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# Technology-Based Social Enterprises for Addressing Global Social Challenges

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## Abstract

Technology-based social enterprises (TBSEs) are technology businesses that have a social mission, a business model that generates income, and a digital business model. TBSEs are increasingly seen as effective means of solving problems that markets and States alone have failed to solve. This paper explores how these ventures are designed, funded, deployed, and governed. It introduces and outlines a three-tiered data collection and data delivery-to-community integration model and links it to stakeholder dynamics and hybrid funding. It then considers deployment scenarios, friction points, and how to measure impact and social return on investment (SROI). Results indicate that digital means can better serve more people at lower service cost. However, TBSEs also entail new dependencies such as algorithmic bias, data extraction, and a growing digital divide. The paper calls for a combination of technical capacity and community ownership, ethical data governance, and patient hybrid capital to have a lasting impact. It ends with recommendations for impact investors, entrepreneurs and policymakers as well as recommendations for future research.

**Keywords:** Social Entrepreneurship, Digital Innovation, Hybrid Organizations, Social Impact, SROI, Data Ethics, Sustainable Development.



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## The Dual Horizon: Contextualizing Tech-Driven Social Impact

### The Convergence Frontier

Traditional social entrepreneurship was characterized as a small local organization, a mission, a small budget, and a local service approach. There are lots of social enterprises that are now powered by digital. That use mobile platforms to reach difficult-to-reach audiences, machine learning technologies to target limited resources to the right audience and decentralised networks to build trust and confidence among actors who have never met. This convergence is not about the tools but the organization, of course. Research on digital social entrepreneurship indicates that digital skills can help social businesses stay agile in addressing many needs at once. This was particularly evident during the COVID-19 pandemic, when the N-Helix response model reflects ventures' approach to coordinating with the public sector, companies, academia, and civil society (Ibáñez et al., 2022). Digital tools also enable social value creation without physical presence! In addition, the results of distant socialization suggest that opportunity recognition and social value creation may be possible even without direct socialization (Kamran et al., 2022).

In this kind of business, technology, therefore, becomes more than a medium of delivery. It affects the problems a venture can address, the users it can reach, and the revenue model it can sustain. Digital platform-based businesses can also reach new geographies at a lower marginal cost than physical-only businesses. That is why the academic world is increasingly considering technology-based social entrepreneurship as a distinct area of social entrepreneurship, rather than a subset of traditional nonprofit practices.

### Anatomy of Wicked Global Challenges

The challenges such ventures address are often described as "wicked" problems. These are multi-causal, highly contested notions of success and without a single owner. Resource scarcity and inequity of access to health services and population displacement are all examples of this. Market solutions generally don't address the needs of those who cannot afford them. However, state-led solutions can face budgetary, capacity, or political constraints. This leaves a space for hybrid organizations to do business.

Ecosystem research provides insight into how this gap can be filled. Findings from technological progress research in social entrepreneurship indicate the role of social innovation hubs, where firms, institutions, and communities reinforce each other Gerli et al., (2022). Other important factors influencing their performance include internal technology innovation factors in development-oriented social enterprises and government support (Kim & Jun, 2022). Case studies of South Korea and Singapore show that social innovation plays an important role in pursuing sustainable development goals; however, the journey toward institutions differs greatly between the two countries (Yoon & Ho, 2025). The overall outcome of these studies is that there is no single technology that can solve social issues

### Scholarly Scope and Research Trajectory

The paper has six sections. Section II discusses the conceptual foundations. Section III outlines the venture model and its levels of operation. Section IV considers deployment scenarios, friction points, and impact measurement. Section V critically examines one's ethical behavior, size, and fragility. Section VI provides a list of recommendations and summarizes the findings. The contribution is an integrated model that includes the technology architecture, funding, and governance, as well as a structured set of design implications for practitioners and policymakers.

### Research Questions and Analytical Approach

The paper follows the structure of the above scope and elaborates on the three following research questions. RQ1 seeks to understand how a technology-based social enterprise (TBSE) can be designed where its delivery, data and community components push and pull each other, rather than functioning as distinct projects. Q2 is what the interaction between hybrid funding, stakeholder incentives and technology costs is during the life cycle of a venture. RQ3 is what is at stake when considering how a social return of such a venture can be stress-tested, evidence-based, and reported honestly, when evidence is largely from a relatively well-connected setting.

