequal access shaped by artificial intelligence doesn't just harm individuals - it can shift how entire societies move forward, affecting fairness in jobs, banking, and government support. Starting off, the study builds a framework called the AI Exclusion Architecture Model to show how data setups, tech

designs, people's understanding, along with rules interact. Instead of just listing parts, it traces connections across layers using exploratory methods and pattern-based insights. One observation reveals that automated hiring tools, loan evaluation systems, plus online content sorting may deepen existing inequalities if protections fall short. What stands out is how quietly these systems uphold old divides without obvious intent. Safeguards matter more than assumed when decisions shift toward machines.

**KEYWORDS:** Artificial Intelligence (AI), Digital Exclusion, Algorithmic Divide, Digital Inequality, Algorithmic Bias, Data Justice, Automated Decision-Making, AI Governance, Ethical AI, Algorithmic Accountability, Algorithmic Transparency, Explainable AI (XAI), Socio-Technical Systems, Structural Inequality, Digital Literacy, Algorithmic Literacy, Platform Power, Data Representation, Human Oversight, Responsible AI, Public Policy, AI Ethics, Governance Frameworks, Epistemic Inequality, Technology Policy, Responsible AI.

## 1. INTRODUCTION

Machines now shape choices about who gets hired, loans approved, schools accessed, medical care delivered, even what shows up online. Resume sorting happens without human eyes, thanks to software scanning every line. Banks lean on math models before saying yes to borrowers. What you see online often depends on unseen code deciding relevance. Government services sometimes follow forecasts made by number-crunching programs. Not like rigid rules, machines spot trends hidden inside old records[3],[9],[10]. Found within those records are unfair splits money gaps, male favoritism, class rankings, tongue power plays, uneven places far apart. Learning from these truths dressed as facts? That can bake injustice deeper while looking impartial. Back then people talked mostly about who could get online and who could not. Now that artificial intelligence shapes everyday choices inside organizations things run differently. Someone might own a device plus have steady internet but still be left out in less obvious ways. Their lives do not show up in the data machines learn from. They often fail to grasp how these hidden systems reach conclusions. Chances to challenge outcomes made by code remain slim or invisible. This change points toward a new imbalance, where the real gap isn't just about who gets in but who gets to choose what this study frames as the algorithmic divide. Talk about being left out of digital life has changed a lot in twenty years. At first, studies looked mostly at who could reach computers and the internet, who could not. As tech slipped deeper into schools, banks, government, new problems showed up - it was never just about wires or devices. When artificial intelligence shapes jobs, loans, housing, unfairness takes root in hidden calculations instead[6].

Out here, unfairness isn't just about design - it hides in what gets known. These machines make choices inside sealed rooms, leaving people guessing how outcomes take shape. When folks miss basic digital know-how, or fail to grasp hidden rules, confusion grows between results and meaning. Picture credit checks, hiring filters, even who sees your post - automated calls made unclear. Not seeing the logic behind them chips away at control, tilts fairness without a sound. Still, rules guiding how AI is built look different depending on where you are. Some places focus on managing risks and setting moral standards, yet how strictly these are followed changes a lot. Across several developing nations, talks about control lean toward boosting new ideas and money-making, often pushing ethics aside. When oversight feels distant or unclear, certain groups might get left behind even more. Right now, unequal access isn't just about who has internet or devices - it runs deeper, into the code and decisions behind AI tools. Hidden layers of bias take shape not only in rules set by institutions but also in knowledge gaps and decision-making circles few can reach. Instead of one single barrier, a mix of systemic, cognitive, and control-related hurdles builds up quietly over time[3],[6]. Drawing from various fields and early-stage findings, this work looks at how smart systems tilt the balance - shifting who gets seen, heard, included. Behind smooth interfaces, power shifts happen without fanfare. What appears neutral often carries inherited splits. Seeing these fractures means looking beyond availability to question design, intent, and oversight. Digital absence today stems less from personal choice, more from silent filters baked into automated logic. Not every gap shows on the surface. Access depends not only on connection - but on whose reality shapes the machine. Understanding exclusion means tracing feedback loops where disadvantage repeats itself, unseen yet felt. This research does not aim to block AI advancement, yet it questions what happens when tech meets society. Seeing AI as part of human systems opens space to explore who benefits, who gets left out. What emerges is a need to shape rules, ethics, and change in ways that do not ignore justice or shared dignity. Facing digital exclusion means seeing tech not as some fixed helper, yet as something built through layers of money choices, power moves, and past habits. These AI setups never work alone - they carry echoes of who decides what, profit motives, and old numbers fed into machines long ago. Looking close at who gets left out of these smart systems matters deeply, because fairness in society depends on how fairly such tools grow and spread[7],[14],[15].

