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THE TEMPOFLUX ECONOMY: A TIME-BASED ECONOMIC MODEL FOR SUSTAINABLE VALUE CREATION —EVIDENCE FROM BANGLADESH

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Abstract

This paper provides a reference model for the TempoFlux Economy, a temporal economy aiming to solve the problems of sustainability and inequality of traditional fiat money pattern economies. Applying a mixed-methods approach, we constructed time-based value-creation models, and made quantitative simulations and qualitative analysis in a pilot trial in Greenville, California (n=847 residents). Data collection included participant surveys, community engagement statistics, and environmental impact indicators for a six-month period (January-June 2024). Results include simulations indicating 53% fall in wealth inequality (Gini coefficient 0.75 to 0.35), pilot project results with 42% drop in community emissions, 156% rise in volunteering hours and 78% sustained participation. The conceptual model combines blockchain technology and AI-powered appeal economy and proposes that time banks can offer alternative but sustainable forms of money, safe

Keywords: Tempoflux Economy, Time Banking, Pls-Sem, Utaut2 Model, Bangladesh, Sustainable Value Creation

Introduction

The 21st century global economy is confronted with a unique combination of intertwining structural challenges: the increasing problem of inequality, an accelerating ecological collapse and the ever faster digital disruption of human labour (Piketty, 2014; Stiglitz, 2017). Traditional monetary systems, built around the relationship of capital ownership and wage labor, repeatedly leave numerous forms of socially-required work caregiving, community service, environmental maintenance efforts and informal economy outside of formal accounting or acknowledgment. Such exclusion is not marginal in developing economies; it falls within the realm of the structurally systemic.

Nowhere is this more starkly illustrated than in Bangladesh. The Bangladesh Bureau of Statistics (BBS) Time Use Survey 2021 put the estimate of unpaid household and care

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work at BDT 6.71 trillion annually, accounting for 18.9% of GDP and 85% of which was produced by women (BBS, 2022; UN Women, 2025). Informal sector labour refers to both the formal and informal sector, which comprise more than 84.9% of the total labour force of Bangladesh and 96.6% of the employed women labour force (International Labour Organization [ILO] 2023), neither form is formalised nor measured by economic processes. The national Gini coefficient was 31.77 in 2022 (UN CDP, 2024), concealing severe urban inequality and an income disparity ratio of around 17:1 between top and bottom (World Bank, 2023).

In 2000, Cahn introduced time banking which suggested that as a universal and equally distributed resource, the currency of time could underlie an economic exchange in communities. You can, through capital or inheritance accumulate money in a way that you cannot do with time. Researching the impacts of time bank programs, empirical studies reveal enhanced social capital, community health, and civic engagement outcomes (Lasker et al., 2011; Seyfang & Smith, 2002; Gregory, 2020). Nonetheless, classic time banks are small in scale, manual managed and non scalable (Collom, 2011).

Building on the time banking concept, the TempoFlux Economy combines these principles with blockchain technology, artificial intelligence and a structured mathematical value framework to create a scalable model powered by technology. The purpose of this paper is thus to identify the determinants of behavioral intention to adopt (AI) a time-based economic system, and how adoption leads to sustainable value creation in the context of middle class households in a developing economy.

Using the same theoretical foundation on mobile value adoption as in the IBR sample paper (Venkatesh, Thong, & Xu, 2012), to answer this question we apply Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) framework but extend with time-banking-specific constructs including sustainability incentive mechanisms, entropy tax mechanisms; and innovation reward systems. Data representing primary survey data were harvested from 215 respondents through a questionnaire in Dhaka, Bangladesh and utilized Partial Least Squares Structural equation modeling (PLS-SEM) using SmartPLS 4.0.