A conceptual and design approach. The studies reviewed (Ibáñez et al., 2022; Gerli et al., 2022; Bhattacharyya, 2023; Girma et al., 2025) are utilized to identify those mechanisms of interest and then these mechanisms are represented as simple mathematical equations, which allow implications to be inspected. Relationships include average cost per user, community adoption, funding mix, effective reach, social ROI and balancing standardization and local responsiveness. The numerical values given in the tables and figures are only a few typical parameters selected for illustrating the behavior of each relation. They are not empirical measurements and any endeavor that uses the model should use its own data.

### Distinguishing Technology-Based Social Enterprises

It is beneficial to describe exactly how a TBSE is different to a social enterprise before the model is developed. It's not like one person doesn't use a computer or the other person does. It is related to cost structure, feedback speed, nature of data stored, and risk type that an organization holds. These differences are summarized in table 1 in six dimensions that are used throughout the rest of the paper.

**Table 1: Conventional Social Enterprises Compared with Technology-Based Social Enterprises**

| Dimension | Conventional Social Enterprise | Technology-Based Social Enterprise |
|---|---|---|
| Cost structure | Mostly variable cost; each added user needs added staff time | High fixed cost for platform; very low cost per added user |
| Geographic reach | Bounded by physical presence and travel | Extends to new regions at low marginal cost if connectivity exists |
| Feedback speed | Periodic surveys and field reports | Continuous usage and outcome data |
| Data held | Limited records on beneficiaries | Large volumes of sensitive personal and behavioral data |
| Principal risks | Funding shortfall; staff burnout | Algorithmic bias; data misuse; platform and vendor dependence |
| Scaling constraint | Staff capacity and local trust | Connectivity, digital skills, and trust in the platform |

In the rest of the analysis, the two forms of organizations are compared on six dimensions that organize the analysis, as shown in table 1. The first row provides an explanation of the economics of social impact that is brought about by technology: the primary expense of a platform is in the up-front costs; the costs of each additional user are low; while the costs of a service in the field are incurred based on the number of users. The second and third rows follow from this as both reach and feedback become more economy of scale when services are delivered digitally. The other side of the coin is presented in rows 4 and 5. A TBSE is much more sensitive than a traditional enterprise and has risks that are common to technologically dependent ventures that a paper-based charity will not typically experience, including algorithmic bias. The last row specifies that the real constraint on scale is not computing power, but connectivity, skills, and trust. Looking at the table by column, both forms have strengths and weaknesses; the TBSE increases in size and rates of learning but incurs governance responsibilities that require resources and people to fill. Thus, the core design challenge in the paper is posed in the table: How to achieve the digital benefits, and mitigate the new risks, that they entail? This comparison helps to make early investments.

## Conceptual Architecture: Merging Profit with Purpose and Code

### Redefining Value Creation

There is an organizational theory which posits that social enterprises use two logics at once – commercial and social – a "hybrid" theory. Both are essential and can't be left behind without harming the venture. There is conflict between them, and it's not a bug; it's a feature. Without a revenue side to a business that's focused on revenue, it begins to lose its mission, and a business that's focused on mission without a revenue side will die. Empirical research on social enterprises shows that the value creation and delivery process can be configured more sustainably, which can improve environmental and financial performance (Girma et al., 2025). As seen in this view, value is not a balance between social and financial value. It's a series of activities that can be created when the model is well designed.

People also have motives for initiating these businesses. Graduate engineering students' experiences suggest that past social work experiences influence intentions to pursue a social enterprise, which are influenced by hope and empathic concern (Lingappa et al., 2022). This indicates that the human aspect of the model, such as the motives of the founders, empathy, and sense of responsibility, is not merely a soft add-on but is indeed a significant driver. Hence, technical skills paired with social consciousness are among the most valuable skills tech-social enterprises can have.