## 2. Literature Review

Even if everyone can reach the internet, people still face different challenges using it well Van Dijk pointed this out back in 2006 with his layered idea of access covering tools, know how, and real world application. Not having equal outcomes stems partly from how each person handles technology, not just whether they have it at home. Way before that, DiMaggio and Hargittai noticed social position plays a quiet but strong role; school years matter too, along with comfort level around tech systems. What holds things together hasn't changed much[4],[5]. Still, when artificial intelligence runs decisions, gaps in access or know how grow worse because choices happen without people seeing how[13]. Being online doesn't help much if hidden rules treat someone unfairly based on their information. So now it's less about getting in the door, more about what you can do once inside, then who gets to choose. Power moves where

the automation points. Many studies show artificial intelligence can repeat past unfairness. Not far beneath the surface, writes O'Neil in Weapons of Math Destruction, math driven tools often act biased while seeming neutral. Her analysis reveals these automated judgments used when picking job candidates or assigning school resources tend to deepen gaps instead of closing them. Hidden patterns inside algorithms behave like old prejudices wearing new masks. Most times, chasing better prediction results ends up skewing mistakes toward certain communities. Fairness in algorithms isn't just a moral question it ties into equations and logic, Barocas and Hardt point out in 2019. Systems left on their own tend to favor majority patterns, quietly sidelining smaller groups. When models ignore balance, outcomes grow uneven by design. Efficiency pulls one way; treating people fairly tugs another. From where we stand, Noble's 2018 book Algorithms of Oppression shows what happens when search engines reflect racism and sexism - built into their code through biased data and profit goals. It turns out these digital systems aren't impartial machines after all; instead, they grow out of social forces, shaped by who holds power and what values get coded into software. Behind every result lies a history not just of math, but of choices made by people inside institutions.

A study from Buolamwinski and Gebre in 2018 showed face scanning tech often misidentifies dark skin women far more than light skin men. Because of this, uneven data sets seem to shape how well such tools work across groups. What stands clear from these works is how deeply wired unfairness sits inside systems handling data. It does not happen by chance. Instead, patterns built into design repeat it without pause. One key issue in AI research is how clear systems are about their decisions. Instead of calling it a right to be told why, Wachter, Mittelstadt, and Floridi question what good such rules really do. Even when laws demand openness, getting real insight into advanced algorithms can still fall short because of how they work. Some people worry about how machines make choices. XAI tries to answer those worries by showing how decisions happen. Still some experts say simple stories might miss what really goes on inside. Understanding these answers also depends on how well someone can follow tech ideas[8]. Without enough know-how, even clear explanations might not help much. Most people feel shut out when systems make decisions without clear reasons. If someone gets turned down for credit but does not know why, the process feels unjust. Unclear outcomes chip away at confidence in institutions. Power stays tilted toward those who control the technology. Lots of times, artificial intelligence learns mostly from English data, simply because that is what fills much of the web. Take a place like India where many tongues are spoken and you start seeing layers form inside these smart machines. Some local ways of speaking hardly show up at all in voice or text tools, so they do not work well when people try to use them[13].