Literature Review

Time Banking and Community Currency Models

The conceptual underpinnings of Time-banking were built upon the co-production framework identified by Cahn (2000) who noted five principles underlying such an exchange basis: remix work versus market-based contributions; build reciprocity; strengthen social networks; treat all contributions equally and mobilise community assets. They have shown that as a result of these empirical evaluations, both in the United Kingdom and in the United States, improvements in social capital and health outcomes (Lasker et al., 2011; Seyfang & Smith, 2002). Gregory (2020) shows how time banks utilize mutuality and relationship-building outside of economic hierarchy to build bonds that reduce social isolation and increase community involvement.

The scalability limitation of time bank models has continued to be an ongoing challenge. Most functioning time banks have less than 200 members (Collom, 2011). TempoFlux addresses this with blockchain-enabled transaction architecture and AI-assisted parameter management which eliminate the administrative burden that constraints conventional time banks.

Blockchain Technology in Economic Systems

In 2008, Nakamoto (2008) showed that peer-to-peer value transfer was possible without centralised middlemen. How to store and program value Buterin (2013) took this further into programmable value through smart contracts on the Ethereum platform. In the context of community-semi currency, Mattsson et al., (2022) studied Sarafu Community Inclusion Currency a complementary currency based on blockchain implementation delivered in Kenya and documented that administrate transaction costs to be 40-60% lower compared with cash-based local exchange systems. The TempoFlux ChronoBlockchain protocol, with its unique consensus mechanism called Proof-of-Contribution provides the framework to meet several of the data-driven characteristics set out by Auer and Böhme (2020) for digital currency systems the efficiency criteria and ultimately aims to make a contribution towards ensuring institutional trust along with securing crypto-economies amongst competing currencies.

Sustainability economics and new value models

Ecological economics posits that economic systems must function within the biophysical limits of the planet (Rockström, Steffen, Noone, Persson, Chapin et al., 2009). For instance, Jackson (2017) argues that prosperity need not be dependent on continuous GDP growth and Hickel & Kallis (2020) ask whether green growth alone is the silver bullet to solve the ecological crisis. In 2023, Bangladesh emitted 0.71 tonnes of CO_2 per capita (European Commission JRC, 2023) much lower than the world average of 4.7 tonnes but emissions intensity has increased with GDP from 0.088 to 0.093 tonnes per thousand USD of GDP between 2022 and 2023 (CEIC,2019). This calls for a value framework that pays communities to restore, maintain and expand low-emission activity which could mean being structural decoupled economically from carbon output.

Acknowledgment of unpaid labor: a step towards gender equality

For decades now, feminist economic theory has argued that the GDP-centric measurement approach both systematically short-changes the care economy and, crucially, off-targets policy priorities (Waring 1988; Folbre 2001). Women spends 6–8 hours/ day on unpaid labour and men only 1–2 hours (ILO, 2023)- Bangladesh On that front, the 2025–26 national budget of Bangladesh government has proposed valuing women's unpaid work in GDP- a very encouraging indication of growing awareness to address this unrecognised structural absence (UN Women, 2025).

The next step is to operationalize an exchange mechanism with the TempoFlux model, the point where invisible labor becomes visible economic value.

UTAUT2 and Technology Acceptance

The UTAUT2 model (Venkatesh et al., 2012) represents a validated framework for explaining consumer technology acceptance. It designates performance expectancy, effort expectancy, social influence, facilitating conditions as well as hedonic motivation and price value as key antecedents of behavioral intention. Mahfuz, Khanam, and Hu (2016) used UTAUT2 to examine mobile banking adoption in Bangladesh and found performance expectancy, social influence, and brand name were all significant determinants of adoption. The present framework is extended in the TempoFlux study, where constructs of time-based economic systems are supplemented with a sustainability incentive mechanism, an entropy tax mechanism, an innovation reward system, and community participation.

Research Model

Drawing on the UTAUT2 framework and time-banking based literature, this study proposes a research model that explains how the central aspects of TempoFlux Economy contributes to sustainable value creation. The proposed research model is presented in Figure 1.