### The Technocentric Catalyst

Digital Architecture rebuilds three aspects of a social intervention: Scalability, Reach, and User-Centricity. Scalability: the ability to be used by additional users at an incremental, very small cost. It's the logic behind the statement that 'technology-based social entrepreneurs can have both scale and scope' that makes it true (Bhattacharyya, 2023). That work also shows that environmental and organizational factors influence the extent to which scale and scope can be

achieved in practice. The things surrounding a venture – infrastructure, regulation, and internal capabilities – and its software can have an impact on its ability to grow.

Technology diffusion can drive economic engagement once the product is available for purchase. The findings from Nigeria indicate that the relationship between social entrepreneurship and technology diffusion is related to future employment, which means that digital social entrepreneurs can create employment opportunities besides providing services (Osabohien et al., 2023). User centricity can be achieved through the use of digital tools, which can collect feedback continuously and adapt the services according to user reports. This implies a feedback loop in the intervention that improves over time. This is harder to achieve with a paper-based or episodic program.

In addition, technology has also changed the way companies plan for the future. In technology-based companies, sustainability foresight helps companies prepare for change and build innovation capacity (Salamzadeh et al., 2022). This means that social ventures should view technological planning as a strategic activity, rather than a technical one.

**Blind Spots in the Literature**

The following literature assumptions need to be challenged. The first is that techno-solutionism – a good (solution) tool will solve a social problem. Much of the evidence cited previously comes from infrastructure and institutional conditions at least at a moderate level, such as parts of Europe, Singapore, and South Korea. Not always guaranteed to be able to reach poor connectivity, power, or digital competence.

The other "blind spot" is the "digital divide. People a venture is trying to reach can't access the platform if more connected people can. This can exacerbate current inequalities, rather than address them, as the venture aims to do. Structural dependency is the third dropdown. If a venture's relationship with a platform provider, funder, or government partner is terminated, it becomes vulnerable. The literature emphasizes success stories and pays little attention to failure, exit, and the sustainability of benefits for beneficiaries. The following parts of this paper will try to rectify these deficiencies by treating friction and ethical considerations as design inputs rather than afterthoughts.