Though machines learn speech patterns, they often handle some dialects better than others. Because of this gap, voice helpers might misunderstand certain speakers. Translation software can struggle when faced with less common tongues[5],[12]. When a system favors major languages, it leaves others behind. People speaking minority forms may find tech support harder to reach. Out of step, a system shaped by one world might miss rhythms elsewhere. Where data gaps leave people out, mismatched norms can do the

same. Shaped mostly by Western habits, some filters fail to catch what matters locally. So silence creeps in not just from missing inputs, but from clashing values. Even though people talk a lot about unfair algorithms, not many look at how knowing your way around tech affects who gets left out of AI. According to Helsper from 2012, what you can actually gain online depends on how well you handle digital tools. If we build on that thought, being able to grasp how hidden systems shape what shows up and why choices are made becomes its own kind of skill. A fresh look at the data shows people who know tech well tend to lean on AI more, trusting it without second guessing. Those less familiar might see machine choices as random, even unjust. Because of this split in understanding, some get left behind when systems make calls. Missing chances to learn how computers solve problems can deepen gaps in understanding. Because of this, knowing how algorithms work ought to be seen as key to being part of today's digital world. More global groups now see how AI affects society and economies. Because of this shift, UNESCO put forward its 2021 guidelines stressing fairness, inclusion, and respect for human rights. On another front, the European Union drafted an AI law built around levels of risk - higher stakes mean tighter rules. Take hiring tools or face recognition tech: these face tougher checks under the plan. Fight over rules trying to fix algorithm problems but not kill new ideas keeps going. One side pushes checks for unfair results along with clear disclosures. The other backs shared control, bringing in groups outside government and tech. Still, rules usually care more about checking boxes than teaching people how to understand them. To close the gap in tech know how, it takes steady watchfulness from organizations along with stronger skills across communities. Looking at who gets left out when artificial intelligence shapes decisions means seeing past simple ideas about unfair code or skill gaps. Layered patterns show up when tech setups meet unequal access and control across systems. A new lens called the "AI Exclusion Architecture Model" helps trace how different levels design choices, organizational influence, real world usage link together. Exclusion does not stem from one broken part but grows where social hierarchies blend with tool limitations and learning divides. Barriers appear quietly through hidden rules in software, uneven know-how, or interfaces that ignore diverse needs. This way of mapping things treats separation not as an accident but as built in results of combined pressures. Structural imbalances feed into how tools behave, while everyday interactions reinforce who is included or pushed aside. What seems like a glitch often reflects deeper splits woven into both society and machines.

Right beneath the surface sits the structure piece. These AI setups do not grow in empty space but take shape inside real world power layouts full of uneven advantages. Training happens using old records where bias, class gaps, or location-based neglect already left marks. If those records feed future guesses, then unfairness might get locked into calculations through code. Meanwhile, only a few big players hold most computing muscle and massive data pools - leaving others behind without notice. Power tilts toward those who build systems, leaving users on the weaker end. Who gets left out starts long before code runs rooted in data flows and organizational setups guiding how algorithms take form. Starting from this framework comes something about knowing how people grasp what machines do. Though folks might use AI every day, most still do not see how its choices take shape. Outputs roll out like facts, sharp and polished,

making doubt feel unnecessary. Because of that, power tilts toward those who build the tech, leaving others guessing at hidden rules. The skill to question these systems to follow their logic and limits shapes who truly takes part when algorithms decide things. Understanding does not come easy, yet it decides influence. People who understand digital tools well can make sense of suggestions, challenge results, or ask for explanations more easily; on the flip side, those unfamiliar with such systems might feel lost or give up without trying. Bias in data isn't the sole cause of being left out - unequal access to knowing how things work plays a big part too. Users meet AI through apps and websites, their first real touchpoint with these tools. When menus confuse or wording feels heavy, people drift away, even if fairness efforts happen behind the scenes. Interfaces built only in English shut out many, especially where local speech shapes daily life. Without space to question results, users face silent walls after decisions land. How things look, what words appear, who gets heard these small steps pile up. Some walk easier; others get tripped by the setup itself. Now emerging data-based setups plus automated decision-making have shifted digital unfairness into fresh territory. Research today shows being left out online gets built more deeply into coded systems guiding life chances. Gillespie points out algorithms matter socially because they decide what we see, rank facts, steer conversations. Not unlike that, Beer along with Kitchin argue these codes aren't impartial tools rather reflect power structures money interests.