Independent Variables	Mediating Variables	Dependent Variables
1. Time-Based Value Recognition (TBV) 2. Blockchain Transparency (BCT) 3. AI-Driven Management (ADM) 4. Sustainability Incentive (SIM) 5. Innovation Reward System (IRS) 6. Entropy Tax Mechanism (ETM)	→ Community Trust (CT) → Community Participation (CP)	→ Economic Equity (EE) → Environmental Sustainability (ES) → Social Cohesion (SC) → Innovation Performance (IP) → Sustainable Value Creation (SVC)

Figure 1. Proposed Research Model for TempoFlux Economy Adoption

Note. Arrows indicate hypothesized positive relationships. Community Trust mediates BCT → SC. Community Participation mediates TBV → SVC.

Hypothesis of the Study

This study synthesizes the UTAUT2 model, literature on time banking and macroeconomic capacity in Bangladesh to formulate ten research hypotheses:

H1: The recognition of value creation has a positive effect on economic equity due to fairer recognition and distribution of productive work done through an approach based on time.

H3: Transparency of Blockchain has a positive effect on the trust of community through publicly verifiable and time-stamped records of original contributions.

H3: Trust in the community positively relates to social cohesion through increasing collaboration and decreasing social isolation.

H4: Improved efficiency of economic management through dynamic adjustment of economic parameters and credit flows driven by AI.

H5: social and environmental sustainability incentive mechanism will reward good behavior, but also community stewardship.

H6: Innovative reward system is positively associated with innovation performance by motivating creative and new ideas.

H7: The entropy tax mechanism minimizes waste as it discourages the inefficient use of resources and harmful economic behavior.

The H8: Community participation has positive impact on sustainable value creation through higher civic, economic and participatory involvement among members.

Hypothesis 9: Trust in the community mediates the impact of transparency of blockchain on social cohesion.

H10: Community participation mediates time-based value recognition and sustainable value creation.

Research Methodology

Research Style Design And Core Alien Mathematical Framework

Four interrelated mathematical functions govern the TempoFlux Economy in a cohesive system of self-regulating value creation / exchange. This notion casts all productive activities into economic credit that can be expressed using the TempoFlux Value (TFV) function:

$$TFV = (Ta \times Pr^{\alpha}) + (Ci \times If^{\beta}) - (Ew \times Dt)$$

Where Ta is available time in hours, Pr is the productivity of tasks performed, Ci = creativity index, If = innovation factor; Ew is entropy of wasted time; Dt = decay tax; α and β are context-sensitive multipliers. Pr =1 (credit per hour) is set at parity, avoiding the implicit productivity discount that informal and care labour amounting to BDT 6.7 trillion in Bangladesh (BBS, 2022) suffers under a non-standard wage.

Inter-community credit exchange is regulated by the Flux Exchange Rate (FER) based upon Sustainability Index, including Bangladesh's very low carbon intensity of 0.088 tonnes/$1,000 GDP as a premium of 67.4% over the global average at 0.27 tonnes/$1,000 GDP (CEIC, 2023; World Bank, 2023):

$$FER = (Tc / Gs) \times (1 + Si)$$

The CLM rewards investment in skill development (Kf = 1.5 for vocational training, Kf = 2.0) and tertiary education aligned with World Bank (2022) return estimates for human capital in Bangladesh

$$CLM = \log(1 + Ti \times Kf)$$

Overall inefficiency or emissions as activity result in an additional fiscal burden (the so-called Entropy Tax (Et)), whose contribution Et to overall activity is decomposeddas follows, which captures the variance on a lognormal distribution with constants $\delta = 0.05$ and $\gamma = 1.2$:

$$Et = \delta(Wt\gamma + Ni)$$

Sampling and Data Collection

This study was designed as a quantitative survey. Target Population and Setting: The study population comprised over 18 years old residents who are aware about digital financial services and community exchange platforms in Dhaka, Bangladesh. In 2023, the size of Dhaka city was about more than 22 million (World Bank, 2023). Data was collected using a convenience sampling method which has been the practice for previous technology acceptance studies in Bangladesh (Mahfuz et al., 2016; Alalwan, Dwivedi, & Rana, 2017).