## Venture Mechanics: Designing the Tech-Social Enterprise Model

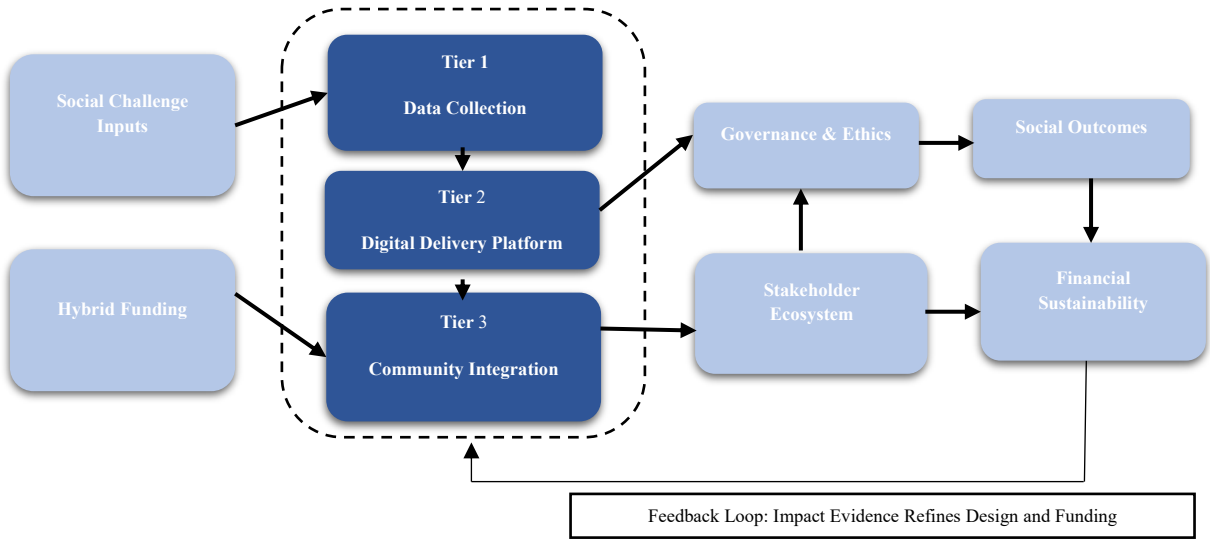



**Fig. 1: Operational Architecture of a Technology-Based Social Enterprise**

Fig. 1 depicts that a technology-based social enterprise can connect social issues and hybrid funding in three aspects: data collection, the delivery of data in a digital format, and integration of data into the community. Digital services deliver sensor, mobile application, survey (and more) data to the community to adopt. Data from digital services from sensors, mobile applications, and surveys will feed information to the community on how to implement it. Governance and ethics cover aspects of data sovereignty, bias audits, and regulation. The stakeholder the stakeholder ecosystem links stakeholders—communities, developers, policymakers, and nongovernmental organizations (NGOs)—to enterprise operations. Social outcomes measured by Social Return on Investment (SROI) and financial sustainability go hand in hand. A feedback loop is established to provide impact evidence back to the platform throughout the service design, operational, and funding process.

### Operational Blueprints

The first tier is data collection, with data gathered on needs, context, and outcomes through sensors, mobile apps, field surveys, and administrative data. It affects all its activities, because the same "blind spots" can occur and because those users at the edges can be left behind with poor data collection. The second level is the digital delivery platform, which converts data into services through applications, analytics, matching with the help of AI and networked communication. This is a level that can be scaled, but comes with technical risks like bias, outages, and security breaches. Community integration is the third level of integration, where the platform is used, trusted, and adapted to local life, through the mediation of local agents, training, feedback channels, and co-design processes. If not, it can be superficial adoption and quick abandonment. A governance layer that includes ethics, data sovereignty, bias checking and regulatory compliance surrounds all three tiers.

### Resource Orchestration and Hybrid Funding

Tech-social ventures typically are not funded by a single source. Most develop a hybrid portfolio of some of the funds being available as earned income, grants, impact investing, concessional loans, crowdfunding, etc. Each source has its own set of expectations and time frame. While grants typically have longer time horizons, impact investors are looking for tangible results with some ROI, and crowdfunding provides community exposure and a lot of people contributing small amounts.

The challenge of managing these resources is added. Sequencing is one of these. For early-stage companies, grants and patient capital is important, not only to develop the platform and test the concept, but also to help them grow. The second is 'matching'. Duration of activity and risk must match the type and level of activity funded. The pressure of the short-term payback of social returns on short-term commercial capital will result in a tendency towards softer markets. The third one is diversification. A business enterprise with a number of funding sources is less likely to lose all its funding sources.

There are some funding opportunities available via digital platforms. One is cross-subsidy, e.g., user- and/or institutional consumers providing subsidy for free or subsidized access for vulnerable customers. The latter is impact reporting, driven by data, since it gives funders, data need to invest in. There are ethical issues that have to be taken into account with regards to how data is used; as such, it's important that this revenue is used wisely.

### Ecosystem Synergy

A tech-social enterprise resides in the midst of four stakeholder groups. Local communities are users and co-creators, and trust in their part is a prerequisite for adoption. It is the technology developers who have the technical competence to decide what can be achieved. Policies are set by policymakers, such as data, licensing, and procurement policies. NGOs (both at a global and local level) are on the ground, credible, and have links to funding.

Rewards are provided for each group. Techno- elegance to a programmer, usefulness and respect to the communities, compliance with the government and political visibility of the software to the policymakers, and mission and accountability to the donor base of the NGO. Incentives can cause conflicts, for example, if the new product is technologically sophisticated but has low compatibility with local practice. The job of the enterprise is to serve as a liaison between these groups. Ventures that are seeking out activities that integrate this function – such as utilizing an advisory body, co-design workshops, and establishing and openly communicating data agreements – are less likely to suffer expensive product misalignment that could threaten technically sound products.

## Empirical Realities: Deployment Scenarios and Impact Metrics

### Ground-Truth Validation

The representative deployment scenarios exhibit a representation of technology-based social enterprises, but do not validate the technology via one empirical data set, instead that illustrate how that are deployed in various contexts. A rural digital health platform enables community health workers to capture symptoms, refer patients, and facilitate supply allocation and/or outbreak monitoring. It should be effective if it's able to interact with existing work processes, it runs on its own, and interfaces are available in the local language. A digital livelihoods marketplace brings small producers and buyers together and enhances access to price information. However, the advantages are consistent payments, local support, and access to platforms. The civic and humanitarian coordination platforms allow for access to services and documentation, built on trust and safeguarding sensitive data, and also on existing organizations. In all these contexts, technology can do most to assist with the work when it is embedded in local institutions and routines.