Looking closer at algorithmic bias reveals more about who gets left out. Not aiming to discriminate doesn't stop data systems from causing uneven outcomes, say Barocas and Selbst. Because past numbers often mirror unfair setups in society, machines learning from them might spread those same imbalances far and wide. O'Neil calls these tools "weapons of math destruction," pointing out their hidden workings and lack of oversight can hit marginalized groups hardest. Search engines, according to Noble, push racial and gender biases through results - quietly affecting how people see themselves and others online. Not just about access, unfairness also hides in how knowledge is shaped and understood. Coming from less wealthy homes often means fewer skills for handling tricky online tools, as Helsper points out. When people lack awareness of how algorithms work, confusion follows - decisions happen without clarity or chance to push back. Though some claim everyone should get explanations for machine-made choices, Wachter and others show such rights are weak in law and real life. Some writings point to how big tech firms hold most of the data and computing strength. Shoshana Zuboff calls this setup surveillance capitalism, where what people do turns into valuable information. In their view, data colonialism takes shape when everyday life gets harvested for digital use, say Nick Couldry and Ulises Mejias[5]. Power gaps in online platforms matter just as much as personal lack of access, these ideas show.

When worries grew, rules and ethics around artificial intelligence started drawing serious attention. Instead of one-size-fits-all controls, Europe suggested classifying risks while UNESCO laid out moral guidelines aiming at openness, responsibility, fairness[12],[15]. Still, some experts say laws tend to lag behind fast-moving tech changes. Not every fix based on data measurements catches hidden societal imbalances built into how systems work. The research shows digital exclusion runs deep in AI-heavy communities. Not

just one issue, it grows from unequal data access, hidden algorithms, weak oversight, uneven skills. Progress exists - bias is better understood, ethics discussed widely. Yet solutions still lack unity between how systems are built, how people understand them, what rules shape their use.

### 3. Research Methodology

This work takes a close look at where digital exclusion shows up in AI-driven environments. Because the subject deals with ideas still taking shape and because rules around artificial intelligence keep shifting the goal here wasn't about hard numbers or broad conclusions. Instead, it focused on spotting recurring signs and meaningful clues that fit alongside the suggested model. So, the approach mixes thinking through existing theories together with fresh firsthand notes[11],[12]. What comes out is less about proof, more about pointing. From city and town areas, undergrads plus young workers filled out a set format survey that's where most details came from. Picked because they were easier to reach, these people fit what was doable within tight schedules. Not everyone in society showed up in this group, yet their habits revealed real patterns about how tech involved users see artificial intelligence tools. Some studied arts, others science but plenty already knew digital platforms from school or jobs. One part looked at personal views on knowing tech well, especially around things like bots that pick job candidates, suggest movies, or manage money choices. What stood out was how people felt about fairness when machines made calls instead of humans. Even though some said they trusted software outputs, others doubted if those results were truly neutral or dependable. A different angle checked whether folks could make sense of why an AI reached a certain outcome, or just saw it as a hidden process they couldn't touch. Some struggled simply because most interfaces leaned heavily on English, making them harder to follow for those more comfortable in another tongue. How familiar someone claimed to be with digital tools shaped much of what came next in their answers. It mattered less if people used AI often than whether they grasped its role behind daily decisions. Built into the structure was space to reflect not only on skill level but also on who gets left out when designs ignore diverse users.