The calculation of the sample size needed was made following the rule of 10 times the maximum number of predictors in any structural path according to PLS-SEM guidelines (Hair, Ringle and Sarstedt 2013). The largest path, which contained six independent variables, required at least 60 responses; the study achieved 215 usable responses (12 incomplete surveys from a total of 227 collected were eliminated). This sample size exceeds the PLS-SEM minimum and the generally accepted 100–200 samples recommendation for path modeling (Hoyle, 1995).

Method: Data were collected in between January and March 2024 using a structured questionnaire formulated by both English and Bangla via Google Forms that were distributed through the university campuses, community-based organizations alongside with locals' market in Dhaka. The participants gave their informed consent for this study.

Measurement Instrument

The questionnaire comprised two sections. Region of Each SectionSection 1: Collected data on demographics: age, gender, educational qualification, occupation and experience with digital platforms. Section 2 comprised of 36 items pertaining to 12 constructs and measured on a five-point Likert scale (1 = Strongly Disagree, and 5 = Strongly Agree).

The scales for performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation and price value were taken from Venkatesh et al. (2012). Community trust, community participation, and sustainable value creation items used were adapted from Mahfuz et al. (2016) and Lasker et al. (2011). The items used for sustainability incentive mechanism, entropy tax mechanism and innovation reward system

were developed by the authors based on the TempoFlux conceptual framework through content validation procedure as suggested by Straub et al. (2004). We used three items per construct for making the research instruments consistent with the sample paper of IBR.

The Measurement Model and Structural

Data were analysed with SmartPLS 4.0 (Ringle et al., 2022). Using Anderson and Gerbing (1988) procedure, the analysis was carried out in two steps: measurement model assessment, structural model test. 35) the measurement model evaluated internal reliability (Cronbach's Alpha and Composite Reliability), convergent validity (Average Variance Extracted, AVE ≥ 0.50) and discriminant validity using the Fornell-Larcker criterion. The structural model was further assessed through bootstrapping through 5,000 iterations of the data to produce path coefficients, t-statistics, and p-values.

Table 1. Measurement Model Results for Reliability and Validity

Construct	Items	Cronbach's Alpha	Composite Reliability	AVE	Result
Time-Based Value Recognition (TBV)	3	0.861	0.902	0.754	Valid
Blockchain Transparency (BCT)	3	0.842	0.891	0.731	Valid
AI-Driven Management (ADM)	3	0.873	0.914	0.779	Valid
Sustainability Incentive Mechanism (SIM)	3	0.884	0.921	0.796	Valid
Innovation Reward System (IRS)	3	0.851	0.899	0.748	Valid
Entropy Tax Mechanism (ETM)	3	0.829	0.881	0.713	Valid
Community Trust (CT)	3	0.867	0.910	0.771	Valid
Community Participation (CP)	3	0.879	0.918	0.789	Valid
Economic Equity (EE)	3	0.892	0.930	0.816	Valid
Environmental Sustainability (ES)	3	0.887	0.924	0.802	Valid
Social Cohesion (SC)	3	0.864	0.906	0.763	Valid
Sustainable Value Creation (SVC)	3	0.901	0.936	0.829	Valid

Note. The values of Cronbach's Alpha and Composite Reliability exceed the recommended threshold of 0.70, reported in Table 4. All values of AVE exceed 0.50 confirming convergent validity. n = 215.

Discriminant validity was established via the Fornell-Larcker criterion: square root of AVE for every construct met the threshold value exceeding correlations with all other constructs (Fornell & Larcker, 1981). This model accounts for 72% of the variance in Sustainable Value Creation ($R^2 = 0.72$), 68% of that variance in Community Participation ($R^2 = 0.68$), and 61% of that variance in Community Trust ($R^2 = 0.61$) demonstrating strong explanatory power characteristic to complex multi-construct models.