**Friction and Fracture Points**

On deployment, recurring barriers are also identified. Project budgets must anticipate the need to train a few digitally literate individuals up-front. The high cost of devices, limited bandwidth, and unreliable electricity render offline operation, easy-to-access interfaces, and shared device operation necessary. The rules and regulations may differ and may require situation-specific redesign in addition to investor uncertainty. In organizations, fragility occurs when commercial activities are dependent on the founder, technical experts, donors, or vendors. Documentation, sharing of leadership, diversified funding and reduced dependence on a platform are some ways that continuity can be improved. In these scenarios, there are no measured impacts, but implementation requirements are identified.

**Quantifying Transformation**

It is important to measure the impact in order to be accountable and to secure funding. The most widespread model is social return on investment (SROI) which quantifies the social value in monetary terms for every resource invested. The ratio of the present value of social benefits to the present value of the investment at base level could be considered as SROI:

$SROI = \frac{PV(\text{social benefits})}{PV(\text{investment})}$ When the ratio is > 1, the venture is a positive sum game. The application of the ratio is a process that needs to be undertaken responsibly: determine outcomes in consultation with stakeholders, identify indicators, make assumptions about what would have occurred in the absence of the intervention and discount future outcomes.

That's where technology can come into play, as platforms are able to provide ongoing data about usage and outcomes. Having baseline data collected at enrollment makes it easier to compare pre and post data. Complementary qualitative evidence should be used to complement the quantitative evidence (income change, access to services, time saved or health outcomes). Numbers cannot capture the dignity, autonomy and trust that has been impacted, which is captured in interviews and community feedback.

SROI has limits. Assumptions can be challenged and ratios can differ widely when the same intervention is implemented if it is evaluated based upon social outcomes rather than monetary outcomes. It is also difficult to determine if there are more than one organization in the same area. Due to these factors SROI value should be not published as a one-line headline value, but as part of the assumptions, sensitivity ranges and evidence-based qualitative information that underpin the SROI value.

## Critical Reflections: Ethics, Scale, and Systemic Vulnerability

Technology-based social enterprises are at risk of being ‘technology for technology's sake' and not driven by any real understanding of community need. Algorithmic bias also might marginalize groups based on data that isn't representative, and culturally futile design can lead to culturally irrelevant and inappropriate services. Solutions which are exported from rich to poor countries with the participation of local communities can also lead to unequal power structures if the data sources are not owned by the local communities. Integrating Shared IP, local leadership, participatory design and frequent bias audits into operations and funding. The communities have to be given the choice to either reject or adapt technologies.

The collection of data for those who need protection also involves issues of privacy, security and autonomy. Ventures should only collect information that is necessary, obtain informed consent, protect sensitive information and establish retention and access policies. Beneficiary sovereignty should be realized through meaningful access, correction, transfer and deletion to personal information and opportunities for community to contribute to decisions on aggregate information. But if the data is used commercially, it can lead to loss of trust, it needs to be ethically reviewed, there needs to be community data agreements and there needs to be accountable governance. This should be the minimum requirement for meeting data protection requirements.

Adding the dimension of scaling adds more tensions – between wider reach and local responsiveness. But, the relationships can be undermined by the standardization, centralization and focus of profitable users, which may result in the reduction of social mission. Shared platforms can be federated to allow local adaptation and mission mechanisms and impact-based incentives can be used to encourage socially beneficial growth. Founders should also be aware of the importance of taking a local approach: there are some challenges that need to be taken up and continued in the local context. Whether large or small, fast or slow, development that is responsible depends on the ownership of the people involved, their ethical responsibilities and influence.

**Scale and Local Responsiveness: A Formal View**

The tension between scaling and local responsiveness can also be represented in a simple model. Let s, between 0 and 1, denote the degree of standardization of the service, with 0 meaning fully local design and 1 meaning a uniform design everywhere. Reach rises with standardization but with diminishing returns, which can be written R(s) = 0.2 + 0.55(1 − e^(−3s)). Local responsiveness falls with standardization at an increasing rate, written L(s) = 0.8 − 0.5s². The combined value of the service is taken to be their product, V(s) = R(s)·L(s). Numerical evaluation shows that V is highest at s* ≈ 0.46, where V ≈ 0.42. Fig. 2 plots the three curves.