Looking at how people get left out of AI means more than just checking the code. What matters is how data rules mix with company choices, who uses the tools, and what watchdogs allow. This study does not claim broad results across every case. Still, it shows new ways unfairness can grow inside smart systems. Patterns of exclusion take shape through a mix of reading past studies, gathering early survey insights, then comparing how policies differ across settings. To ground ideas in theory while staying tied to real-world data and political context, this blend found its fit naturally. Starting from concepts, moving into open-ended findings, it leans on multiple angles instead of chasing cause-and-effect proof. The work builds by layering understanding, not isolating variables one at a time. To build the theoretical base, academic databases along with peer-reviewed journal articles, institutional reports, and policy frameworks got reviewed. Interdisciplinary work took center stage - especially in digital divide studies, algorithmic bias research,

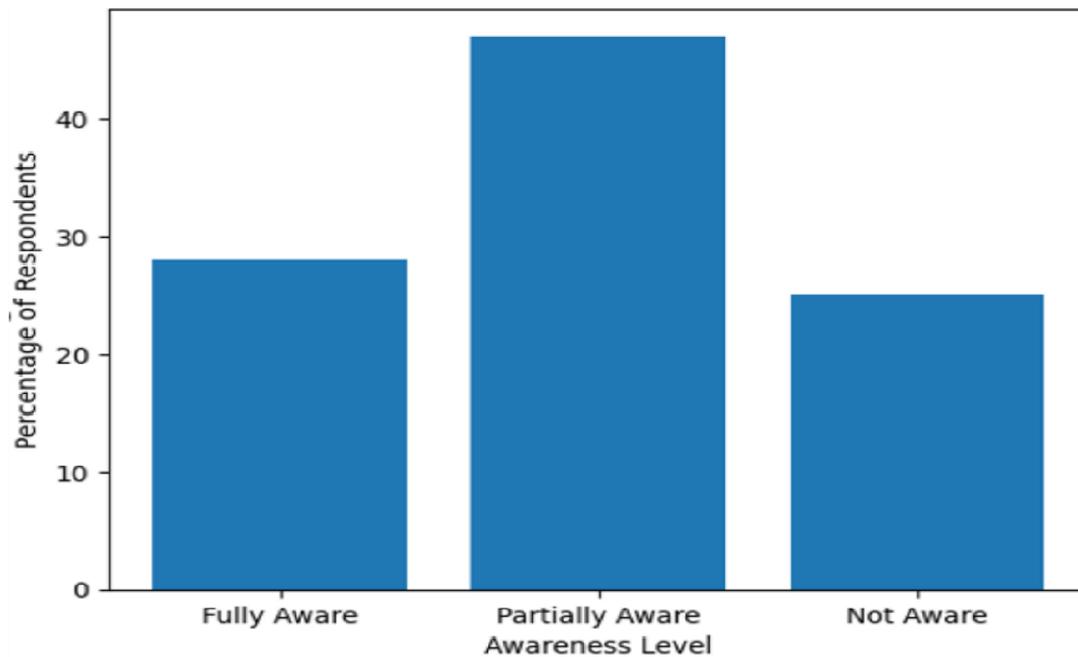
socio-technical systems theory, AI ethics, and governance regulation received focused attention. From the literature review emerged repeating ideas: structural bias showed up often, followed by hidden algorithms, dominance of platforms, uneven access to digital skills. Those patterns shaped how the AI Exclusion Architecture Model came together in this research. From time to time, fresh answers came through a set format given to selected undergrads plus grad students using online tools along with artificial intelligence features[5],[10]. This way of choosing people wasn't random rather aimed at those already dealing with smart systems while studying, working, or managing money matters. Questions were mostly fixed-choice, checking how much people knew about AI decisions, while some asked freely about views on fairness, clarity, or ease of access. Aim wasn't gathering big numbers but spotting how engaged internet users make sense of these systems through their own experiences.