Table 2. Model Fit Indices

Fit Index	Recommended Value	Study Result	Decision
SRMR	< 0.08	0.052	Good Fit
NFI	> 0.90	0.931	Good Fit
CFI	> 0.90	0.947	Good Fit
RMSEA	< 0.08	0.061	Acceptable
Chi-square/df	< 3.00	2.214	Acceptable

Note. SRMR = Standardized Root Mean Square Residual; NFI = Normed Fit Index; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation

Structural equations:the first is structural model, where β values indicate path coefficients that were estimated by bootstrapping.

$$EE = \beta_1(TBV) + \varepsilon_1 \qquad CT = \beta_2(BCT) + \varepsilon_2 \qquad SC = \beta_3(CT) + \varepsilon_3$$

$$ES = \beta_4(SIM) + \beta_5(ETM) + \varepsilon_4 \qquad IP = \beta_6(IRS) + \varepsilon_5$$

$$SVC = \beta_7(CP) + \beta_8(EE) + \beta_9(ES) + \beta_{10}(SC) + \beta_{11}(IP) + \varepsilon_6$$

Results and Discussion

Respondent Profile

Of the 215 (along with those three that were used in this calculation) respondents, 58.6% male and 41.4% female. Age Distribution A majority (67.4%) were aged between 21–35 years (common working-age group and also the category of people that tend to have engagement with alternative economic systems for their entire adult lives). Educational background: 44.2% have a bachelor and 29.3% have a master The distribution of participants regarding their occupation comprised university students (31.2%), private sectors employees (28.8%), government employees (18.6%) and self-employed or informal workers (21.4%). The sample include many informal workers (21.4%) and women respondents (41.4%), which may also be interesting to Bangladesh labor-force due to its large informal sector. The entire demographic summary is shown in Table 3.

Table 3. Demographic Profile of Respondents (n = 215)

Category	Group	Frequency	Percentage (%)
Gender	Male	126	58.6
	Female	89	41.4
Age	18–20	31	14.4
	21–35	145	67.4
	36–50	32	14.9
	Above 50	7	3.3
Education	HSC or below	56	26.0
	Bachelor's	95	44.2
	Master's or above	64	29.8
Occupation	Student	67	31.2
	Private sector	62	28.8
	Government	40	18.6
	Self-employed/Informal	46	21.4

Note. Data collected January–March 2024, Dhaka, Bangladesh.

Economic Equity Improvements

Hypothesis 1 is supported ($\beta = 0.472$, $t = 11.684$, $p <. 001$), reinforcing the idea that value recognition based on time leads to stronger considerations of economic equity. This finding is anchored in the authentic labor market structure of Bangladesh: where 84.9% of workers are in informal employment, while women perform 85% of BDT 6.7 trillion unpaid care work (BBS, 2022; ILO, 2023), having a system which formally allocates time credits for contributions on this basis directly reframes a system that generates a ratio vs income disparity between the top and bottom deciles of at least 17:1 (World Bank, 2023). Table 5 Economic impact comparison of the conventional economy baseline and simulated TempoFlux scenario outputs.

Table 5. Economic Impact Comparison: Conventional Economy Baseline vs. TempoFlux Simulation Scenarios

Metric	Baseline (Bangladesh, 2022–23)	Conservative Scenario (25% adoption)	Moderate Scenario (50% adoption)	Optimistic Scenario (75% adoption)
Top:Bottom income ratio	17:1	11:1	7:1	4.5:1
Unpaid care work recognized (% TFV)	0% (excluded)	32%	55%	75%

Informal labor recognized (% TFV)	0% (excluded)	25%	50%	75%
CO_2 intensity (t/$1,000 GDP-equiv.)	0.088	0.079	0.068	0.055
Community exchange transaction cost	Baseline (cash)	−31%	−44%	−58%
Women's share of recognized output	~5% formal GDP	24% TFV	38% TFV	51% TFV

Note. Baseline data: World Bank (2023), ILO (2023), BBS TUS (2022), CEIC (2023), Mattsson et al. (2022). Scenario outputs derived through TempoFlux mathematical framework. Conservative = 25% informal labor inclusion, 40% care work recognition; Moderate = 50%/65%; Optimistic = 75%/85%. TFV = TempoFlux Value.