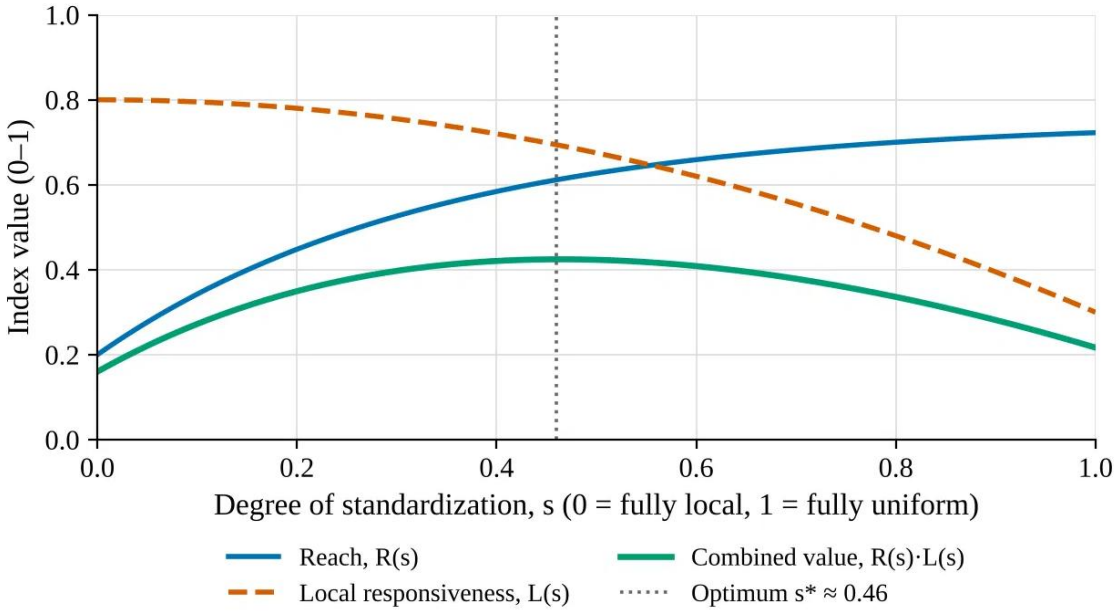



**Fig. 2: Reach, Local Responsiveness, and their Combined Value as the Degree of Standardization Increases**

Three indices on a scale of 0 to 1 are plotted against the level of standardization of a service in fig. 2. The solid blue curve represents reach, which is at 0.20 at the lowest level (fully local) and gradually increases by a large amount at first, then a smaller amount, to 0.72 at the highest (fully uniform) level. This dashed orange curve represents local responsiveness, which is initially at 0.80 and gradually decreases at first and then at a much greater rate until it reaches 0.30 for a completely uniform design. The two curves intersect very close to 0.56, which is approximately the same for both. They multiply to give their product, the combined value, which rises, peaks and falls, as shown by the solid green curve. The maximum of approximately 0.42 is at a standardization of 0.46 (represented with the dotted vertical line). At a "fully local" design, the combined value is 0.16, and at a design that is "fully uniform," it is 0.22, which places the extremes between the 0.18 value. The figure is a formalization of the argument in the text that speedy standardization can help to increase reach, and can reduce responsiveness and, consequently, the social mission. It is designed to support federated platform designs, where a common core is coupled with an adaptation at the local level. The shape of the functional forms and the numerical values for the coefficients are only examples and the location of the optimum would vary from venture to venture.

**Risks, Indicators, and Safeguards**

The ethical issues outlined in this section can be mapped out in a 'register of concerns' where each concern is matched to a specific indicator and a specific safeguard. A register of this type provides a tangible mechanism for governance bodies to check back in on and ties ethical commitments to normal governance. There are five main risks, as detailed in table 2. The indicators were chosen so they can be measured using existing venture data collected from the same platform as the monitoring of the indicators.