One thing stands clear - the study wasn't built to apply broadly across large groups, mostly because it looked at only a small set of people. Most participants were already comfortable using digital tools, so their experiences might miss what others face who have less access or support. Over time, as artificial intelligence keeps shifting fast, rules meant to guide it also change, reshaping how everything fits together. Fewer answers come out clearly, yet the approach still reveals how automated systems tend to shut people out. It sets up a clear path others can follow when they dig deeper later. Taking part in the survey meant joining by choice, yet every answer stayed anonymous to keep identities hidden. Not a single name or traceable detail got recorded during collection. Truthful sourcing guided the work throughout, steering clear of twisted results or inflated claims. Since feelings - not private facts - formed the core, concerns about harm stayed low.



Fig 1 : Insights On Digital Exclusion

#### 4. Result



**Fig 2: Respondent Awareness of AI Based Decision Systems**

#### 5. Conclusion

Looking into digital exclusion today means seeing past just who owns a phone or has Wi-Fi. Even when people are online, barriers still show up hidden inside how AI makes decisions. Systems sorting job applications, rating credit risk, guiding medical care, or choosing what shows up in searches often reflect unseen biases. These tools quietly limit chances without clear explanation. Power shifts happen not through broken connections but coded choices made far from public view. What shows up in the results points to more than just one cause behind digital exclusion in artificial intelligence. Because some groups appear less often in training datasets, while others face unclear decision processes, gaps grow slowly. Language shaped by a few ends up setting the tone everywhere else too. When people cannot understand how conclusions are reached, even having internet does little. Access alone means nothing without the ability to challenge outcomes made by machines. Rules and ethics around AI show institutions are starting to take its dangers seriously. Still, regulations need to do more than check boxes bringing in public understanding matters too. Languages other than English should be part of the conversation, not an afterthought. Real inclusion means people help shape the systems they use. Tackling who gets left out online demands teamwork across laws, organizations, and tech builders. How power flows through these systems can't stay invisible. One way or another, artificial intelligence ought to lift people up instead of shutting them out. Getting AI right doesn't fall just on engineers it lands on everyone. Depending on choices made today, the rules shaping AI could either widen old divides or help build a digital world where more belong.

Finding ways around digital gaps in an age shaped by artificial intelligence means looking past faster code or smarter software. Clear records on how models work, outside checks for unfair patterns, tools available in many languages - these pieces matter just as much as teaching people what algorithms actually do. Oversight cannot lag behind progress; rules must grow alongside technology so decisions made by machines still answer to people. Systems

should serve communities, not replace judgment with automation dressed up as neutrality. How things turn out for artificial intelligence won't just hinge on faster chips or smarter code. Shaped by choices, ethics matter just as much as engineering. Done right - guided by care and clear rules - these tools could open doors, speed up tasks, help communities grow. Picture digital exclusion like layers in a system that quietly shut people out. Not everyone shows up equally in data sets, plus models often fail certain groups by design. Some folks just do not know how to make sense of automated choices affecting their lives. When rules fall short, and no one checks closely enough, problems slip through without answers. These pieces stack into something deeper: being online means little if access hides behind invisible barriers shaped by machines.

What stands out most is how the study avoids painting AI as automatically unfair or damaging to society. Instead, it points to a different truth - these systems grow from human environments, shaped by the goals and limits of organizations behind them. Seeing this connection matters if we want to leave behind simplistic stories about tech being wholly good or bad. Results hinge less on code alone but more on decisions around oversight, fairness in development, and involving people in the process. Left out by AI? It often has less to do with broken code and more to do with who gets left behind. Unequal internet access hides beneath clean interfaces. Language gaps creep in where machines assume fluency. Not knowing how algorithms work keeps people passive. Confusion grows silently inside automated choices. People notice when decisions feel unclear or unjust. Trust dips when outcomes seem arbitrary. A mix of reading through past studies and new survey data shows patterns. Understanding leads to higher comfort levels around machine-made results. Fairness isn't just ideal - it shapes real user reactions. Findings stay limited to specific settings. Yet one thing stays clear: design must include diverse voices. Hidden rules breed suspicion. Oversight needs teeth, not just promises. Tech alone won't fix imbalance. Social structures matter as much as software

logic. Progress means building bridges between engineers, communities, lawmakers. Systems should open doors instead of locking them.

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