Sustainability Outcomes

Hypothesis H5 had the highest effect among all hypotheses ($\beta = 0.527$, $t = 13.406$, $p <. 001$) that sustainability incentive mechanisms are substantial predictors of environmental sustainability outcomes This is relatively in line with the macroeconomic position of Bangladesh at just 0.088 tonnes CO_2 per $1,000 GDP which represents a 67.4% margin below the global average; therefore communities operating TempoFlux within Bangladesh receive Sustainability Index premiums from simply existing to pray dividends in the FER formula since:FER = (Tc/Gs) × (1 + 0.674). Here the addition of the entropy tax function ($\delta = 0.05$, $\gamma = 1.2$) creates further structural incentives for low-emission behaviour The CO_2 intensity of material use is 10–37.5% lower in each scenario (10% for one product and up to 37.5% for an entire category of products) which aligns with projections from circular economy literature that estimates a reduction of ecological footprint of 25–45%(Hickel & Kallis, 2020).

Blockchain Transparency and Community Trust

H2 ($\beta = 0.438$, $t = 10.217$, $p <05$. In statistics, causal inference is one of two sides of research with respect to a treatment or intervention (the other side is associational analysis). 00(001) confirm that community transparency around the blockchain is an important definition for strengthening social cohesion. This mediation effect (H9: β=0.171, t=5.932,p<. 001) supports partial mediation. These results are consistent with the work of Mattsson et al. Tokunga et al. (2022) found that transparency in blockchain transactions decreased perceptions of favoritism within the Sarafu Community Currency Network.In an economy such as Bangladesh — where 96.6% of employed women work informally (ILO, 2023) — secured trust in a community-based exchange system is essential and verifiable, immutable contribution records fulfil this need.

Harnessing synergies of the community and responsive mechanisms for sustainable value creation

H8 ($\beta = 0.486$, $t = 12.204$, $p < 001$),which is the second strongest direct effect, confirms community participation as a central determinant of sustainable value creation. The mediation result (H10: $\beta = .196$, $t = 6.284$, $p <. 001$) does support partial mediation of the TBV→SVC relationship through community participation. This result is consistent with Cahn's (2000) fundamental theory that the central purpose of time banking is to stimulate local community reciprocity and mutual acknowledgement. Against this particular backdrop in Bangladesh,142 — where 21.4% of the sample were self-employed or informal workers with limited opportunity for formal economic participation — TempoFlux's mechanisms of participation provide a meaningful avenue to better integrate these vulnerable groups into more solid and lasting livelihoods.

Theoretical Contributions

This study contributes four theoretical contributions to alternative economics, sustainability economics, blockchain governance, and inclusive value theory.

These contributions are three-fold; First, it extends the time banking theory through a technology-mediated time-based economic system via UTAUT2- grounded validation of the basis hereof as an empirical reality. dot, For research on time banks generally, much is descriptive and smaller scale (2011; Gregory, 2020; attention on the larger part of human activities has been focused at evolution over the course of century General review Davidson & McLoughlin) The findings of the TempoFlux study from an academic perspective are threefold: first, we show that existing technology acceptance constructs namely performance expectancy, social influence and facilitating conditions meaningfully apply to time-based exchange systems; this advances theoretical integration between the niche literature on time banking and traditional technology acceptance research.

Secondly, within sustainability economics, this applied study incorporates environmental incentives into an economic model structurally so that they become internal to the system rather than imposed as an external regulation. In this paper, we theoretically demonstrate how individual economic interests can be reconciled with overall environmental goals by establishing novel mechanisms such as an entropy tax and a sustainability index extending Rockström et al. Incorporating the planetary boundaries framework of Rockström et al. (2009) into economic system architecture

Third, the formalization of Proof-of-Contribution as a third viable consensus mechanism with theoretical rigor contributes to blockchain economic theory alongside Proof-of-Work and Proof-of-Stake. TempoFlux extends what Mattsson et al. (2022) community currency blockchain literature into a full economic governance framework.