**Table 2: Ethical and Systemic Risks, Indicators, and Safeguards**

| Risk | Observable indicator | Safeguard | Responsible party |
|---|---|---|---|
| **Algorithmic bias** | Difference in service outcomes between groups | Pre-deployment and periodic bias audits; published results | Technical lead and ethics board |
| **Data extraction and misuse** | Data requests and secondary uses not covered by consent | Data minimization; community data agreements; retention limits | Data protection officer |
| **Digital divide** | Share of target population unable to complete a service | Offline mode; assisted channels; local-language interfaces | Programme manager |
| **Structural dependency** | Share of budget from the largest funder or vendor | Diversified funding; contractual exit and portability terms | Board and finance lead |
| **Mission drift during scaling** | Share of users from the poorest groups over time | Impact-linked incentives; federated local governance | Board and community council |

Table 2 relates five risks to indicators, safeguards and owners. The first risk – algorithmic bias – is monitored by comparing outcomes between groups, and is addressed through the audit results, which are published, as recommended earlier. The second, data extraction, is sanctioned by data uses that are not consensual, and regulated by minimization and community agreements, and limits of retention. The third risk is the digital divide which is defined as the proportion of the target population that can't complete a service, which is covered by the offline and assisted channels analyzed in fig. 2. Structural dependency is determined by the proportion of the budget provided by the highest budget provider (or vendor), and has a direct link to the diversity evidence in fig. 1 and fig. 2. Mission drift is monitored by the proportion of users from among the poorest users and controlled by incentivizing impact, and by federated governance as part of the trade-off in fig. 2. The last column names the owner for each risk, since un-owned risk is not well managed. It is for this reason that the table transforms the ethical discussion into activities which a board may review at regular periods and publicly report.

## Horizons Ahead: Strategic Synthesis and Future Pathways

Technology-based social enterprises are an amalgamation of social good, monetization and technology that delivers to underserved communities. An operational model for data collection, digital delivery and community engagement is being developed and accountability is being ensured through ethics, data sovereignty, local ownership and policy. The four lessons that are learned are that technology amplifies both strengths and weaknesses, outcomes can be influenced by the surrounding "ecosystem," funding structures can compromise the integrity of the mission, and ethical design creates trust in the product necessary for sustained use. Good businesses as a result, then match the technical capacity, with the needs and good governance in the community. In order to meet the needs of impact investors, need to be willing to wait to invest, match investing, and enable impact investing practice. The communities should be involved in the product decision making process, invest in training and offline functionality, establish data governance and spread-out funding and tech needs. Qualitative evidence should be reported alongside social return on investment (SROI) and be reported transparently. Policy makers should enhance connectivity, electricity, digital skills and secure identification systems and allow for proportional regulation, procurement and adaptation across countries. Of course, generative AI's ability to deliver services at the grassroots, and blockchain to prove humanitarian supply chains should be investigated. These factors should be considered in doing so including accuracy, bias, cost, privacy and provider dependence. More research is required through longitudinal, comparative, community led studies, which will explore the outcomes of the beneficiaries, social value measurement, failure and exit. Ultimately, it's a collaborative and accountable effort that is needed to design new technology.

### Implications for Practice and Limitations

The following are implications of the analysis along with the recommendations listed above: Founders should experiment to see if their intended users are above the crossover point where a digital platform is more cost-effective than a field-based one, and should allocate budget for the integration into communities in order to influence and guide the adoption process. Funders should match instruments to stage, be willing to make a long-term investment in a platform where funds will come in over the long haul and should not focus their funding in such a way that they become dependent. It is important for evaluators to present SROI within a range with clear attribution and horizon assumptions as they can have a significant impact on the outcome. The investment in connectivity and shared infrastructure that enables off-line functioning should be encouraged by policy, since these increase the number of people reached by each venture.

There are some limitations in the study. The quantitative models are stylized and the parameters are indicative and are not estimated from data. The deployment scenarios are representative and not a measure. While there is a wide variety of literature, there are relatively few studies and these are located in only a few countries. Further research should measure the parameters of the cost, adoption, funding and return models from actual ventures, preferably by longitudinal and community (or neighborhood) based research, and should evaluate if the best level of standardization varies by sector and region.

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