Most importantly, this research provides genuine data on unpaid care work in Bangladesh (BBS, 2022) and ILO informal employment statistics to formally operationalize the definition of invisible labour in developing countries - bringing us closer to designing systems based on feminist economic arguments put forth by Waring (1988) and Folbre (2001).

Practical Contributions

The TempoFlux model offers additional support for decision-makers in Bangladesh, complementing the landmark commitment of the country to integrate women's unpaid labor into the GDP by way of a historic budget (UN Women 2025-26).

Instead of merely quantifying hidden labor, TempoFlux establishes a market exchange that generates material economic value for its contributors. For communities the system provides a formal recognition of the 84.9% of workers currently outside formal economic measurement, providing clear steps towards economic participation without any formal employment criteria. ChronoBlockchain protocol and AI governance layer offers a conceptual roadmap that technology developers can use for platforms in relation to social value, environmental contribution and economic participation.

Limitation of the Study

The study has four major limitations. There are several limitations of this study, First of all geographic representativeness is limited by convenience sampling from Dhaka. The rural respondents in this sample, who constitute the majority of Bangladesh (~63%) are also differently constrained with respect to digital access through formal and informal labour versus their urban counterpart. ILO (2023) estimates that 92.7% of youth aged 15–27 are in informal employment, and a much larger share lack the digital literacy one would expect for a smart-phone based TempoFlux platform. This sample needs to be expanded for peri-urban and rural settings in future research.

Second, although many PLS-SEM studies examined perceived characteristics of a system and behavioral intention toward this system (in our case: EHRs), they are likely not equivalent to actual adoption behavior. This gap between intended use and actual use is well established in technology acceptance literature (Venkatesh et al., 2012). Physical pilot deployment data, which is not currently available, would give stronger causal evidence.

Third, the simulation scenario results (that is, outputs) reported in Table 5 are synthesized not from actual TempoFlux deployment, but rather from mathematical modeling applied to average published macroeconomic parameters. The entropy tax constants (δ, γ) and adoption rate parameters are set by the researchers and are sensitive to these settings. This would require, among other data, conducting controlled pilot studies in Bangladeshi communities to empirically provide estimates of these parameters.

Fourth, the study models no general equilibrium effects of a parallel currency system including higher prices, misalignment of exchange rates or crowding out of formal economic activity. The macroeconomic dynamics would need a computable general equilibrium (CGE) model in order to be appropriately evaluated and provide an important avenue for future research.

Conclusion

The TempoFlux Economy is a time-based economic system that aims to mitigate the endemic problem of informal and unpaid labour in developing economies, which structurally go invisibly while contributing significantly to national economies. Based on the reality of Bangladesh's labor market which has 84.9% of workers in informal employment and whose unpaid care work represents 18.9% of GDP this model has established a formal mechanism with time credits for recognizing, valuing, and exchanging all productive contributions or other socially relevant activities.

The research strongly supports ($p < .001$ based on 215 responses collected in Dhaka) all ten of the proposed hypotheses. 001).Note: the sensitivity analyses revealed that sustainability incentive mechanisms had the largest positive effect on environmental outcomes ($\beta = 0.527$), followed by community participation as a driver of sustainable value creation ($\beta = 0.486$), while economic equity perceptions improved most with regard to time-based value recognition ($\beta = 0.472$). The mediation findings provide further evidence that community trust and community participation both are important bridging factors in the transformation of technological affordances into sustainable value.

By combining blockchain transparency, AI-generated guidance and entropy taxation, we can develop a self-sustaining system that aligns individual economic rewards with collective social and environmental value. The TempoFlux Economy lays a foundation for the possibility of an inclusive, sustainable value creation system that conventional monetary systems by design are incapable of achieving, and does so based on time, the one resource equally distributed to every person.

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